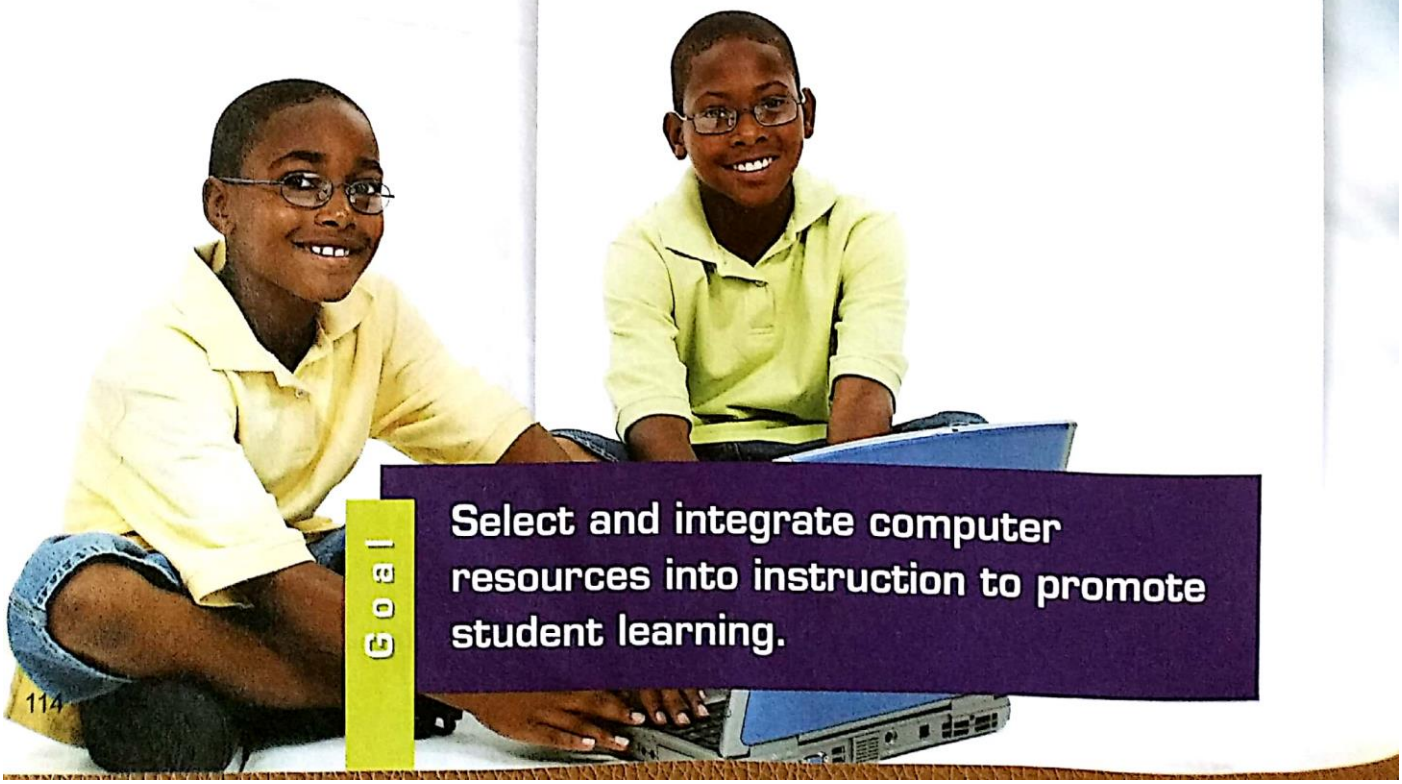
Engaging
Learners with Computers

Engaging Learners with Computers

Knowledge Outcomes

This chapter addresses ISTE NETS-T 1, 2, and 3.

1. Describe strategies for and examples of integrating computer resources into the curriculum.
2. Describe five types of software that might be used in the classroom.
3. Discuss the advantages and limitations of using computer resources in learning.
4. Discuss the differences among a one-computer classroom, a multiple-computer classroom, laptop carts, and computer laboratories in terms of setups and uses.
5. Describe an appropriate instructional situation for using computer resources to support student learning. Include the setting, topic, audience, objectives, content of the materials, and rationale for using this media format.



Goal

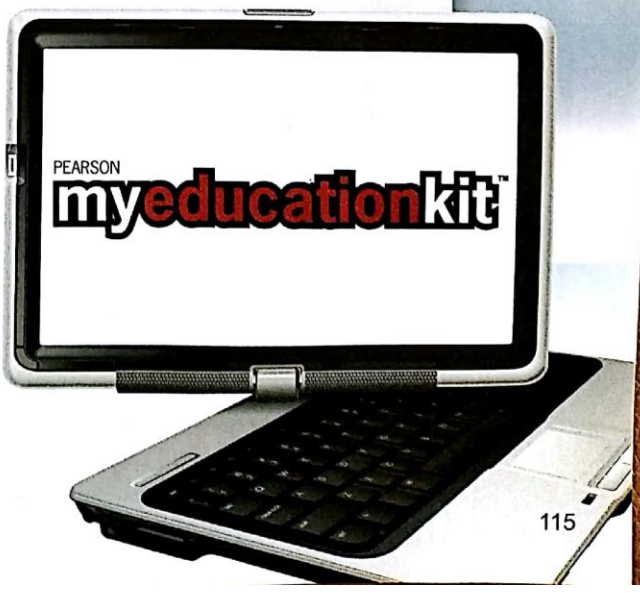
Select and integrate computer resources into instruction to promote student learning.

ASSURE Classroom Case Study

This chapter's ASSURE Classroom Case Study describes the instructional planning of Kerry Bird, an elementary teacher for nearly 30 years and one of the first in his school to embrace new technology. Kerry, who views the advent of computers as one of the biggest changes in education during his career, is currently teaching fourth grade, where he strives to integrate a variety of computer projects into instruction. He has found that student motivation and learning increase during active hands-on engagement with computers. As one of his projects, he is considering how to upgrade his presentation of the water cycle, a concept his students have struggled with. He currently teaches this process by having students create water cycle posters. He would like his students to use computers to demonstrate their understanding of the water cycle, but is not sure of the best approach.

*To view the **ASSURE Classroom Case Study** Video for this chapter, go to the MyEducationKit for your text and click on the ASSURE Video under Chapter 5 to explore how Mr. Bird decides on strategies to teach the water cycle and then chooses technology, media, and materials to achieve 21st century learning environments.*

Throughout the chapter you will find reflection questions to relate the chapter content to the ASSURE Classroom Case Study. At the end of the chapter you will be challenged to develop your own ASSURE lesson that incorporates use of these strategies, technology, media, and materials, for a topic and grade level of your choice.



INTRODUCTION

Computers have become one of the key instructional technologies in education, especially in light of what we know about the 21st century learner. The computer plays multiple roles within the curriculum, ranging from tutor to student creativity resource. Teachers can use the computer as an aid to collect student performance data as well as to manage classroom activities. To make informed choices on computer use, you need to be familiar with the various computer applications—word processing, graphics, and presentation software; games and simulations; tutorials; and teacher resources. It is extremely important to develop critical skills for appraising instructional software because there are so many available programs. The hardware, too, becomes much less intimidating when you know some of the basic technology. Whether you teach with a single computer in the classroom or a room full of them, you can learn to make optimal use of the computer to support student learning. This chapter focuses on the types of computer resources available for the classroom, as well as how to go about selecting software to support student learning. To help understand how computers operate, there is information on the components of the computer, as well as classroom setup options to optimize computer use.

USING COMPUTERS IN THE CLASSROOM

COMPUTER LITERACY

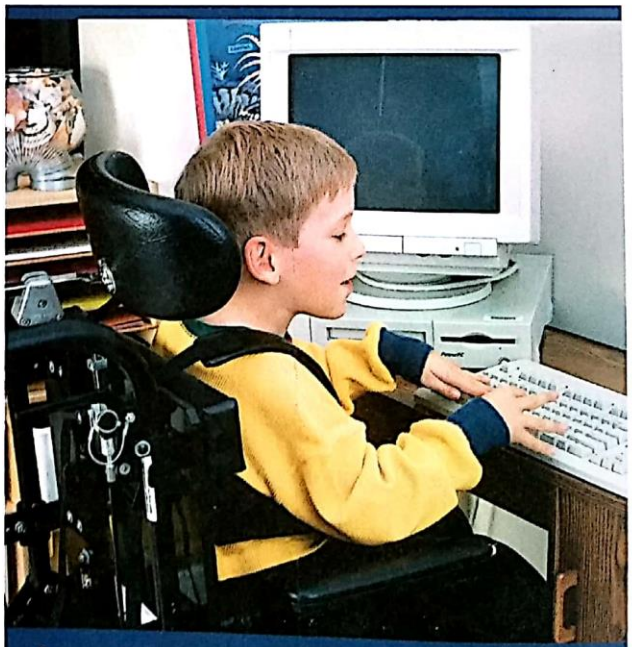
Computer literacy can be explained as the ability to use computers and technology efficiently (Wikipedia, 2009). It has also been described as skill in applying computer software to achieve desired outcomes, such as using a word processing program to write, edit, and complete a document. Computer literacy also includes knowing the components of the computer and how they operate. Part of this definition is the ability to recognize a problem and even troubleshoot the computer system if necessary.

When the International Society for Technology in Education (ISTE) first developed standards for students, they started their list of knowledge and skills with the ability to operate the equipment. In 2007, ISTE reordered the list for students and changed the importance of computer operations and concepts from the first skill to the last (ISTE, 2009). Although determining that it was still important for students to know about and be able to operate the computer efficiently, ISTE decided that knowing how to use tools to support learning was more important than being able to label the parts of a computer or select and use applications.

ISTE also developed a set of standards for teachers that parallel those for the students. The teacher standards also do not place much emphasis on the operations of the tools but rather emphasize the ability to create learning opportunities for students with computers and technology. Teachers are expected to model appropriate use of the resources and to guide students as part of their learning experiences. The decisions teachers make about applying computer resources to support learning are considered to be more important than knowledge of basic operations. This definition of computer literacy as skill in using computers to support learning will be our focus in this chapter.

