CHAPTER

2

Designing and Assessing 21st Century Learning

Knowledge Outcomes

This chapter addresses ISTE NETS-T standards 2, 4, and 5.

1. Describe the similarities and differences in learning theories.
2. List the eight principles of effective instruction for 21st century learners.
3. Describe the similarities and differences in the principles of effective technology and media utilization.
4. Describe the similarities and differences between the types of effective learning assessment.

Goal

Understand how to design and assess 21st century learning.

Learning is the development of new knowledge, skills, or attitudes as an individual interacts with information and the environment. Learning doesn't happen by magic. Rather, teachers must make important decisions to ensure learning, especially when integrating technology and media into a lesson. Foundational learning theories, the principles of effective instruction that integrate technology and media, and effective assessment of learning are all elements of designing and assessing 21st centruy learning.

The resources available to students today offer them many opportunities for learning.

Technology and media can be valuable resources to integrate into the assessment of learning. Learners in the 21st century need to be better educated to assume the challenges of continually evolving knowledge and skill requirements for the future (Partnership for 21st Century Skills, n.d.). What students are learning today needs to prepare them for an uncertain tomorrow, and lifelong learning is a cornerstone to guiding students toward understanding how to approach the shifting knowledge and skills of their future. By creating seamless access to the global community and opening new avenues for addressing how and what to learn, technology and media have become essential interfaces for learners as they move forward in their education.

Even as students are entering the classroom with greater understanding of worldwide issues, other learning challenges prevail. Many come into school speaking more than one language, and it is predicted that by 2025, nearly half of all classrooms will have students who do not speak English as their first language (Partnership for 21st Century Skills, n.d.). Students also have greater fluency with technology and media and have greater opportunities for exposure to different points of view and cultures. Even before today's children enter school, many have experience with technology as a learning tool through television programs designed to instruct young children. Many also understand how computers can be used for learning and for communicating. Another medium for communication and interactivity, the cell phone, has become the great equalizer for all students regardless of their social and ethnic backgrounds. How teachers view the role of technology and media in the classroom depends very much on their beliefs about how people learn.

Learning Theories

Even at an early age, children learn to use technology to expand their learning opportunities.

Over the past half-century there have been several dominant theories of learning. Each has implications for instruction in general and for the use of technology and media in particular. We briefly survey each of the major perspectives on learning and discuss their implications. Driscoll (2005) discusses learning theories and their impact on teaching decisions in greater detail.

BEHAVIORIST PERSPECTIVE

In the 1950s, B. F. Skinner, a psychologist at Harvard University and a proponent of **behaviorism,** conducted scientific studies of observable behavior. He was interested in voluntary behavior, such as learning new skills, rather than reflexive behavior, as illustrated by Pavlov's famous salivating dog. He demonstrated that reinforcing, or rewarding desired responses, could

Learning is sometimes done best by the individual student working alone.

shape the behavior patterns of an organism. Skinner based his learning theory, known as *reinforcement theory,* on a series of experiments with pigeons. He noted that when the pigeons were given a reward for a desired behavior, they tended to repeat it. When the pigeons did not receive any reinforcer, they tended to stop a particular behavor. Skinner reasoned that the same procedures could be used with humans. The result was the foundation for computer-assisted instruction. Unlike earlier learning research, Skinner's work was logical and precise, leading directly to improved instruction and learning.

Behaviorists refuse to speculate on what goes on internally when learning takes place. They rely solely on observable behaviors. As a result, they are more comfortable explaining relatively simple learning tasks. Because of this posture, behaviorism has limited applications in teaching higher-level skills. For example, behaviorists are reluctant to make inferences about how learners process information. Although most would argue that, in the 21st century, behavioral concepts are not necessarily applicable to the types of learners you are encountering in your classrooms, you may determine that some basic knowledge or skills require a behaviorist approach to instruction. For example, you might have a student who would benefit from completing a math program that guides him through a series of incremental steps to learning multiplication, with reinforcements integrated throughout, until he has mastered the multiplication table. The student will not be finished with the program until his work is considered to be acceptable and he can demonstrate his ability to complete multiplication facts.

COGNITIVIST PERSPECTIVE

In the latter half of the twentieth century, cognitivists made new contributions to learning theory by creating models of how learners receive, process, and manipulate information. **Cognitivism,** based on the work of Swiss psychologist Jean Piaget (1977), explores the mental processes individuals use in responding to their environment—that is, how people think, solve problems, and make decisions. For example, behaviorists simply state that practice strengthens the response to a stimulus. Cognitivists, on the other hand, create a mental model of short-term and long-term memory. New information is stored in short-term memory, where it is rehearsed until ready to be stored in long-term memory. If the information is not rehearsed, it fades from short-term memory. Learners then combine the information and skills in long-term memory to develop cognitive strategies, or skills for dealing with complex tasks.

Cognitivists have a broader perception of learning than that held by behaviorists. Students are less dependent on the guiding hand of the teacher and rely more on their own cognitive strategies in using available learning resources. Many would suggest that the cognitivist approach to instruction is a good compromise between required **benchmarks,** those standards against which students are tested, and **metacognition,** thinking about one's own learning.