STRATEGIES AND APPROACHES

Educating 21st century students has shifted from providing information to opening doors for them to explore topics and create meaningful learning experiences for themselves. Computer technology has been incorporated as a central feature of this process. The implication is that educators are moving away from the idea of school as a place to get knowledge to the view that *school is a place to learn how to learn*. The challenge for you as a teacher is to provide opportunities for all students to use technology in meaningful ways to accomplish learning tasks. This may mean selecting specific software for individual students—for example, to practice



As a tool, the computer can be useful to students in their learning.
Modern Curriculum Press/Pearson

TAKING A LOOK AT TECHNOLOGY INTEGRATION

Testing the Waters

A school in Ann Arbor, Michigan, was being bothered by an odor from a stream in a small park next to its property. A trio of science teachers decided to integrate their classes and present students with the problem of the smelly stream. They introduced the scientific inquiry model and provided an array of technologies that could help students analyze and hypothesize. Groups worked together to investigate the source of the problem and initiated community action to alleviate it. Reorganizing the science classes and integrating technologies to successfully solve real problems demonstrated to the administration that problem-based learning is a constructive and beneficial way for students to learn.

Source: Adapted from a lesson developed by the Hi-Ce Research Group, University of Michigan, http://sitemaker.umich.edu/hice/home.

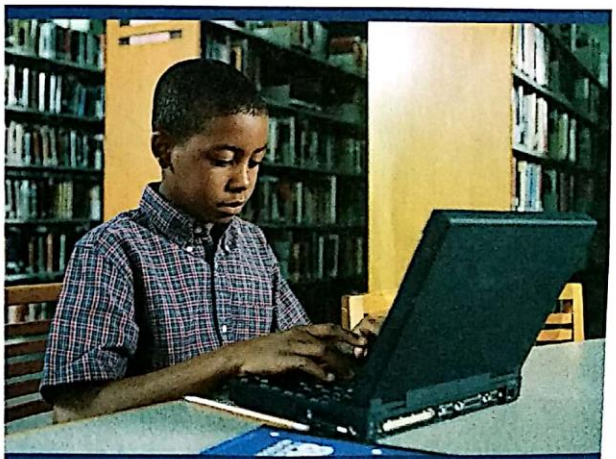
Anthony Magnacca/Merrill

math skills or to search online databases. Or it may mean changing your entire approach to a lesson. Student projects such as working on an ecology report are not new within the school curriculum, but the approach certainly can be.

You should be a model user of computer software for your students. Students will quickly notice if the teacher makes illegal copies of programs and doesn't follow copyright guidelines. Remember, actions speak louder than words (see Copyright Concerns: Computer Software). Check with your technology coordinator, library media specialist, or principal for the specific guidelines followed by your school.

Students can interact directly with the computer as part of their instructional activities in a variety of ways, from working with material presented by the computer in a controlled sequence, such as a drill-and-practice program, to a student-initiated creative activity, such as a desktop-published book of student poems. The computer can help both the teacher and students in maintaining information about their learning and in guiding instruction. That is, the computer can organize and store easily retrievable information about each student and about relevant instructional materials. Learners may take tests on the computer or input information into personal **e-portfolios**. Computer programs can also diagnose the learning needs of students and prescribe optimal sequences of instruction for each student.

Traditionally, computers were used to reinforce classroom instruction. Software was designed to provide direct instruction or practice for students, often programmed to branch to other segments of the lesson based on student responses. Many of these designs are still in use today. Based on the constructivist view of learning, current instructional strategies try to engage students in ways that allow them to develop, or construct, their own mental structure in a particular area of study. To engage students in this type of learning, the environment must provide them with materials that allow them to explore. Early research by Papert serves as



Students can produce their own written materials with minimal time and little computer expertise.

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Copyright Concerns

Computer Software

Congress amended the Copyright Act to clear up questions of fair use of copyrighted computer programs. The changes defined the term *computer program* for copyright purposes and set forth rules on permissible and nonpermissible use of copyrighted computer software. According to the amended law, you are permitted to do the following with a single copy of a program:

- Make one backup or archival copy of the program.
- Use a "locksmith" program to bypass the copy-prevention code on the original to make the archival copy.
- Install one copy of the program onto a computer hard drive.
- Adapt a computer program from one language to another if the program is not available in the desired language.
- Add features to a copyrighted program to make better use of the program.
- Adapt a copyrighted program to meet local needs.

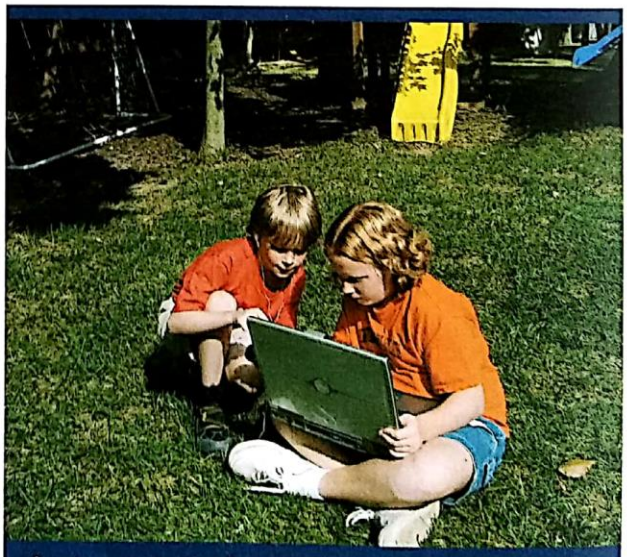
Without the copyright owner's permission, you are prohibited from doing the following:

- Make multiple copies of a copyrighted program.
- Make additional copies from an archival or backup copy.
- Make copies of copyrighted programs to be sold, leased, loaned, transmitted, or given away.
- Sell a locally produced adaptation of a copyrighted program.
- Make multiple copies of an adaptation of a copyrighted program even for use within a school or school district.
- Put a single copy of a program onto a network without permission or a special site license.
- Duplicate the printed copyrighted software documentation unless allowed by the copyright-holding software company.

the foundation for digital "microworlds," environments that permit students to freely experiment, test, and invent (Papert, 1993a,b). These environments reinforce 21st century skills by allowing students to focus on a problem area and create solutions that are meaningful to them.

Jonassen, Howland, Moore, and Marra (2003) have expanded the idea that computers can engage and support students in their learning. They have suggested that students learn from the computer environment because it encourages students to use cognitive learning strategies and critical-

Students of all ages can manage CD-ROM discs to support their learning.
Nicola Sutton/PhotoDisc/Getty



Laptop computers have changed the way people use computers. Combined with wireless technology, they have made computing truly portable.
Maria B. Vonada/Merrill

Students can enjoy books on CD-ROM.
David Young-Wolff/PhotoEdit

thinking skills. Students control how and when the computer provides them with the information they need. Part of the teacher's responsibility is to choose from among the many computer software packages available to create such learning environments and to assist students in constructing their own mental models.

ADVANTAGES

- *Learner participation.* The R of the ASSURE model is achieved with computer materials because they require learners to engage in activities. These materials help to maintain students' attention.
- *Individualization.* Computer resources allow students to manage the rate and sequence of their learning, giving them more control over outcomes. High-speed personalized responses to learner actions yield immediate feedback and reinforcement.
- *Special needs.* Computer resources are effective with special learners, gifted and at-risk students, and students with diverse physical or demographic backgrounds. Their special needs can be accommodated to ensure that instruction proceeds at an appropriate pace.
- *Monitoring.* The record-keeping ability of the computer makes instruction more individualized; teachers can prepare individual lessons for all students and monitor their progress.



TECHNOLOGY for Diverse Learners

Computer Software

Computer applications can help with a variety of learning needs. The following examples demonstrate ways that learners can use computers to help with specific learning problems.

Students can work on improving their problem-solving abilities with The Factory Deluxe (www.Sunburst.com), software that highlights different strategies for problem solving, such as working backward, analyzing a process, and determining a sequence. Learners are given a square on the computer and four types of machines to shape it as they work through a series of levels that build their knowledge of geometric attributes in order to prepare a product. The "rotator" machine can be programmed to rotate the square from 30 to 180 degrees. The "puncher" machine can punch square or triangular holes in the square. The "striper" machine paints thin, medium, or thick stripes of various colors. And the "cutter" cuts off and discards parts that are not needed. Learners must apply problem-solving strategies in order to successfully manufacture a product with the machines.

For students with visual impairments who need to use computer software, email, or the Internet, adaptive software programs called screen readers use speech synthesizers to read aloud the text and names of icons. Learners can navigate using the keyboard, hitting the tab button to move from icon to icon. Nontext items, such as graphics and photos, are labeled with alternative textual descriptions, called **alt-tags,** which allow learners with visual impairments to hear descriptions of these items. These software programs are available on both PC and Mac operating systems in a section of the operating software called "universal access."

Students with advanced learning skills can be challenged to put on their thinking caps and create interesting solutions by completing complex puzzles. Puzzles are an interactive way to engage students in finding alternative ways to examine an issue or problem. For example, using inquiry and imagination, students link their knowledge of facts to the resolution of the puzzles presented in the Jewel Quest game (www.iWin.com). Students are given clues along the way to help them find the golden path. And in the process students learn some information about archeology. Jewel Quest is only one of many types of puzzle-based games available to challenge students.

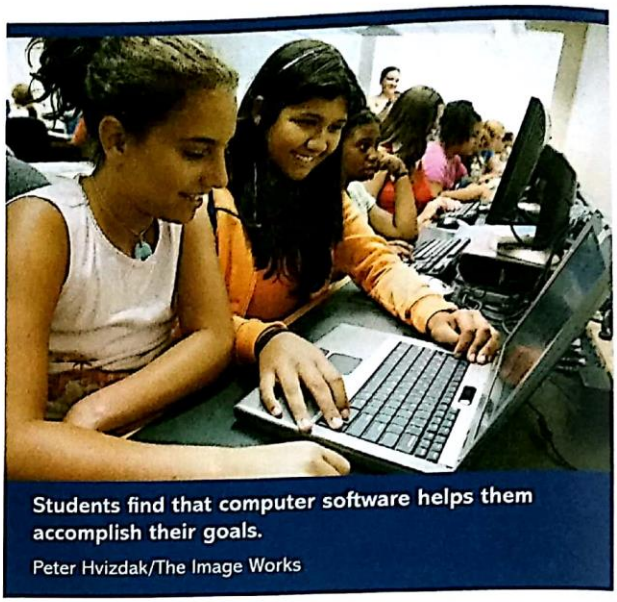
- *Information management.* Computer resources can cover a growing knowledge base associated with the information explosion. They can manage all types of information—text, graphic, audio, and video. More information is easily accessible by teachers and students.
- *Multisensory experiences.* Computer resources provide diverse learning experiences. These can employ a variety of instructional strategies that use audio, visual, and tactile approaches at the level of basic instruction, remediation, or enrichment.

LIMITATIONS

- *Copyright.* The ease with which software and other digital information can be duplicated without permission has inhibited some commercial publishers and private entrepreneurs from producing and marketing high-quality instructional software (see Copyright Concerns: Computer Software).
- *High expectations.* Users, both learners and teachers, may have unrealistic expectations for computers. Many view computers as magical and expect learning to happen with little or no effort, but in reality (and as with all other learning resources) users derive benefits proportional to their investments.
- *Complex.* More advanced programs may be difficult to use, especially for student production, because they require the ability to use complex skills.
- *Lack of structure.* Students whose learning style requires more structured guidance may become frustrated. Students may also make poor decisions about how much information to explore.

INTEGRATION

The ultimate value of computers in education depends on how fully and seamlessly computers are integrated into the curriculum. The computer in the classroom is not an additional "thing" that teachers must include, but rather is integral to the support and extension of learning for all students (ISTE, 2009). Teachers need a framework for using computer technology that covers a variety of learning styles and accommodates varied teaching strategies. Most important, results need to be measurable to align with a clear set of standards and objectives—the second step in the ASSURE model. In classrooms where computer technology is integrated successfully, students use it with the same ease with which they use books, maps, pencils, and pens. In computer-rich classrooms students and teachers engage in problem solving, cultivate creativity, collaborate globally, and discover the value of lifelong learning.



Students find that computer software helps them accomplish their goals.

Peter Hvizdak/The Image Works

With increasing ease of use, computers are becoming more natural tools to use in problem-solving and cooperative learning strategies. Software is now available to provide students with experiences in working together to solve complex problems. Often students incorporate several different types of applications to explore a problem situation. For example, when assigned to prepare a report on ecology, a group of students might use computer databases to search for information resources to include in their report. They might send email messages to people in different locations requesting information. They might use database and spreadsheet programs to store and sort their information.

Some computer software can be valuable for tasks that must be shown rather than simply told. Printed materials and lecture cannot adequately present some instruction alone. Learners who want to interact with the instruction may need to find an appropriate software choice. Many newer versions of software now come with interactive media demonstrations. For example, The Ellis Island Experience is an interactive documentary with a wealth of information about the role this primary immigration station played in U.S. history from 1892 to 1954. Designed for middle school and high school students, the software lets them explore five modules filled with images, audio, and video to learn more about the experiences of immigrants as they entered the United States. An artifact viewer resource lets students look at images, memorabilia, and documents in detail.

TYPES OF COMPUTER RESOURCES

The computer provides virtually instantaneous response to student input, has extensive capacity to store and manipulate information, and is unmatched in its ability to serve many students simultaneously. The computer's role in instruction is to serve as a resource for rich learning experiences, giving students the power to influence the depth and direction of their learning. It has the ability to control and integrate a variety of media—still and motion pictures, graphics, and sounds, as well as text-based information. The computer can also record, analyze, and react to student responses typed on a keyboard, selected with a mouse, or activated by voice. As students begin to work with information, they find the computer resources available to them help make the process easier and more fun. Students can use the technology to gather information and to prepare materials that demonstrate their knowledge and understanding of that information.

Besides providing information, computers are also tools for creativity and communication. Because computers also allow collaborations with others around the world via social media resources, students often strive to achieve their "best" writing or productions because they can go beyond the teacher and classroom with their audiences.

Computers have become pervasive in education. Most learners have access to and are influenced by computer-based instruction.
Anthony Magnacca/PhotoEdit

Computers are used widely for word processing and desktop publishing. Most students have access to word processing programs to produce papers and assignments. Some students create multimedia projects, integrating graphics, sound, and motion for presentations to their classmates or

WHEN to USE Computers

Use when student learning will be enhanced by . . .

Guidelines	Examples
Practicing what they have just studied in class	Students who need extra help with a skill or task can play a drill-and-practice game to practice skills or reinforce their understanding.
Learning independently	A computer can be part of a kindergarten classroom learning center. Young students can complete learning tasks by using a tutorial type of activity-based software to advance their knowledge.
Creating learning opportunities for gifted students	Gifted students can be challenged to expand or enhance their learning by using more complex software programs or by extending classroom activities with challenging problems.
Working collaboratively with other students	Students can work together to navigate through instructional materials to help each other understand the information.
Reaching a student who is having difficulty in learning	Students can use the material in personally meaningful ways, navigating through the material as appropriate to their style of learning.
Challenging students to present information in a new way	Students can create their own materials to share their knowledge with others in the class or school.

other groups. Presentation software, which incorporates the computer with a digital projector, allows students to share and discuss their work.

INFORMATION

Today's students need to learn to manage information—to retrieve, sort, organize, and evaluate. For inquiry and research, students can use a **database,** a collection of related information organized for quick access to specific items. Whereas a telephone book is a printed database, computer databases are electronic file cabinets filled with information that is easily accessible in many different ways (e.g., a computer phonebook that can show telephone numbers by name or after-school activity). A database is a versatile and easy-to-learn computer tool (Figure 5.1).

Classroom Databases. Databases can be created by students. For example, students can design information sheets and questionnaires, collect data, input relevant facts, and then retrieve data in a variety of ways. The facts selected might include student information, book reports, or sample math problems. Having constructed databases as part of their research, students are better able to engage in higher-level thinking skills as they analyze and interpret the data.

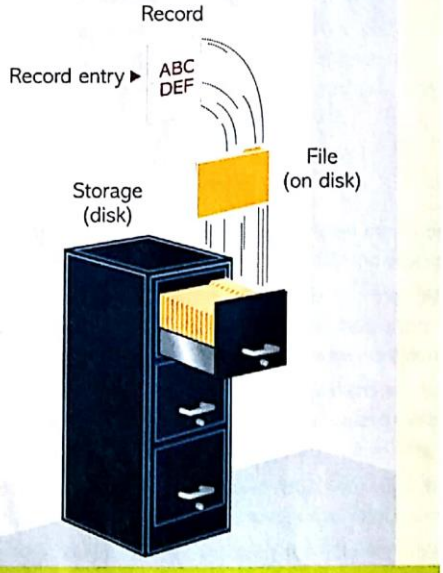


Figure 5.1
Database Organization
A database is used to organize information so the user can easily sort, rank, calculate, and store it.

Commercial Databases. Commercial databases are produced for purchase on CD-ROMs or via an Internet connection. For example, Fifty States, a database available both on disc and the Web, contains information for all the states in the United States, including data about population, the capital, geography, and economic data, as well as the state bird, flower, and tree. Larger databases are available online and may contain medical information, environmental statistics, historical data, census figures, and the like. Your school media specialist can help identify commercial databases suitable for particular areas of inquiry.

COMMUNICATION

Email Messages (Text Messages). Today's students are familiar with sending email to friends or text messages using computer instant messaging or cell phones. This type of message format is quick and easy to use. In the classroom you may wish to engage students with email messages as a means for connecting with classmates or students from a distant location (e-pals). As text messaging has taken hold of the cell phone communication industry, you may want to take some time to teach your students when to use appropriate abbreviations and when to use full-text for their messages.

Oral and Visual Messages. Communication in your class is not limited to text-based messages. You can encourage students to incorporate audio files they create with voice rather than text to enhance their communication with others. Students are very creative and can use images captured on their cell phones or digital cameras to enhance their messages or substitute for words when possible.

WORD PROCESSING AND DESKTOP PUBLISHING

Using concept-mapping programs such as Inspiration or PicoMap, which is designed for a handheld device, students can gather their ideas into concept maps (Figure 5.2). They can then begin to work those ideas into connected text from outlines generated by the concept-mapping programs. These outlines are imported into a word processing program, which makes it easy for students to edit their work. The word processor makes it possible for students to work with their ideas and to quickly make changes as they explore various ways to present them. Spelling and grammar checking are available to assist students in identifying and correcting errors in draft versions of their papers. A thesaurus helps them find the right

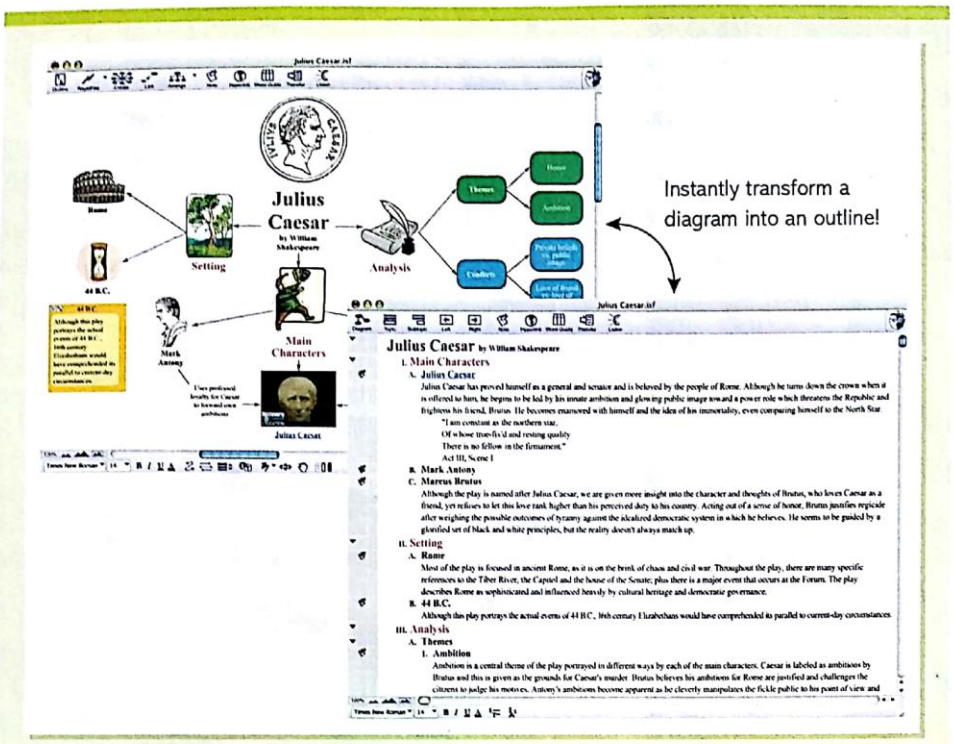


Figure 5.2

Inspiration Software

Software programs like Inspiration help students to organize their thinking about a variety of topics.