CONSTRUCTIVIST PERSPECTIVE

Constructivism is a movement that extends beyond the ideas of cognitivism, considering the engagement of students in meaningful experiences as the essence of experiential learning. Shifting from passive transfer of information to active problem solving and discovery, constructivists emphasize that learners create their own interpretations of the world of information. They argue that students situate the learning experience within their own experiences and that the goal of instruction is not to teach information but to create conditions in which students can interpret information for their own understanding. The role of constructivist

instruction is to provide students with ways to assemble knowledge rather than to dispense facts. Constructivists believe that learning occurs most effectively when students are engaged in authentic tasks that relate to meaningful contexts (i.e., learning by doing). The ultimate measure of learning is therefore the ability of the student to use knowledge to facilitate thinking in real life. This approach fits with the needs of 21st century learners who must solve problems that not only capitalize on their existing knowledge, but also require them to seek additional information or skills in finding effective solutions.

Teachers can help guide the 21st century learner explore new information.

SOCIAL-PSYCHOLOGICAL PERSPECTIVE

Social psychology is another well-established approach to the study of instruction and learning. Social psychologists look at how the social organization of the classroom affects learning. For example, what is the group structure of the classroom—independent study, small groups, or the class as a whole? What is the authority structure—how much control do students have over their activities? What is the reward structure—is cooperation rather than competition fostered?

Researchers such as Robert Slavin (1990) have taken the position that cooperative learning is both more effective and more socially beneficial than competitive and individualistic learning. Slavin developed a set of cooperative learning techniques embodying the principles of small-group collaboration, learner-controlled instruction, and rewards based on group achievement.

The 21st century learner enters your classroom with many skills developed from technology-based social networking. The ideas fostered in the social psychology perspective address such interdependent collaborative abilities that 21st century learners need to use as part of their learning.

Teachers need to develop an eclectic attitude toward the various schools of learning psychology. You are not obliged to swear allegiance to a particular learning theory. You want to use what works. If you find that a particular learning situation is suited to a behaviorist approach, then you should use behaviorist techniques. Conversely, if the situation seems to call for cognitivist or constructivist strategies, those are what you should use. When guiding the 21st century learners in your classroom, consider which learning theory best applies to the particular type of learning task at hand.

Together, a group of students can collaborate on their learning.

Principles of Effective Instruction for 21st Century Learners

As a classroom teacher, your role is to establish learning experiences that foster the defined learner outcomes. At times those outcomes may be based on specific state or national learning standards; at other times they may be based on negotiated outcomes with individual learners. Whichever direction you take, you need to think about how to engage students in the learning process.

As an educator seeking ways to improve your practice, it is important to consider how to engage learners in their learning.

Because one common feature across all classroom settings is the variety of learning levels and needs among students, it is also critical to determine the best ways to meet the needs of all students by becoming skilled at differentiating instruction to ensure that all learners are adequately and appropriately challenged in their learning. For example, you may offer in-depth reading materials for students who are reading above grade level for extended learning experiences, and worksheets with hints and answer keys for those who are struggling to understand the concepts of the topic.

Research-based classroom practices to engage learners have evolved over time. These principles of effective instruction offer ways to engage your learners regardless of their ability levels:

- *Assess prior knowledge*. Before you can properly provide instruction, you should gather relevant information about each student's knowledge and skill level. You need to know what knowledge your students already have learned. To learn from most materials and activities, students must possess prerequisite knowledge and skills (Newby, Stepich, Lehman, & Russell, 2010).
- *Consider individual differences*. Learners vary in terms of personality, general aptitude, knowledge of a subject, and many other factors. Be aware of the multiple learning needs of your students—for example, whether a language other than English is spoken in a child's home. You need to consider the technology and media experiences your students have had and what resources are essential to help your students learn. Effective instruction allows individuals to progress at different rates, cover different materials, and even participate in different activities (Cooper & Varma, 1997).
- *State objectives*. For you and your students to know where instruction is going and what is to be accomplished, the goals must be specified. Learning objectives must match expected outcomes or standards (Mager, 1997).
- *Develop metacognitive skills*. The skills of selective monitoring, evaluating, and adjusting their approaches enhance students' learning and help to make them lifelong learners. Learners need assistance in understanding how they learn and what resources help in that process (Nelson, 1992).
- *Provide social interaction*. Teachers and peers serving as tutors or group members can provide a number of pedagogical as well as social supports. Learners gain experience and expertise when collaborating with others in and beyond the classroom (Jonassen, Howland, Marra, & Crismond, 2008).
- *Incorporate realistic contexts*. Learners are most likely to remember and to apply authentic knowledge presented in a real-world context. Rote learning leads to "inert knowledge"; that is, learners know something but cannot apply it to real life. Students benefit from understanding how their knowledge and skills fit into the world around them (Bransford, Brown, & Cocking, 2000).
- *Engage students in relevant practice*. The most effective learning experiences are those requiring learners to practice skills that build toward the desired outcome. Learner participation increases the probability of learning. Practice, especially in varying contexts, improves retention rate and the ability to apply the new knowledge, skill, or attitude. Practice promotes deeper, longer lasting learning (Morrison & Lowther, 2010).
- *Offer frequent, timely, and constructive feedback*. Student learning requires accurate information on misconceptions, misunderstandings, and weaknesses. Learners need to know if their thinking is on track. Feedback may come from a teacher, a tutor, electronic messages from a computer, the scoring system of a game, or oneself. In addition to knowing that responses are incorrect, students need to know why they have been unsuccessful and how they can improve their performance. Further, knowing details about their correct responses in terms of how and why they are accurate helps students understand more about what they have learned (Black & William, 1998).

INFORMATION VERSUS INSTRUCTION

As educators, it is important to distinguish between information and instruction. **Information** is knowledge, facts, news, comments, and content. Information can be presented in a memo, in the classroom, in a textbook, or on the Web. Often the presentation, whether it is live, printed, or on the Internet, is general in content and its purpose is to give an overview of ideas or subject matter—to generate interest, to provide background information, or to give procedural details.

Learners should not be expected to be responsible for the retention or use of information they have only seen or heard. The information provided by a job aid (a short guide to help the user), like a phone book, is not meant to be memorized. It is assumed that you will look up the information when needed. With computers, it has become possible to give ever more rapid and detailed information in specific situations, to the point that the computer could be said to be helping or "coaching" the individual. Although with frequent use of a job aid or a computer help system a person might gradually internalize information, remembering more and more of the information provided, the learning is not an intentional part of the system, whose aim is only to provide just-in-time assistance or specific information.

Instruction, on the other hand, refers to any intentional effort to stimulate learning by the deliberate arrangement of experiences to help learners achieve a desirable change in capability. Instruction is meant to lead to learning. Active engagement with the information—questioning it, discussing it, applying it to practice situations—is the critical component of instruction. Meaningful understanding, retention, and application require instructional activities, including practice with feedback. Instruction, therefore, has as its goal a lasting change in the capability of the learner. This is a crucial point in distinguishing instruction from just providing information.

Instruction is also the arrangement of information and the environment to facilitate learning. By *environment* we mean not only where instruction takes place, but also the strategies, technology, and media needed to convey information and guide learning. The learner or the instructor may do this. Gagné (1985) describes instruction as a set of events external to the learner designed to support the internal process of learning.

Preparing the instructional environment is another critical role for teachers. As a teacher responsible for creating learning opportunities for your students, you will need to help them work within learning communities. By using collaborative learning tools such as classroom blogs, wikis, social networking resources, and learning management systems, you can help your 21st century learners move through the various levels of learning appropriate to their goals, the state learning standards, and expected outcomes.

BLOOM'S DIGITAL TAXONOMY AND 21ST CENTURY 4 CS

Benjamin Bloom developed a learning taxonomy that he described as stages focused on cognitive learning skills ranging from knowledge through evaluation (Bloom and Krathwohl, 1984). His idea was that students progressed in an orderly fashion from simple to complex mental abilities. He suggested that students started at the knowledge stage by recalling specific content (e.g., reciting a poem from memory). Students then progressed to the comprehension stage, in which they would be able to paraphrase or summarize the content (e.g., using your own words, describe what the author meant in her poem). He assumed if students could understand meaning, then they were ready for the next step, application. At the application step, students could use the ideas or information in a meaningful way (e.g., using the author's ideas in her poem, relate those ideas to a similar topic). Finally, Bloom felt that when the student had progressed through these prior steps, it was now time to generate a new idea or example (e.g., using a similar poetry style, write your own poem about a similar topic). He called this highest step evaluation.

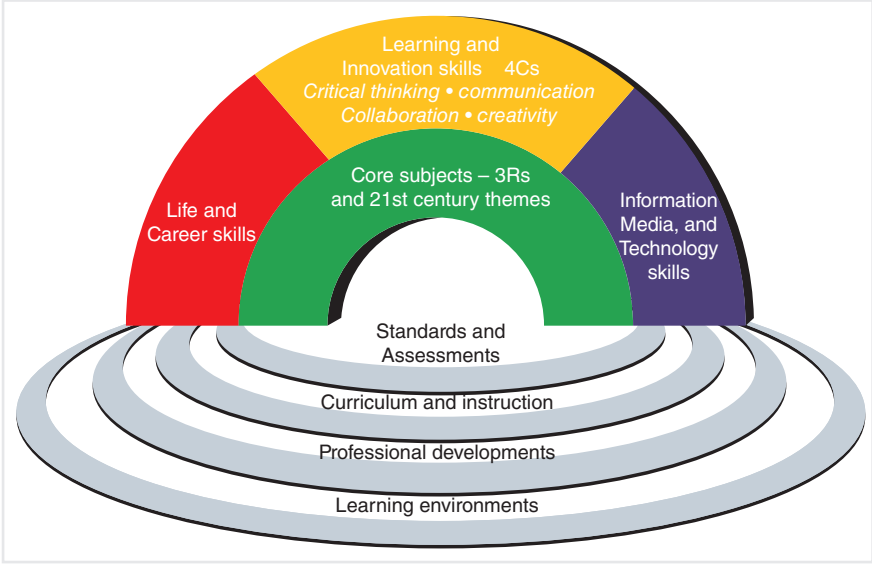
Over time, Bloom's Taxonomy has been revised and modified. While best known for his original work in the cognitive domain, Bloom added the psychomotor (manipulative or physical skills) and affective (attitudes or feelings) domains, which followed a similar pattern in a

taxonomy. Bloom further expanded his cognitive taxonomy and divided it into lower-order thinking skills, such as requiring the ability to recall specific facts, and higher-order thinking skills, such as applying the facts to a unique task. His idea was that students needed the lower-order skills in order to be successful at the higher-order skills. In addition, he advocated that all students were to be guided through the steps into higher-order thinking. For example, a teacher would require students to learn multiplication tables, explain relationships between the number facts, use multiplication to solve a specific story problem, and finally to use their multiplication knowledge in a unique and different way, such as in an art project in which they discussed how they repeated certain design elements as a means to demonstrate their understanding of multiplication concepts.