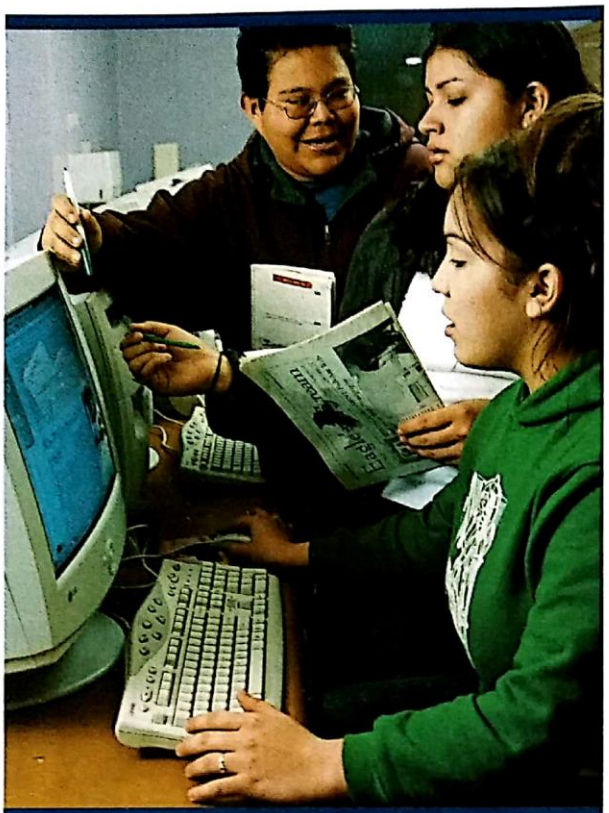
Source: © 2011 Inspiration Software, Inc. Diagram created in Inspiration by Inspiration Software, Inc. Used with permission.

word for a specific situation. Editing, a process children are not prone to enjoy, suddenly becomes easier. Students are more willing to make changes when editing is simplified.

Students enjoy putting their ideas onto paper. They especially enjoy seeing their work in finished copy. Desktop publishing allows students to design layouts that are creative and enjoyable to read. Using a desktop publishing program, students can add graphics to their pages. They can see how the pages will look before they print or publish them to the Web. Students of all ages like to produce their writings in formal documents, such as small books and newsletters. Class newsletters are also very popular, as students work together to produce a document they are proud to share with family and friends.

CREATIVITY

Graphics. Drawing and creating graphics is a fun activity for students. Computer software such as KidPix Delux can make drawing even more pleasurable. This software allows a variety of engaging effects with special tools such as a "rubber stamp" that makes noise as it marks on the screen or a "drippy" paintbrush for drawing lines that have paint drips across the screen. Another tool is one that allows users to use an eraser to clear an image on the screen to find a hidden picture behind it. Computer technology thus changes the dynamics of art for children. As students gain skill with drawing software, they can learn more complex drawing and drafting programs. High school students can use computer-aided design (CAD) and graphics programs to prepare complex visuals. Many of the skills associated with these types of software are easy for students to learn. As another example, an art program such as Photo Deluxe allows students to develop complex projects with an array of tools ranging from basic drawing tools for lines and shapes to advanced tools for editing and redesigning. They may create their own pictures or begin with commercially designed clip art available from many suppliers



Working collaboratively, students can produce school newsletters and yearbooks with desktop publishing programs.

Michael Newman/PhotoEdit

(Figure 5.3). A simple picture can be developed into a very artistic piece with only a few keystrokes.

Students can use graphics software programs to manipulate digital photos they have taken to make the images more appropriate for a particular purpose. For example, students can take a photo, crop it, and then use it as a **link,** a way to connect sections of a file, or within their PowerPoint slides. They can add images to their word-processed documents as well.

Audio Resources. Many types of audio resources are available for learners to create exciting representations of their learning. For example, students can add narration to a presentation, create an audio podcast that discusses opinions on global warming, or enhance a digital story with sound effects (a closing door, footsteps, a cat purring). Students who enjoy music or have musical talent can create interesting vocal and instrumental music with such programs as GarageBand. Their musical files can be incorporated into their PowerPoint files.

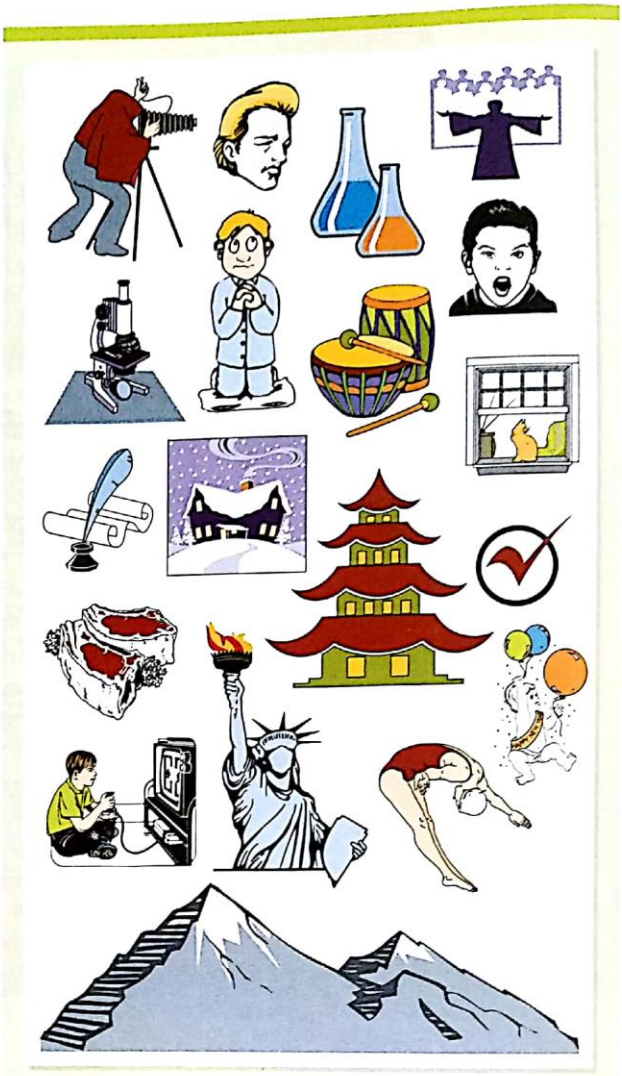


Figure 5.3

Examples of Clip Art

Clip art can add an important visual element to student work.

PRESENTATION SOFTWARE

Presentation software has become a very popular format for teachers and students alike. With the computer connected to a digital projector, it is possible to create colorful and animated slides. Many students enjoy preparing presentations for their classmates using programs such as PowerPoint and Apple's Keynote. The software can also be used to create additional media materials, such as electronic portfolios or digital storybooks, allowing students to demonstrate their knowledge or to challenge other learners. Supervise carefully though; individuals sometimes spend more time deciding

the color scheme, the transitions, or the font style than they do actually preparing the content of the presentation.

GRAPHING CALCULATORS AND SPREADSHEETS

Most computers include calculators as one of the basic tools built into the operating system, with newer computers offering graphing calculators as an option. Learners can use them to solve complex mathematical calculations, as a traditional calculator is used, but with increased power and speed. Students can also learn to use a spreadsheet program to prepare sets of data collected as part of a project (Figure 5.4). The computer can facilitate data gathering when connected to laboratory equipment. The collected data are downloaded to a spreadsheet program for data analysis and to prepare tables or graphic displays of the results.

GAMES AND SIMULATIONS

Games and simulations are instructional tools that support students in learning knowledge and skills and involve the use of problem-solving strategies and techniques. Games and simulations incorporate many good learning principles, such as interactivity, challenge, problem solving, systems thinking, distributed knowledge, and performance related to competency (Gee, 2005). In short, games and simulations provide learners with multiple opportunities to practice solving structured or ill-structured problems, engaging students in complex, higher-order thinking. Students are asked to analyze a task, determine the conditions to address that task, identify cues, and engage in self-monitoring and evaluation. Problems can be introduced to students as a way to have them practice skills in practical applications. Providing students with rich and varied problems challenges them to integrate knowledge and skills into their learning strategies

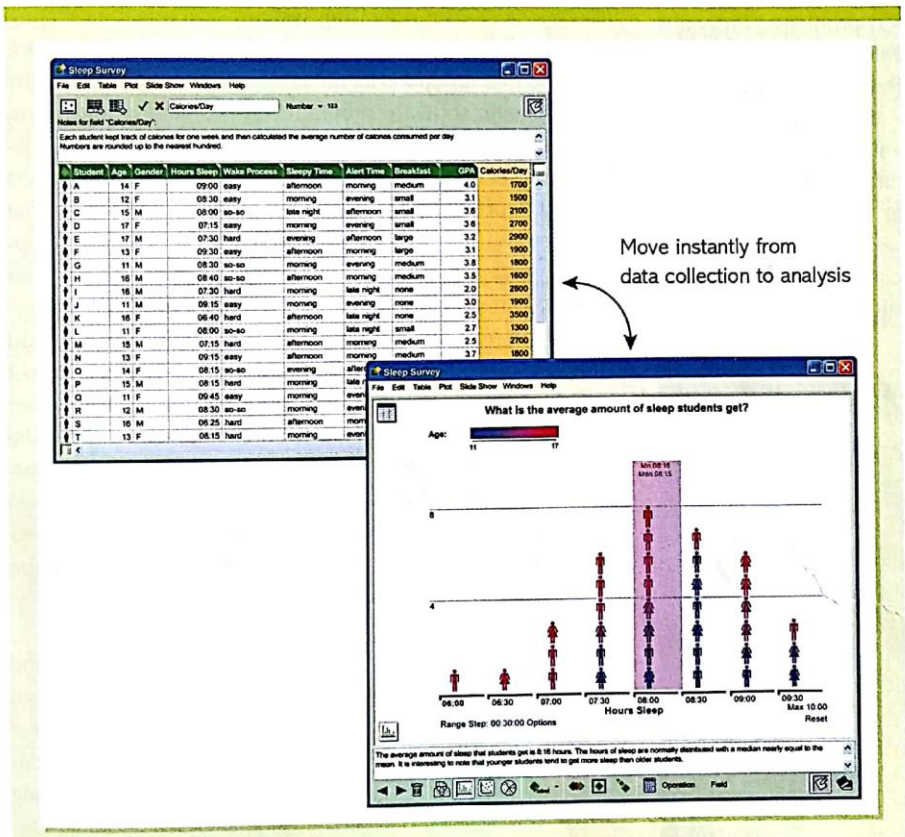


Figure 5.4

Example of a Spreadsheet

A spreadsheet is a page of rows and columns that displays text, numeric, and formula entries. Students can use a spreadsheet to record, average, and manipulate science data.

while engaged in a meaningful activity within a virtual world (Shaffer, Shaffer, Squire, & Gee, 2005).

COMPUTER-ASSISTED INSTRUCTION

Students benefit from practice on basic skills or knowledge. **Computer-assisted instruction (CAI)** helps students learn specific knowledge and skills. The computer serves as an easy-to-use device to reinforce classroom instruction. The variety of instructional software across all content areas is vast. Types of software range from basic drill-and-practice and tutorials to more extended and complex learning problems. For students who need review or practice, drill-and-practice programs can challenge students to remember the specific steps needed to complete a task. For example, Math Blaster Plus assists students in learning math facts (addition, subtraction, multiplication, and division) through drill-and-practice using an arcade game format, giving students the opportunity to practice what they have learned.