The most recent modification to Bloom's original steps has been termed Bloom's Digital Taxonomy (Churches, 2008). What is significantly different about the new taxonomy is that it is not focused on only cognitive skills, but rather integrates action and resources into the stages. In the Digital Taxonomy, the interplay of use of resources with the cognitive process is an essential element to understanding how students learn. The premise of moving through each stage is not emphasized, but rather the intent is to capitalize on where the student is and what approaches will best help the student to learn the information and use it in meaningful ways. Also critical to the new taxonomy is a focus on collaboration and scaffolding of ideas. In the Digital Taxonomy, the teacher's role as a learning guide is emphasized, as is the idea that technology and media are essential tools to facilitate student learning. Now the teacher does not need to require prior knowledge of multiplication skills in order for students to gain that knowledge as they apply multiplication skills to a problems they generated as part of their explorations of a local problem to be resolved.

Fast forward several years, and the Partnership for 21st Century Skills (**www.p21.org**) identified skills that every student needs to have to be a successful learner (Figure 2.1). The focus is on those higher-order thinking skills that Bloom and Churches identified as critical to quality learning experiences. The Partnership identified four skills as the means by which children can acquire their academic knowledge: critical thinking, communication, collaboration, and creativity. Each of these skills requires that students have knowledge or can locate the information they need in order to be successful in the implementation of the knowledge as part of their active learning experiences. As a teacher, you would work with groups of students who share their knowledge and understanding to gain further knowledge as they resolve a creative and unique problem that has significant impact on a local setting.

FIGURE 2.1 21st Century Student Outcomes and Support Systems



Source: Reprinted with permission of the Partnership for 21st Century Skills.

Closely aligned to the four 21st century skills are cross-cultural understandings through which students have opportunities to view their learning experiences in a global context. For the classroom teacher, these new views of Bloom's Taxonomy and the 21st century skills suggest new approaches of facilitating learning using media and technology outside the regular classroom to facilitate preparation of classroom activities. You can guide your students to work on larger issues across a greater span and learn more from students outside the classroom setting. The GlobalSchoolNet (**www.globalschoolnet.org**) offers teachers opportunities to collaborate, plan, and

New Tech Network

Started in California, the New Tech Network is a national initiative to develop innovative high schools. It is an outgrowth of the philosophy that empowering students through an alternative instructional approach will help them to become creators, leaders, and tomorrow's productive citizens. New Tech Network advocates learning environments that provide student-centered settings in which

- Problem-based learning engages learners
- Students and teachers have ownership of their learning experiences
- Technology is integrated throughout the entire learning experiences

The goal is to provide students with an integrated curriculum that focuses on critical thinking, collaboration, and problem solving as vehicles to learning. They have the data to demonstrate that their ideas are working, with graduation rates that are significantly higher than the national averages. Also, more of the graduates from New Tech high schools pursue careers in mathematics, science, and engineering than their regular high school peers.

Technology and media are good sources for gathering information prior to classroom activities.

conduct joint learning projects that engage students from varied locations in working together to solve a common problem. Teachers can also participate in topical discussions with groups focused on key educational issues. Other possibilities include the opportunity to manage or attend online courses, mentor other educators, or try out new ideas in a safe, supportive environment.

The teacher is no longer the source of knowledge, standing and delivering as in earlier school models. Rather, the teacher designs learning situations that focus on engaging learners in active learning experiences while developing their knowledge, understanding, and ability to use knowledge to generate new ideas. As a teacher, you will design lessons, considering the NETS-T (**www.iste.org/standards/nets-for-teachers**) and NETS-S standards (**www.iste.org/standards/nets-for-students**) and the resources available to students in order to facilitate moving students toward critical thinking, collaboration, and creativity. Technology and media provide the valuable resources that teachers and students can use to achieve the learning outcomes while engaging in those higher-order thinking arenas. In other words, you can "flip" your classroom by having your students explore the content through media and technology prior to coming to the classroom where you can engage them in applying that knowledge to real-world situations.

Teachers guide students in their effective use of technology to support learning.

MEETING LEARNER NEEDS

Your students are the focus of your instruction; everything you do in the classroom is designed to help your students meet the intended learning outcomes. The more you understand their levels of learning and their interests, the easier it will be for you to address ways to help them learn. When making instructional decisions your goal is to find ways to ensure success. Decide on the strategy or strategies you will use, the technology and media that will offer the best support, and how you will assess students' learning progress.

It is important for teachers to be aware of the multiple types of student intelligences when planning lessons. Howard Gardner (2011), who was dissatisfied with the concept of IQ and its unitary view of intelligence, developed the concept of **multiple intelligences.** Noting that not everyone has the same abilities nor do they learn in the same way, he identified nine aspects of intelligence:

- Verbal/linguistic (language)
- Logical/mathematical (scientific/quantitative)
- Visual/spatial (imagining objects in space/navigating)
- Musical/rhythmic (listening/movement)
- Bodily/kinesthetic (dancing/athletics)
- Interpersonal (understanding other people)
- Intrapersonal (understanding oneself)
- Naturalist (relating to one's surroundings)
- Existentialist (ability to reflect)

Gardner's theory implies that effective teachers need to consider the different learning abilities of their students, recognizing that students vary widely in terms of strengths and weaknesses in each of these areas. The best way to do this is by designing lessons that actively address the range of learning abilities, considering students' perceptual preferences and strengths, information processing habits, motivational factors, and physiological traits that influence their ability to learn. Your 21st century learners come into your classroom with abilities in varying states of development. Your responsibility is to determine how best to address their learning needs while also attending to their individual approaches to acquiring knowledge and skills.

Most lessons can include a variety of technology and media that address the wide range of student abilities. For example, your lessons can include writing activities for students with verbal/linguistic strengths, use of graphics for visual/spatial abilities, or out-of-seat activities for students who prefer bodily/kinesthetic learning. Using Storymaker software allows your students to blend images with text and gives them the opportunity to practice both their verbal/linguistic and their visual/spatial intelligences.

Principles of Effective Technology Utilization

The National Education Technology Plan sets clear expectations for today's teachers to be competent in the use of technology in their teaching (U.S. Department of Education, 2010). This is especially true when working with 21st century learners and addressing the skills outlined for them. Teachers not only need to use technology effectively in their teaching, but they also need to guide students in using those tools to enhance their learning (Bowes, D'Onofrio, & Marker, 2006). The advent of newer technologies requires critical decisions related to the best tools to integrate into teaching. We will be addressing many of these newer technology resources throughout the remaining chapters of this textbook.

The **National Education Technology Standards for Students** (NETS-S), noted in the following list, specifically outline expectations for student use of technology to guide their learning (International Society for Technology in Education [ISTE], 2007).

- Creativity and Innovation
- Communication and Collaboration
- Research and Information Fluency
- Critical Thinking, Problem Solving, and Decision Making

- Digital Citizenship
- Technology Operations and Concepts*

Information can be learned from materials beyond the classroom.

Many of these standards address the essential elements for success in acquiring 21st century knowledge and skills. As a teacher you will be expected to enhance students' abilities to engage in the use of technology to support their learning and address these six areas of competency, also known as **technology literacy** skills. In addition you are expected to enhance learning by engaging students in the 21st century skills of critical thinking, collaboration, communication, and creativity and innovation. What you can note in looking at the two lists of skills to emphasize is that they are very similar and are not something to be considered as "add ons," but rather they can be integrated into the learning experiences you arrange for your students.

You should combine knowledge and skills related to content areas and information literacy skills by using technology in ways that help students learn information and communicate knowledge. For example, in a science lesson on weather, you can present a problem to your students that will require them to search websites for data or information, use communication tools to collaborate with outside experts, generate solutions to the problem collaboratively, and present their ideas to classmates using creative resources. By approaching your instruction in that manner, you have addressed many of the standards by which your students will be measured and will have given them guided practice in developing their knowledge and skills.

Principles of Effective Media Utilization

Learning from multiple sources of media provides us with information and challenges our thinking. As users of these sources we need **media literacy** skills to know how to access them, how to understand and analyze the content, and how to create new media messages (Stansbury, 2009).

Text, television, video, and a host of other media sources covered within this textbook are all valid and vital sources of information. Your role is to guide your students to use these media as sources for their learning in ways that are wise, safe, and productive. For example, students need to learn to find multiple sources to verify facts they may have heard on the news or read in the newspaper. They need to learn to be critical users of these resources to ensure that they are well informed and their conclusions are accurate. As mentioned earlier, the NETS-S and 21st century skills address many of the abilities learners need to be successful consumers of the media resources surrounding them.

Furthermore, your teaching approach should provide students with opportunities to explore how to use these media resources to communicate their knowledge. Later in this textbook you will see examples of how teachers guide their students to use a variety of media to express their knowledge and skills.

Principles of Effective Learning Assessment

The method of assessing achievement depends on the nature of the objective. Some learning objectives call for relatively simple cognitive skills—for example, stating Ohm's Law, distinguishing adjectives from adverbs, or summarizing the principles of the Declaration of Independence. Learning objectives such as these lend themselves to more traditional written tests.

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Other objectives may call for process-type behaviors (e.g., diagramming a sentence, solving quadratic equations, or classifying animals), the creation of products (e.g., a sculpture, a written composition, a PowerPoint presentation, or a portfolio), or to exhibit attitudes (e.g., choosing to read during free-time activities, placing used paper in the recycle bin, or eating healthy snacks). This type of learning objective requires a more comprehensive, **authentic assessment**, such as a performance-based evaluation of a student's demonstration of learning in a natural context.

AUTHENTIC ASSESSMENT

Rising interest in authentic assessment of students is driven by commitment to a constructivist perspective. Authentic assessments require students to use processes appropriate to the content and skills being learned and to how they are used in the real world. It is the difference between learning science facts and doing what scientists do. How many people take paper-and-pencil tests as part of their occupation?

Authentic assessments can be applied to most performance or products that students develop to demonstrate their knowledge or understanding of the content. The most commonly used rating scales for authentic assessments include performance checklists, attitude scales, product-rating checklists, and rubrics.