Software is capable of providing students with complex tasks that engage them in real-world problems. Programs such as National Inspirer ask students to engage in activities related to geography, helping them learn how geography plays an important part in the economy of any state in the United States. International versions of Inspirer cover Europe, Africa, and Asia. Video technologies can easily be incorporated, focusing attention on tangible examples of geographic occurrences and how they impact the economy. Word processing, graphics, and a host of computer software help students organize and communicate their ideas.

Handheld computers such as the Palm have helped popularize the use of microcomputers in schools.
Masterfile

COMPUTER-MANAGED INSTRUCTION

Use computer resources to assist you in the process of facilitating student learning. For example, you can use a mobile device, such as a Palm handheld, cell phone, or tablet computer, to collect information on how students are completing tasks. Or you can use the computer at the end of the day to assist you in preparing instructional materials such as handouts or presentations.

SOFTWARE SELECTION

There are several factors associated with selecting software (see Selection Rubric: Computer Software at the end of this chapter). It is very important to examine the software within the context of learning outcomes. Other factors that should be considered include how the software stimulates creativity, fosters collaboration, and provides feedback. You should also consider your **operating system,** which is the computer's underlying system software, such as Mac OS, Windows, or Unix, that functions as the computer's interface with the user. Specific software programs, also called **applications,** are written to run on different operating systems, which determine precisely how the user, computer, and application interact to produce the desired results. You must ensure that software you select is designed to run on your available operating system and that it will function properly with your specific hardware configuration (see Computer Hardware).

When you are evaluating instructional software, you should consider how information is presented to be certain it is done in a clear and logical manner to ensure learning (see Selection Rubric: Computer Software). You need to examine the intent of the lesson and its relation to your intended outcomes, the curriculum, and the pertinent achievement standards. The information needs to be presented in a manner designed to maintain student interest and involvement in the learning tasks. Additional aspects to consider are accuracy, age appropriateness, and ease of use.

It is important that instructional software follows sound educational techniques and principles and also provides students with **feedback** on their efforts. In a drill-and-practice program, it is important that students have frequent informative feedback in order to improve their skills. When using software designed to challenge higher-order thinking, students will need feedback to determine the quality of their choices. If your goal is to provide students with collaborative learning opportunities, many programs are designed so that groups of students can work together to achieve the intended outcomes. Several of these types of programs are designed with the one-computer classroom in mind (see Media Sample: Computer Software).

MEDIA SAMPLE

Computer Software

Inspiration/Kidspiration

Inspiration Software, Inc. (www.inspiration.com)

Concept-processing program. Inspiration is a software package that facilitates brainstorming, concept mapping, and planning. It creates visual diagrams of the ideas generated by an individual or a group. Use this program to create overviews, presentation visuals, and flow charts. Kidspiration is designed to help younger students develop similar skills. Once their thoughts have been visualized, both Inspiration and Kidspiration easily convert the concept map into a word processing outline.

JumpStart Math for Kindergarteners

Knowledge Adventure (www.knowledgeadventure.com)

Tutorial program. JumpStart Math for Kindergarteners is one of a series of JumpStart software products for younger students. Using a game format, eight fundamental kindergarten math concepts based on National Council of Teachers of Mathematics standards are introduced. The goal is to help students learn critical math skills while they participate in planning activities for Guthry the Giant's surprise birthday party. In addition to making math fun for the students, a tracking and reporting system is built into the program for teachers to monitor progress and to adjust difficulty levels for individual students.

Zoombinis Mountain Rescue

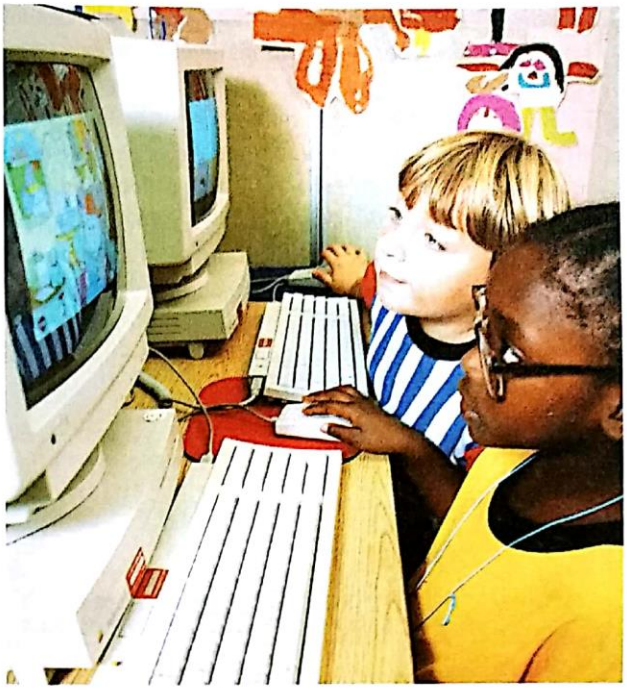
K12 Software (www.k12software.com)

Problem-solving program. The lively and endearing Zoombinis jump into an exciting adventure to rescue fellow Zoombinis trapped in a mountain cave. Students help the creatures solve the logic problems they encounter along the way. The program encourages students to practice their math skills while challenging them to use logic to solve problems. An added feature is that the puzzles that must be solved are never the same, so students are always finding new adventures to follow.

Decisions, Decisions

Tom Snyder Productions (www.tomsnyder.com)

Simulation program. Decisions, Decisions is a series of role-playing software packages designed specifically to generate informed discussion and decision making in the classroom using only one computer. The program has a mode for whole-class discussion with the teacher leading the entire group, as in a traditional classroom. In addition, it offers a small-group option for managing a cooperative learning environment. Up to six small groups of students can move through the simulation, each independently directed by the computer. Titles include Substance Abuse, Violence in Media, Immigration, The Environment, and Town Government.



Mary Kate Denny/Stone/Getty

Magic School Bus Lands on Mars

Microsoft (www.microsoft.com)

Science discovery program. This is another in the Magic School Bus series of interactive software programs in which students must interact with the characters and the action onscreen to seek answers to questions. In this program, students learn about Mars and space exploration while they play games, drive a Mars rover around the planet, and participate in some science experiments.

Neighborhood MapMachine

Tom Snyder Productions (www.tomsnyder.com)

Social studies program. Neighborhood MapMachine is a hands-on program in which students create and navigate community maps. While engaged in generating their maps, students learn concepts related to location, scale, distance, and compass navigation. Students can add pictures, movies, and website links to customize their community maps. In addition, students can use their writing and mathematics skills as they share the maps with others.

Sometimes software has special effects or features that may be essential for effective learning. Often, however, special effects are only window dressing that add no value to the learning. In fact, they may interfere with learning. Color, graphics, animation, and sound should be a part of quality software only if they contribute to student learning. Text should be presented in a consistent manner, using size, color, and location to reduce the cognitive burden of deciphering meaning. Keystroking and mousing techniques should be intuitive for students. The manner in which students interact with software needs to be transparent, allowing them to focus on content.

ASSURE Case Study Reflection

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Review the ASSURE Classroom Case Study and video at the beginning of the chapter. What software would be appropriate for Kerry Bird's fourth-grade students to create a product that will demonstrate knowledge of the water cycle? What would be a good way for students to share materials with each other?

COMPUTER HARDWARE

Regardless of type of computer or complexity of the system, computers have a number of standard components. The physical equipment that makes up the computer is referred to as the **hardware.** A computer's specific combination of hardware components is called its *configuration*. The basic hardware components are diagrammed in Figure 5.5.

Input devices transmit information to the computer; output devices display the information to the user. The most commonly used input device is the keyboard. Others include the mouse, trackball, joystick, graphics tablet, and even voice. Both students and teachers can use graphics tablets to incorporate drawings into their programs. Science laboratory monitoring devices such as temperature probes can also be connected directly to a computer with the proper interface device.

Monitors are the standard output device. Another output device, allowing large-group viewing, is the digital projector. Connected to the computer, the digital projector can be used as part of class instruction, such as in a PowerPoint display or to show slides outlining steps for students to follow when using specific software in a computer lab.

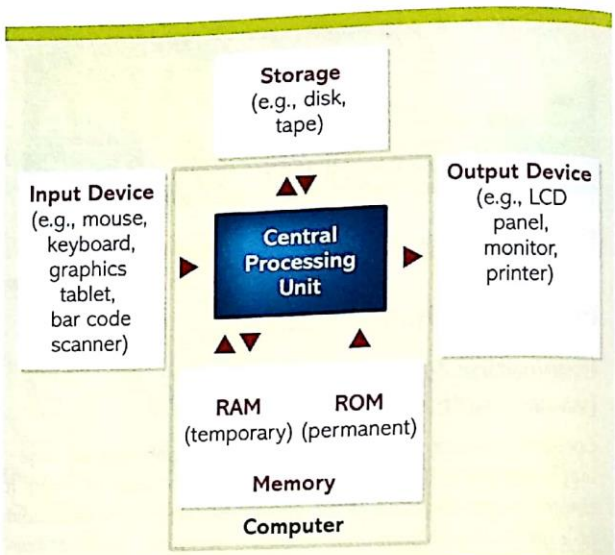


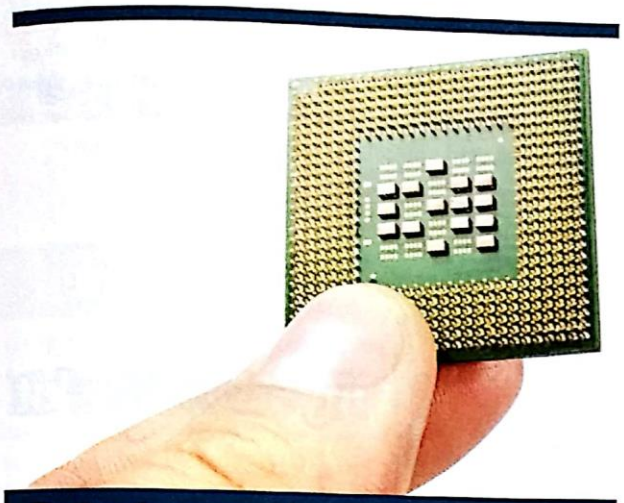
Figure 5.5
Basic Elements of a Desktop or Laptop Computer

Computers also commonly provide output in the form of print (text or visuals), commonly called "hardcopy." Available in a range of prices and quality, printers are often combined with scanners and photocopiers, some with fax capabilities, as "all-in-one" devices.