When assessing basic process skills, a performance checklist can be an effective, objective way of recording student performances. Figure 2.2 shows a primary-grade checklist for using an audio storybook. Notice the simple yes or no recording system.

Although attitudes are admittedly difficult to assess, measurement tools have been devised, such as attitude scales (see the biology example in Figure 2.3). The five-point scale (strongly agree to strongly disagree) offers the opportunity to capture a range of attitudes. A number

FIGURE 2.2 Performance Checklist: Using an Audio Storybook

Performance Checklist: Using an Audio Storybook

Name _____ Class _____

Indicate Yes or No with an "X" in the appropriate column.

Did the Student	Yes	No
1. Locate the assigned audio storybook?	_____	_____
2. Complete the Material Checkout Form for the storybook?	_____	_____
3. Select the appropriate CD player?	_____	_____
4. Select the appropriate headphones?	_____	_____
5. Correctly insert the storybook CD?	_____	_____
6. Correctly connect the headphones?	_____	_____
7. Play the CD and follow along as the storybook was read?	_____	_____
8. Remove the CD and headphones when the story was finished?	_____	_____
9. Return the audio storybook, CD player, and headphones to the proper location?	_____	_____
10. Complete the Materials Return Form?	_____	_____

Teacher Name _____ Date _____

FIGURE 2.3 Attitude Scale: Biology

Attitude Scale: Biology

Each of the statements below expresses a feeling toward biology. Please rate each statement on the extent to which you agree. For each, you may select (A) strongly agree, (B) agree, (C) undecided, (D) disagree, or (E) strongly disagree.

A	B	C	D	E
Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree

_____ 1. Biology is very interesting to me.
_____ 2. I don't like biology, and it scares me to have to take it.
_____ 3. I am always under a terrible strain in biology class.
_____ 4. Biology is fascinating and fun.
_____ 5. Learning biology makes me feel secure.
_____ 6. Biology makes me feel uncomfortable, restless, irritable, and impatient.
_____ 7. In general, I have a good feeling toward biology.
_____ 8. When I hear the word *biology* I have a feeling of dislike.
_____ 9. I approach biology with a feeling of hesitation.
_____ 10. I really like biology.
_____ 11. I have always enjoyed studying biology in school.
_____ 12. It makes me nervous to even think about doing a biology experiment.
_____ 13. I feel at ease in biology and like it very much.
_____ 14. I feel a definite positive response to biology; it's enjoyable.

of other suggestions for attitude measurement can be found in Robert Mager's *How to Turn Learners On . . . without Turning Them Off* (see this chapter's Suggested Resources).

For product skills, a product-rating checklist can guide your evaluation of critical subskills and make qualitative judgments more objective, as in the rating form in Figure 2.4 for a student-created digital concept map. This checklist provides more detailed information regarding student performance because each product component is rated from poor to excellent rather than on a yes/no scale.

Used to provide a more comprehensive assessment of student performance, a rubric is a set of assessment criteria for appraising or judging student products or performances. A rubric typically consists of a rating scale for performance criteria based on level-of-performance descriptors. The performance criteria are the key area of focus for the performance or the product (e.g., problem presentation, supporting graphics, appropriate labels). Rating scales to measure achievement of performance criteria normally range from three to six levels designated by names and/or numbers. A three-point scale might be shown as (1) needs work, (2) okay, (3) good. An example of a four-point scale might show the following levels: (1) beginning, (2) developing, (3) accomplished, and (4) exemplary. The descriptors for the levels of performance describe the student performance or product at each level. By comparing an actual student product or performance to the descriptors, a teacher can give a numerical score. An example rubric for a multimedia product is presented in Figure 2.5. See "Technology Resources: Rubrics" for rubric resources.

FIGURE 2.4 Product Evaluation Checklist: Digital Concept Map

Product Evaluation Checklist: Digital Concept Map

Name _____ Date _____

Rate the digital concept map on the basis of content and layout by checking the appropriate box.

Content	Poor	Fair	Good	Very Good	Excellent
• Key ideas are represented	☐	☐	☐	☐	☐
• Supporting ideas are logical	☐	☐	☐	☐	☐
• Information is accurate	☐	☐	☐	☐	☐
• Paraphrasing is appropriate	☐	☐	☐	☐	☐
Comments about the content:					
Layout					
• Main idea shapes are appropriate	☐	☐	☐	☐	☐
• Supporting idea shapes are appropriate	☐	☐	☐	☐	☐
• Connecting lines are meaningful	☐	☐	☐	☐	☐
• Graphics support concepts	☐	☐	☐	☐	☐
• Use of colors is appropriate	☐	☐	☐	☐	☐
• Font is clear and easy to read	☐	☐	☐	☐	☐
Comments about the layout:					

Overall Evaluation:	Overall Comments:
____ Poor	
____ Fair	
____ Good	
____ Very Good	
____ Excellent	

Portfolio Assessment. If your assessment plan involves determining the overall individual performance of each student, traditional or electronic portfolio assessments can help achieve your goal. Portfolios are used to assess tangible products that exemplify student accomplishments in terms of analysis, synthesis, and evaluation. A key component of portfolios is their requirement for students to self-reflect on their own learning as demonstrated in the portfolio products. For example, students are asked to select a piece of work that demonstrates achievement of a learning objective and then to explain why they chose the piece and how it shows the target knowledge and skills. The reflections can be extended to develop metacognitive skills by asking the students to describe what they would do differently to improve their learning.