The **central processing unit (CPU)** is the core element, or "brain," that carries out all the calculations and controls the total system. In a personal computer the CPU is one (or more) small chips (microprocessors) inside the machine.

The computer's **memory** stores information for manipulation by the CPU. The memory contains what is termed the

A typical printer used with a computer.
iStockPhoto



The tiny microprocessor fostered the microcomputer revolution. Chips like this one are used in home appliances, automobiles, toys, and hundreds of other devices, giving each a "brain" of its own.

Shutterstock

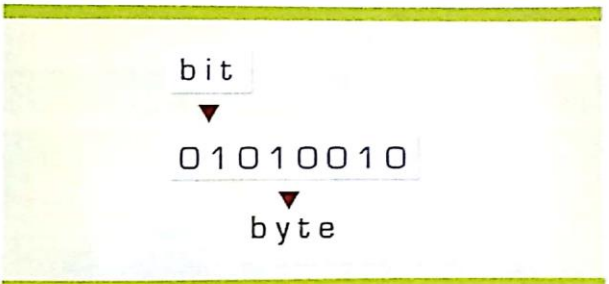


Figure 5.6

Representation of the Letter *A* in ASCII (American Standard Code for Information Interchange) Code

control function—that is, the programs written to tell the CPU what to do and in what order. In computers, control instructions and sets of data are stored in two types of memory:

- **Read-only memory (ROM).** The control instructions that have been "wired" permanently into the computer's memory make up the ROM, which the computer needs constantly, to read programming language and perform internal monitoring functions.
- **Random access memory (RAM).** The more flexible part of the memory makes up the RAM. The particular program or set of data being manipulated by the user is temporarily stored in RAM, only to be erased or transferred to storage after use to make way for the next program.

A computer's memory size is usually described in terms of how many bytes it can store at one time. A **byte** is the number of bits required to represent and store one character (letter or number) of text. A **bit** is a single unit of data, coded in binary form as either 0 (off) or 1 (on). A byte is usually made up of 8 bits of various combinations of 0s and 1s (Figure 5.6) A **kilobyte (KB)** refers to approximately 1,000 bytes (1,024 to be exact), a **megabyte (MB** or "meg") indicates 1,000 KB or approximately a million bytes, and a **gigabyte (GB** or "gig") is equal to 1,000 MB or approximately one billion bytes. Megabytes are the units used to measure the RAM storage capacity of a computer. Thus, if a computer can process 1,024,000 bytes, it is said to have 1 "meg" of memory capacity. We now talk about RAM storage in terms of **terabytes (TB),** which is a million megabytes or a trillion bytes. These more powerful machines capable of processing more bytes simultaneously thus have more computing capacity.

A computer's memory is one of its limiting factors. You need to be sure that the computer has enough memory to run the software you will be using. If you plan to use more than one application at a time, it is recommended you have a minimum of 1 GB. Although one megabyte of memory can hold approximately 2,000 single-spaced pages of text, many graphics and animations require several megabytes to display properly. The computer's operating system, application programs, and data files are usually stored on the computer hard drive, which is inside the computer. The hard drive provides a "permanent" place within the computer for these types of programs and documents to reside. But a hard drive is vulnerable and can "crash," so it is often best to keep backups of programs and data files separately from the CPU. Recordable CD-ROMs are a common way to store programs, and recordable DVDs are also available on most machines. Storage capacity (measured in MB or GB) has expanded to keep pace with the rapidly growing memory demands of today's software and the ever-increasing size of graphics- and animation-laden data files.

High-capacity removable media devices serve as the portable storage format of choice. Usually called **removable-storage devices,** they are small, portable, and used primarily for backing up and archiving data files. **USB (universal serial bus)** is a hardware interface technology that allows the user to connect a device without having to restart the computer. A USB minidrive, sometimes called a **flash drive** (or *jump drive*), is a form of removable storage device that lets you store files in a portable unit, whose capacity can range from a few megabytes to a gigabyte or more. Some minidrives have removable flash memory cards, allowing the user to increase the memory capacity of the minidrive by changing the memory chip. This same memory chip might also fit into a digital camera or a handheld device, thus making the interchange of visual and text information very flexible. The

The USB flash drive is a convenient way to transfer information from one computer to another.
Lexar Media

USB minidrive does not require any special wiring and can fit into your pocket. One additional feature is its suitability for either Windows or Mac computers, permitting users to switch between platforms with ease.

Removable-storage devices have many uses, including the following:

- Archiving old files that you don't use anymore but may want to access someday
- Storing unusually large files, such as graphic images that you need infrequently
- Exchanging large files with someone
- Moving your files from one computer to another, perhaps from your desktop to your laptop computer or from your home computer to a classroom computer
- Keeping certain files separate from files on your hard disk (e.g., old test files)

CD-ROM discs can digitally store and reproduce music, verbal narration, text, or graphics. A CD-ROM can hold approximately 250,000 pages of text. An entire encyclopedia can be stored on a single CD-ROM with room to spare. A computer can find and list all page references to any topic in that encyclopedia within seconds.

Nearly all computers now have built in CD-ROM read/write drives, allowing the computer not only to read what is on a CD-ROM but also to copy data to a blank CD-R (recordable CD). Most computers are now available with DVD-R (recordable DVD) devices to play and record DVD media. DVD devices are capable of reading both DVD and CD-ROM discs. A single-layer DVD can store up to 4.7 gigabytes of data at a cost of less than a penny per megabyte of storage. Newer high-definition (HD) DVDs can store up to 60 GB. Its vast storage capacity makes the DVD an extremely attractive medium for reference materials, multiple media applications, simulations and games, virtual reality experiences, and complex problem-solving exercises.

ASSURE Case Study Reflection

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Review the ASSURE Classroom Case Study and video at the beginning of the chapter. What hardware will be needed for students to create, save, and present their final water cycle products? What storage system would be appropriate for Kerry Bird's fourth-grade students to save the files they have created?

COMPUTER ACCESS

We have seen a trend in schools toward the multiple-computer classroom, in particular toward the use of laptop carts. In earlier days when schools had a limited number of computers, they often assembled them in a computer laboratory. As more computers became available, single computers were assigned to individual classrooms. Teachers soon discovered how to successfully use multiple computers in their classrooms. Some schools therefore dismantled the laboratories, distributing the computers to individual classrooms and increasing the number of classrooms with multiple computers.

ONE-COMPUTER CLASSROOM

In some schools access to computers is still limited. Often there is just a single computer lab where a teacher can take a whole class of students to work on computers as part of a lesson (See Taking a Look at Technology Integration: Classroom Use of a Single Computer with a Large Group). However, increased interest by many teachers in incorporating computers into lessons limits the availability of the computer lab. One solution has been to place a computer in each classroom that teacher and students can use throughout the day.

It is possible for a teacher to use a single computer in creative ways with a whole class of students. Although some

TAKING A LOOK AT TECHNOLOGY INTEGRATION

Classroom Use of a Single Computer with a Large Group

A high school economics teacher uses a single computer with a class of 24 students, coupling the computer with a data projector that allows all students to see what is on the monitor. The teacher uses prepared computer graphics instead of overhead transparencies for key points and illustrative graphs. She can advance from one visual to the next as needed and also reveal key words from the presentation with the touch of a key.

The biggest advantage of the computer in a large-group instructional situation is its usefulness in presenting "what if" results. For example, while presenting the concepts of supply and demand, students can discuss the effect of an increase in availability of a product on its cost. Following the discussion the teacher can project the results. When the teacher puts student-suggested values into the computer, the class sees the results immediately. Economics comes alive in the classroom when years of data can be manipulated within minutes for all to see.

Ellen Senisi

software is geared for use by single students in work on specific tasks, other software is designed for group activities. For example, with the series Decisions, Decisions, groups of students interact with the computer to get specific information before they can proceed with their group activity. The students do not need to work on the computer during the entire lesson. While one group interacts with the computer, the remaining groups are working at their desks.

The one-computer classroom allows several formats for use of the equipment:

- *Large group.* With a digital projector you can demonstrate to a whole class how to use a particular software program or how to manage a particular set of data.
- *Small group.* A small group of students can work together on the computer. Each group has a turn using the software to gather or present data and then returns to their seats, allowing the next group to have their turn.
- *Learning center.* Individual students or small groups can go to a learning center anchored by the computer. By integrating a particular specific software program, you create an interactive learning center on that subject.
- *Personal assistant.* The computer can assist you with maintaining grades, communicating with parents, and preparing instructional materials.

MULTIPLE-COMPUTER CLASSROOM

Many classrooms have several computers available. This can be helpful when groups of students need to use the same software simultaneously (Figures 5.7 through 5.9). Student groups of two or three can share one computer. The teacher may also have a projection device to display information for all students on one screen.

LAPTOP CART CLASSROOM

A popular variation of the multiple-computer classroom is the mobile computer cart. Many schools provide a laptop cart as

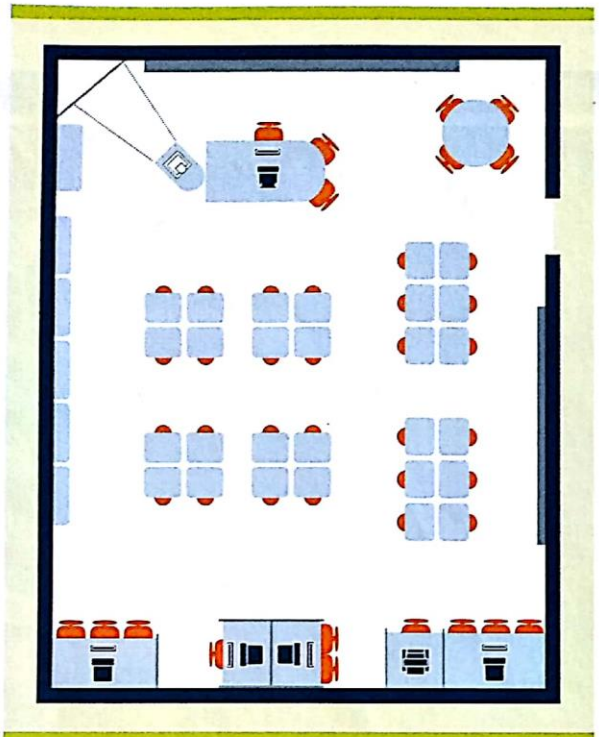

Figure 5.7
Elementary Classroom with Four Computers Used for Individual and Small-Group Study
Source: Plan developed by Interactive Learning Systems, Inc., Cincinnati, OH.

a way to offer multiple computers for the classroom without the major expense of installing permanent computers. The cart allows teachers access to a set of laptop computers when needed. Teachers share the cart and benefit from computers in classroom settings, rather than having to leave the classroom to go to a computer laboratory. Additionally, the carts take advantage of wireless technology, thus providing access to the Internet or to software available on the central school server.

COMPUTER LABORATORY

When a teacher wants each individual student to be working on a computer during a lesson, it is necessary for the whole class to have access to computers simultaneously. Schools often place 20 to 25 networked computers together in a single room shared by all. The computer laboratory or "lab" is appropriate if you want students to be working independently or in small groups on different programs and different activities. To monitor student activity and keep them on task, as well as preventing students from viewing inappropriate or irrelevant material, the computers can be placed around the walls of the computer lab with the monitors facing the center of the room (see Figure 5.10), allowing you to quickly see what each student is doing and respond to student questions individually. In some networks the teacher can control and monitor what is shown on each student computer.

There are advantages to using a computer lab. A group of students can be taught the same lesson simultaneously, which might be more efficient for the teacher. Also, software can be located in one place conveniently. Supervision and security are often easier when all the computers are located in a single room. Labs are often structured to facilitate ease of use by putting all the computers on one network, sharing software stored on a central server. This allows connected computers to be placed throughout the school building so students can connect to the network from the computer lab, their classrooms, or the media center.

The foremost limitation with the computer lab is access. If there are no other computers available to students outside the lab, then students will have to wait until the lab is not scheduled to use the facilities. If one class is scheduled to use the lab, the other classes will have to wait. Also, because

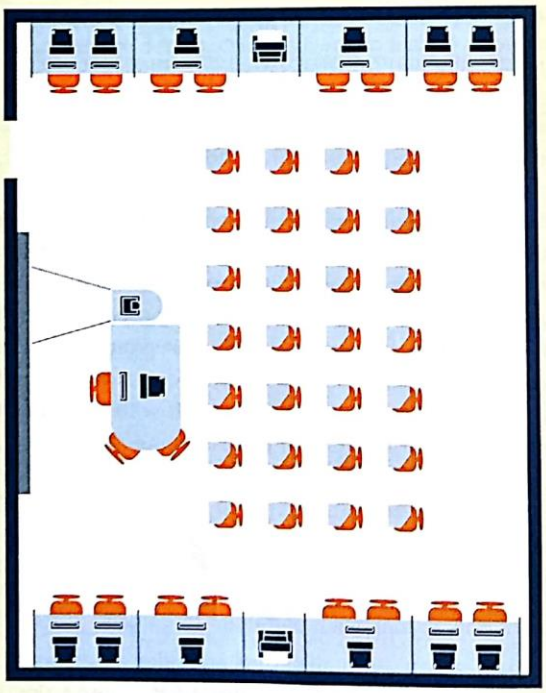

Figure 5.8
High School Classroom with 12 Computers and 2 Printers Used Individually
Source: Plan developed by Interactive Learning Systems, Inc., Cincinnati, OH.

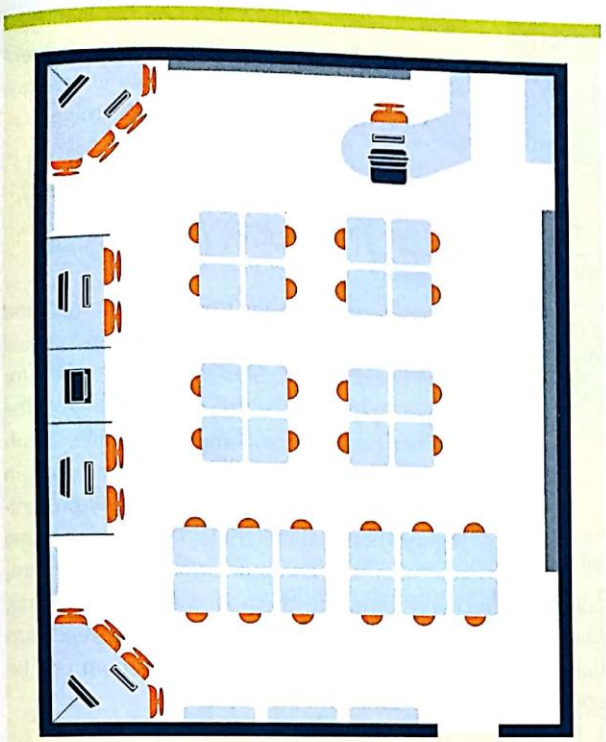

Figure 5.9
Middle School Classroom with Chairs Arranged at Computers for Collaborative Learning
Source: Plan developed by Interactive Learning Systems, Inc., Cincinnati, OH.

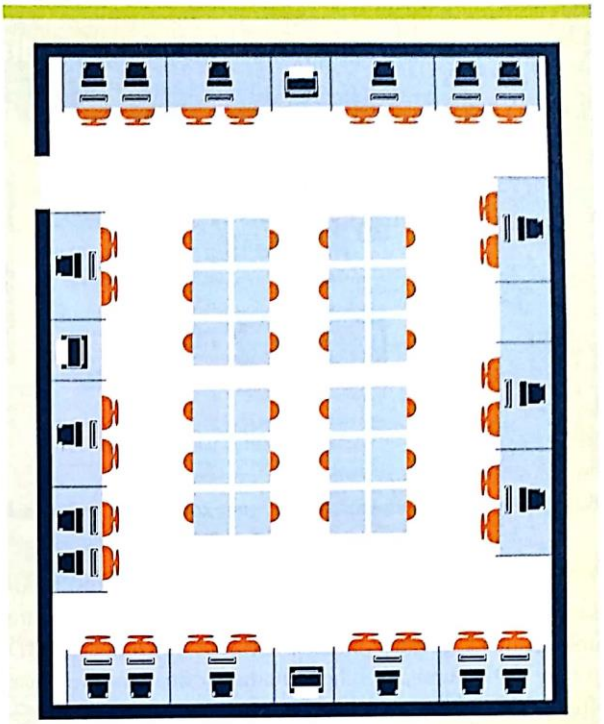

Figure 5.10
Computer Lab
Computers around the wall in a laboratory allow one teacher to monitor all student activity.

of scheduling problems, some classes may not have access to the lab at all. Creative use of school-wide networks can ease some of the congestion problems so that classroom and laptop cart computers can be connected to the resources. Thus, if the lab is not available, students can use the classroom computer or laptops from the cart to do what they needed to do in the lab.

ASSURE Case Study Reflection

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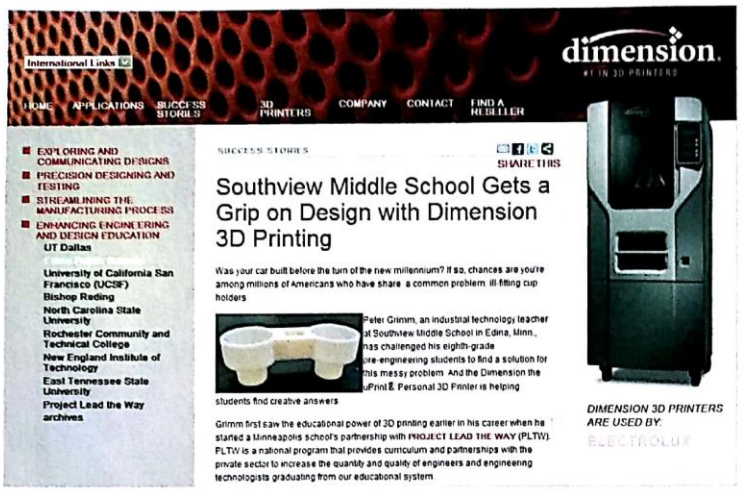
Review the ASSURE Classroom Case Study and video at the beginning of the chapter. What type of computer access would be appropriate for Kerry Bird's fourth-grade students as they work on their product? Describe the advantages and limitations of each of his choices.

DIGITAL FABRICATOR

A Printer for Real Objects

3D printers or rapid prototyping machines, also known as "fabbers" (short for fabricators), are a relatively new form of computer output device that can build 3D objects by carefully depositing materials drop by drop, layer by layer. Using a geometric blueprint from a CAD program and the proper type of fast-setting liquid, you can create complex objects that would normally take special tools and skills when using conventional manufacturing techniques. A fabber can allow you to explore new designs, email physical objects to other fabber owners, and most importantly—set your ideas free.



Source: www.dimensionprinting.com. Image courtesy of Stratasys, Inc.

Traditional 3D printers are room-sized and cost thousands of dollars. As the technology improves, companies are able to make smaller printers, such as the Dimension 3D printer shown here, for school, home, or small business use. The Fab@Home digital fabricator printer is even smaller—the size of a desktop printer—and is comparable in cost to a home computer system. It uses common materials to create the three-dimensional objects. Silicon calk, fast-drying liquid resin, and even Cheez Whiz work well in the fabricator. The one thing the printer cannot print is paper! If you can imagine it, you can build it on your fabricator.

These printers are appearing in schools around the world where students are learning to use CAD programs. Now students can design their ideas with the CAD program and then actually print or "fab" them on the spot. They can hold the object and view it from all directions, permitting 21st century learners to move literally into new dimensions of learning.

SUMMARY

Computers are by far the most common and important instructional technology device used in education. Students can use them for active, hands-on learning experiences. The teacher can use the computer to help in collecting information about student progress in the classroom and for preparing and presenting instructional materials. Whether you have one or a few computers in your classroom, you can effectively integrate them into student learning. Many schools have computer labs; however, the trend is to make laptop carts available so that any classroom can be converted into a lab setting.

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To check your comprehension of the content covered in Chapter 5, go to the **MyEducationKit** for your book and complete the Study Plan for Chapter 5. Here you will be able to take a chapter quiz, receive feedback on your answers, and then access resources that will enhance your understanding of the chapter content.

ASSURE Lesson Plan

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The following ASSURE Lesson Plan provides a detailed description and analysis of the lesson in the ASSURE Classroom Case Study and video at the beginning of the chapter. To review the video again, go to the MyEducationKit for your text and click on the ASSURE Video under Chapter 5. The video explores how Mr. Kerry Bird implements a lesson in which fourth-grade students complete a PowerPoint project to demonstrate their knowledge of the water cycle.

Analyze Learners

General Characteristics. The students in Kerry Bird's fourth-grade class are of mixed ethnicities and from low- to middle-income homes. They are fairly equally distributed by gender and all are 9 or 10 years old. The majority of the students are reading at grade level, with four reading above grade level and three struggling with reading. Generally, the students are well behaved, but tend to become restless when required to complete traditional seatwork.