To use portfolios, begin by deciding between traditional or electronic formats. Then identify the types of artifacts that will demonstrate student achievement of the standards and objectives and select or develop an appropriate rating scale (previously described). The rubrics should be given to students before they begin working on the products. The types of artifacts that a portfolio might contain include the following:

- Written documents such as poems, stories, or research papers
- Audio recordings of debates, panel discussions, or oral presentations
- Video recordings of skits, lab experiments, or 3-D models
- Computer multimedia projects such as animated timelines, podcasts, or WebQuests

Traditional versus Electronic Portfolios. Traditional portfolios are physical collections of student work, whereas electronic portfolios contain digital work. Traditional portfolios consist of paper documents, photos, video and audio recordings, or perhaps 3-D models. The portfolios

FIGURE 2.5 Multimedia Product Rubric

Multimedia Product Rubric

Student's Name _____ Date _____

Category	4	3	2	1
Content	Covers topics in-depth with details and examples. Subject knowledge is excellent.	Includes essential knowledge about the topic. Subject knowledge appears to be good.	Includes essential information about the topic but there are 1–2 factual errors.	Content is minimal OR there are several factual errors.
Sources	Source information collected for all graphics, facts, and quotes. All documented in desired format.	Source information collected for all graphics, facts, and quotes. Most documented in desired format.	Source information collected for all graphics, facts, and quotes, but not documented in desired format.	Very little or no source information was collected.
Organization	Content is well organized, uses headings or bulleted lists to group related material.	Uses headings or bulleted lists to organize, but the overall organization of topics appears flawed.	Content is logically organized for the most part.	There was no clear or logical organizational structure, just lots of facts.
Requirements	All requirements are met and exceeded.	All requirements are met.	One requirement was not completely met.	More than one requirement was not completely met.
Originality	Product shows a large amount of original thought. Ideas are creative and inventive.	Product shows some original thought. Work shows new ideas and insights.	Uses other people's ideas (giving them credit), but there is little evidence of original thinking.	Uses other people's ideas, but does not give them credit.

TECHNOLOGY RESOURCES

Rubrics

Rubistar

http://rubistar.4teachers.org

Rubistar is a free online tool designed to assist teachers in creating a variety of rubrics. The website has numerous examples of rubrics that can be accessed through keyword searches. If you are new to rubrics, the site offers a rubric tutorial. When you are ready to try it out, Rubistar provides an easy-to-use template to create and print rubrics. If you complete the registration, you can save and edit rubrics online.

Assessment Focus

www.assessmentfocus.com/rubrics-rubric-makers.php

Assessment Focus offers a number of links to sites that will help you generate rubrics. The site includes links for ready-made rubrics, as well as sites that will allow you to build your own rubrics.

Teach-nology

www.teach-nology.com/web_tools

The Teach-nology site offers a variety of rubric resources for teachers. Both samples and templates are available to use. The rubrics are developed for grades K–12 to include social studies, math, science, and reading and language arts.

are often kept in large three-ring binders and storage boxes, which are moved from teacher to teacher as the student progresses through school. As can be imagined, over time the portfolios can become quite large and hard to manage and store.

Electronic portfolios (called **e-portfolios**), on the other hand, store all the student work as digital files. For example, any computer-generated products, such as spreadsheets, word-processed reports, or WebQuests, can be directly added to the portfolio. Student work created on paper, such as drawings, handwritten poems, or illustrated stories, can be converted to digital format with a scanner. For capturing actual student performances, digital audio and video are also important components of an electronic portfolio, including readings, skits or presentations, student-created 3-D models, or lab experiments conducted by students. The digital format also allows students to add their self-reflections as text or audio narration.

An e-portfolio provides the opportunity for a student to use artifacts in multiple ways. For example if a student writes a paper on how the Mississippi River influenced the economy of the bordering communities that he feels is a good example of his language arts skills, he would place it in the e-portfolio for that purpose. If later, that student realizes that the paper would also serve to demonstrate his insights into social studies knowledge, he can connect that same artifact to another aspect of his e-portfolio. The ability to move or connect the artifacts within the e-portfolio offers students more options in how they capitalize on the ways to demonstrate their success in learning outcomes.

Electronic portfolios can be created with specialized portfolio software, at online sites, or with combinations of basic software such as PowerPoint. Drawbacks for electronic portfolios include availability of equipment and time, as well as questions of access to the tools. Moreover, creating e-portfolios is initially time-consuming because teachers and students need to learn how to scan, save, and format documents in a useful and appealing manner. However, once the process is mastered, e-portfolios take less time to maintain and obviously require less storage space than traditional portfolios. Security is a concern when deciding who will have access to the files among parents, principals, counselors, teachers, and other students. For some practical tips on using Google Docs as an open source software solution for e-portfolios, visit Dr. Helen Barrett's ePortfolios website, http://electronicportfolios.org.

TRADITIONAL ASSESSMENT

There are times when, as a teacher, you need to verify that students have specific knowledge or skills. Often, more traditional measures are used to demonstrate levels of knowledge. Such things as multiple-choice, fill-in-the-blank, true/false, or short-answer tests are ways to identify students who have mastered particular facts and to determine which students may need additional instruction (Waugh & Gronlund, 2012). Traditional tests tend to be used to measure lower-order learning, which is sometimes essential to ensuring students are meeting state and local learning standards.