Entry Competencies. The students are, in general, able to do the following:

- Create and save PowerPoint presentations
- Locate and download digital files from the server
- Insert graphics into presentations
- Enter and edit presentation text

Learning Styles. Kerry's fourth-grade students learn best when engaged in hands-on activities. Their level of motivation increases when using computers because they can personalize their work. Some students prefer to express their creativity through written narratives or drawn images, whereas some choose to create or find existing images to express their ideas. Students' learning styles also vary in their preference for working independently or with other students.

State Standards and Objectives

Curriculum Standards. National Science Education Standards—Content Standard D: As a result of their activities in grades K–4, all students should develop an understanding of changes in earth and sky.

Technology Standards. National Educational Technology Standards for Students 3—Technology Productivity Tools: Students use technology tools to enhance learning, increase productivity, and promote creativity.

Learning Objectives

1. The students will illustrate and accurately label the four stages of the water cycle in a hand-drawn storyboard.
2. The students will create a PowerPoint presentation meeting the following criteria: contains five slides, with first slide as title slide; each slide includes a graphic, text, and sound; transitions are used between each slide; the presentation uses a design template that supports the water cycle theme. The PowerPoint presentation illustrates and provides an accurate text explanation of each of the four phases of the water cycle.
3. The students will verbally describe each of the four phases during their PowerPoint presentations of the water cycle.

Select Strategies, Technology, Media, and Materials

Select Strategies. Kerry Bird selects teacher- and student-centered strategies. The teacher-centered strategies involve a review of the water cycle process by the use of a wall poster and

a student question-and-answer session. Kerry also guides students through the beginning stages of producing their water cycle storyboards to ensure they understand the process. The student-centered strategies occur in three stages. First, students complete their water cycle storyboards by writing descriptions of each phase and sketching images to illustrate the concepts. Next, students go to the computer lab to create PowerPoint presentations of the water cycle. The final strategy involves how students present their water cycle projects.

Select Technology and Media. This lesson involves student use of computers and PowerPoint software to create water cycle presentations. Kerry uses the computer lab for the lesson because each student is required to create an individual PowerPoint presentation. The lab also has a digital projector and screen for the student presentations. Students download digital photos of local areas and insert audio files of weather sounds and music to their PowerPoint presentations. Kerry uses the following guidelines to assess the appropriateness of his technology and media selections:

- *Alignment with standards, outcomes, and objectives.* PowerPoint provides the necessary tools for students to meet the learning objectives.
- *Accurate and current information.* Not applicable for the chosen technology and media.
- *Age-appropriate language.* PowerPoint is written at a somewhat advanced level for fourth-grade students; however, the icons assist with understanding.
- *Interest level and engagement.* PowerPoint provides features, such as inserting graphics and sound and personalizing backgrounds and color, that increase student interest level and engagement.
- *Technical quality.* PowerPoint has superior technical quality.
- *Ease of use.* Use of PowerPoint requires initial training and support when using some features, such as inserting graphics from a server or the Web.
- *Bias free.* PowerPoint is bias free.
- *User guide and directions.* The online help features of PowerPoint are difficult for fourth-grade students to use. Students most frequently ask each other or the teacher for assistance with technical difficulties.

Select Materials. The materials for this lesson include a color poster of the water cycle, a teacher-created storyboard, and blank drawing paper for students to produce storyboards of the water cycle. The water poster is commercially produced and was purchased with school funds.

Utilize Technology, Media, and Materials

Preview the Technology, Media, and Materials. Kerry previews the PowerPoint software to ensure it has the features needed for the lesson. He previews the water cycle poster to ensure it has content that matches the lesson standards and objectives. He also previews the digital photos saved on the school server to ensure that images accurately reflect water cycle stages.

Prepare the Technology, Media, and Materials. Kerry prepares two sets of materials for the lesson. The first is a hand-drawn storyboard of the water cycle that will serve as a model for the student products. The second is a PowerPoint presentation of the water cycle that not only serves as a model for the students, but also ensures that the planned activities are workable. In other words, students will be able to access and download files from the server, students will be able to insert and listen to audio files, and the presentations will be viewable with the digital projector.

Prepare the Environment. The lesson takes place in the classroom and the computer lab. Computers in the lab should be checked to ensure that PowerPoint software is functional and that all computers have access and can save to the school server. The projector needs to be tested to ensure that it projects clear images, is properly connected to the appropriate computer, and displays PowerPoint presentations with full functionality.

Prepare the Learners. To prepare the students, Kerry introduces the lesson and reviews the learning objectives. When in the computer lab, he reviews the basics of using PowerPoint software, downloading files from the server and operating the digital projector.

Provide the Learning Experience. The learning experience occurs in the classroom and the computer lab. It involves both teacher-centered and student-centered activities and the use of computers to produce and present student-created PowerPoint presentations of the water cycle.

Require Learner Participation

Large-Group Activities. Kerry introduces the lesson, reviews the learning objectives, and asks students questions about the water cycle as he completes the first two stages of a "class-size" storyboard. Kerry uses the questions to check for student understanding of previously learned content.

Independent Student Activities. Following the large-group activity, the students individually complete their water cycle storyboards. Taking the storyboards to the computer lab, the students use computers and PowerPoint software to create water cycle presentations. Students produce the basic five-slide presentation and add text to each slide as it is written on their storyboards. They then review images saved on the server and select one or more for each water cycle stage. When the text and images are in place, students can add audio, change the backgrounds and color schemes, and add transitions between slides. For the final activity, students present their water cycle PowerPoint products to the class.

Evaluate and Revise

Assessment of Learner Achievement. Kerry assesses learner achievement in two ways. He first assesses demonstration of content knowledge from the information in students' PowerPoint displays and in their oral narrations during the presentations. The second part of his assessment considers the technology skills shown, which Kerry assesses by evaluating the final student presentations according to the assignment criteria stated in the learning objectives: five slides, the first of which is the title slide; each slide containing a graphic, text, and sound; transitions used between each slide; presentation based on a design template that supports the water cycle theme.

Evaluation of Strategies, Technology, and Media. Kerry evaluates the water cycle lesson strategies, technology, and media by continually checking with students during lesson implementation and by also conducting a whole-class discussion of the process at the conclusion of the lesson. His goal is to determine student impressions of this use of technology and to solicit their ideas for improving the process. Also, because Kerry keeps notes for each lesson,

he can review past water cycle lessons and compare the current lesson to identify strengths and weaknesses.

Revision. The evaluation reveals that the students really enjoyed creating the PowerPoint presentations but were uncomfortable presenting them to the class, primarily due to feeling unprepared and from lack of student interest in their presentation. Kerry revises the lesson by providing instruction on how to give an oral presentation. He also introduces the use of a peer evaluation form that includes student ideas about what an "excellent" presentation would include.

CONTINUING MY PROFESSIONAL DEVELOPMENT

Demonstrating Professional Knowledge

1. What are techniques for integrating computers resources in the curriculum?
2. Describe five types of software that can be used in the classroom.
3. Discuss the advantages and limitations of using computer resources in learning.
4. Discuss the differences among a one-computer classroom, a multiple-computer classroom, laptop carts, and computer laboratories in terms of setups and uses.
5. Describe an appropriate instructional situation for using computer resources to support student learning. Include the setting, topic, audience, objectives, content of the materials, and rationale for using this media format.

Demonstrating Professional Skills

1. Create a list of topics you would include if you were to conduct a one-day computer implementation workshop for teachers in your content area. (ISTE NETS-T 5.D)
2. Describe how you can use a computer resource as a learning tool within your content area. (ISTE NETS-T 2.A & 2.B)
3. Select at least five computer programs suitable for your content area. Critique each program using the Selection Rubric: Computer Software found in this chapter. (ISTE NETS-T 2.A)
4. Select a topic or standard that can be used in a classroom setting of your choice. Describe three ways to use computer software to address the diverse learning needs of students and three ways to develop students' higher-order thinking skills and creativity. (ISTE NETS-T 2.A, 2.B, & 2.C)

Building My Professional Portfolio

- *Creating My Lesson.* Using the ASSURE model, design a lesson for one of the case studies presented in the Case Study Chart in the Lesson Scenario Chart appendix or use a scenario of your own design. Use information from this chapter related to incorporating computers into your instructional setting. Be sure to include information about the audience, the objectives, and all other elements of the ASSURE model. Be certain to match your intended outcomes to state or national learning standards for your content area. (ISTE NETS-T 2.A)
- *Enhancing My Lesson.* Using the lesson you have just designed, consider your audience again. Assume that some of your students have special needs, such as physical or learning impediments. Also assume that several students are identified as gifted. How will you adapt or change your lesson design to ensure that these students are recognized and supported to allow them to succeed in your lesson? (ISTE NETS-T 4.B)
- *Reflecting on My Lesson.* Reflect on the process you have used in the design of your lesson and your efforts at enhancing that lesson to meet student needs

within your class. What have you learned about matching audience, content, instructional strategy, and materials? What could you have done to develop your students' higher-order thinking or creativity skills?

In what ways did the materials you selected for your lesson enhance the learning opportunities for your students? (ISTE NETS-T 5.C)

SUGGESTED RESOURCES

Print

Cook, A., & Hussey, S. (2007). *Assistive technologies: Principles and practice* (3rd ed.). St. Louis, MO: Mosby.

Counts, E. L. (2003). *Multimedia design and production for students and teachers*. Boston: Allyn & Bacon.

Gura, M. (2005). *Recapturing technology for education: Keeping tomorrow in today's classrooms*. Latham, MD: Scarecrow Education.

Ivers, K. S., & Barron, A. E. (2005). *Multimedia projects in education: Designing, producing, and assessing* (3rd ed.). Westport, CT: Libraries Unlimited.

O'Bannon, B., & Puckett, K. (2010). *Preparing to use technology: A practical guide to curriculum integration* (2nd ed.). Boston: Allyn & Bacon.

Roblyer, M., & Doering, A. (2010). *Integrating educational technology into teaching* (5th ed.). Boston: Allyn & Bacon.

Web Links

To easily access these web links from your browser, go to the MyEducationKit for your text, then go to Chapter 5 and click on the web links.

Awesome Library

www.awesomelibrary.org

This website provides links to resources for technology use in the classroom at all levels and for helping schools with technology decisions.

Classroom Connect

http://corporate.classroom.com

Classroom Connect provides resources and guides for professional development and technology integration to help classroom teachers and school districts.

Education World

www.education-world.com

Lesson plans, school resources, and new technology ideas are all included in Education World's site.

InTime

www.intime.uni.edu

InTime provides many different video examples of teachers using and describing technology in their teaching.

Kathy Schrock's Guide

http://school.discovery.com/schrockguide

Among the many resources for teachers is one developed by classroom teacher Kathy Schrock. This site offers classroom teachers an array of links, lesson plans, and professional development suggestions.