Teachers can design traditional tests using learning objectives as their guide. Many instructional materials, such as textbook series, include tests as part of their teacher resource package. Teachers can use these types of tests as quick measures to determine which students need additional instructional assistance or to check on student progress on a particular topic or skill. Traditional tests can serve as a way to identify where students are in their knowledge about a topic prior to designing instruction; thus, you will not repeat content that students have already mastered.

In addition, each state is required to annually report the progress of students' learning. State-wide **standardized tests,** which are administered in a consistent manner and use the same scoring procedures, are a type of traditional assessment measure. In this instance, the tests are scheduled for a specific date across the state and the procedures are carefully orchestrated so that student learning is measured in the same way. Currently, state standardized tests are used to identify student learning that is meeting or exceeding state standards and to determine where there is a need for improvement.

Summary

In this chapter we discussed the major theories of learning and how teachers need to consider them when working with a variety of students. Teachers need to design instruction to meet the needs of 21st century learners. As a teacher, you will want to be prepared to engage your students with technology and media to motivate them and help them to gain the types of knowledge and skills they need to be successful learners. In addition, we addressed several ways to assess student learning.

Professional Development

DEMONSTRATING PROFESSIONAL KNOWLEDGE

1. Describe the similarities and differences in the learning theories discussed in this chapter.
2. What are the eight principles of effective instruction for the 21st century learner?
3. Describe the similarities and differences in the principles of effective technology and media utilization.
4. Describe similarities and differences in the different types of effective assessments presented in this chapter.

DEMONSTRATING PROFESSIONAL SKILLS

1. Prepare a 10-minute presentation on your reaction to a topic of interest in this chapter (ISTE NETS-T 5.C).
2. Analyze an instructional situation (either real or hypothetical) and identify the psychological perspective on learning and the technology and media used (ISTE NETS-T 5.C).

3. Prepare a position paper on the roles of technology and media in learning (ISTE NETS-T 5.C).
4. Describe different instances in which you would use the types of assessment described in this chapter (ISTE NETS-T 2.D).

BUILDING YOUR PROFESSIONAL PORTFOLIO

- *Enhancing My Portfolio*. Select a lesson from a source on the Web. Indicate how specific portions of the lesson illustrate, if present, the psychological perspectives addressed in this chapter (behaviorist, cognitivist, constructivist, and social psychology). Identify the assessment that is used to measure student learning. Discuss the value of the assessment being used. Cite the source of the lesson. Reflect on this analysis, providing strengths, weaknesses, and recommendations for teaching this lesson to a specific group of students (ISTE NETS-T 2.C).
- *Reflecting on My Learning*. Reflect on the different assessment processes described in the chapter. Discuss how these assessment strategies measure student learning and where they best fit into an instructional situation. Comment on the types of teacher feedback that might contribute to student understanding of the assessment results (ISTE NETS-T 5.C).

Suggested Resources

PRINT RESOURCES

Anderson, R., Grant, M., & Speck, B. (2008). *Technology to teach literacy: A resource for K–8 teachers* (2nd ed.). Boston, MA: Allyn & Bacon.

Callison, D. (2003). *Key words, concepts and methods for information age instruction: A guide to teaching information inquiry.* Englewood, CO: Libraries Unlimited.

Del, A., Newton, D., & Petroff, J. (2007). *Assistive technology in the classroom: Enhancing the school experiences of students with disabilities.* Upper Saddle River, NJ: Prentice Hall.

Erben, T., Ban, R., & Castanda, M. (2008). *Teaching English language learners through technology.* New York, NY: Routledge.

Jonassen, D. H., Howland, J., Moore, J., & Marra, R. M. (2002). *Learning to solve problems with technology: A constructivist perspective* (2nd ed.). Upper Saddle River, NJ: Merrill/Prentice Hall.

Mager, R. (1997), *How to turn learners on . . . without turning them off*. Atlanta, GA: CEP Press.

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

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

WEB RESOURCES

International Society for Technology in Education

www.iste.org

ISTE is an association focused on improving education through the use of technology in learning, teaching, and administration. ISTE members include teachers, administrators, computer coordinators, information resource managers, and educational technology specialists.

eSchool News

www.eschoolnews.com

This site offers a convenient way to keep up to date electronically with what is going on with technology in schools.

Partnership for 21st Century Skills

www.p21.org

The Partnership for 21st Century Skills advocates for infusing 21st century skills into education. Working with leaders in business, education, and policy, the organization's goal is to work with schools to infuse 21st century skills into education and provides tools and resources to help facilitate and drive change.

Learning Styles Inventory

http://www.learning-styles-online.com/inventory/questions.php?cookieset=y

The Learning styles inventory has 70 questions that assess dominant and secondary learning styles concerning the following areas: aural, verbal, physical, logical, social, and solitary.

Learning Styles Inventory for Students with Learning Disabilities

www.ldpride.net/learning_style.html

This website offers an inventory to identify the preferred learning styles of students with learning disabilities. The inventory results provide educators and parents with a better understanding of students' learning preferences. This information will assist in adapting learning environments to better meet the needs of individual learners.