Chapter 9

Teaching and Learning with Technology in Special Education

By Min Wook Ok and Joan E. Hughes

Learning Outcomes

After reading this chapter and completing the learning activities, you should be able to:

9.1 Identify basic special education concepts that teachers should know in order to make best use of technology to meet special needs of students. (ISTE Standards for Educators: 1—Learner; 2—Leader)

9.2 Identify current issues and challenges related to providing services for students who have special needs as teachers plan for technology integration. (ISTE Standards for Educators: 1—Learner, 2—Leader; 3—Citizen; 7—Analyst)

9.3 Select technology integration strategies that can meet diverse needs for all students. (ISTE Standards for Educators: 1—Learner; 2—Leader; 3—Citizen; 4—Collaborator; 5—Designer; 6—Facilitator; 7—Analyst)

Technology Integration in Action: Mitosis

GRADE LEVELS: High school

CONTENT AREA/TOPIC: Mitosis (Life Sciences)

LENGTH OF TIME: 6 days

PHASE 1 Analysis of Learning and Teaching Assets and Needs

Step 1: Analyze problems of practice (POPs)

Ms. Ravenscroft, a high school biology teacher, noticed that some students with learning disabilities were doing poorly on content area tests in comparison with the rest of her class. She was becoming frustrated because the strategies she had tried were clearly not sufficient for her students with cognitive disabilities. She decided to collaborate more directly

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with Ms. Ethelbart, the special education resource teacher for the high school. Ms. Ethelbart and Ms. Ravenscroft decided to focus on ways they could enhance explicit instruction on content area concepts, skill, and strategies with special attention to provide multiple representations of content and multiple expressions of mastery of content, a core idea within Universal Design for Instruction (UDL). Research has shown that students with learning disabilities benefit from these instructional strategies because they accommodate varied ways of making meaning and providing explicitness around difficult scientific concepts and processes. Ms. Ravenscroft wanted to focus on an upcoming cell biology unit.

Step 2: Assess technological resources of students, families, teachers, and the school

Ms. Ravenscroft's high school had many computer laboratories, but most were reserved for specialty classes such as computer science and photography/film. She had five computers in her classroom, and she had a teacher innovation station from which she could display digital materials to the whole classroom. Because no students in her class had physical, sensory, or communicative disabilities, her computers did not have any assistive hardware or software beyond what was built in to the operating system. Based on a survey Ms. Ravenscroft gave, most of her students had extensive computer-based experience with social media, web searching, and software use for productivity activities like word processing and presenting. She also knew that all her students had computer access in their homes. The school's library was also available for computer use before and after school and during lunch. Ms. Ravenscroft felt that she was an expert technology user because many of her colleagues came to her to ask for advice. She also had confidence in Ms. Ethelbart's extensive knowledge in special education and assistive technologies. She was known to find creative solutions to learner needs.

Step 3: Identify technological possibilities

The two teachers began researching online resources and assistive technologies to find key solutions for her students with learning disabilities. To target instruction on content concepts, they focused on expanding beyond the textbook-based reading to incorporate other content representations including:

- A computer simulation of mitosis
- A filmed student role-play of mitosis, which would then be an additional learning resource
- A video recording of the teacher lecture portions of instruction, which would then be provided as a learning resource

Ms. Ravenscroft also planned to encourage students to use StudyBlue to create vocabulary flashcards for review activities.

For the final assessment, instead of a text-based test assessment, the teachers decided to offer multiple ways for the students to show mastery of the content. They provided support for students to create a:

- Graphic organizer
- Oral recitation
- Digital presentation
- Written essay

PHASE 2 Design of the Integration Framework

Step 4: Decide on learning objectives and assessments

The teachers based their objectives on Next Generation Science Standards (NGSS) in the high school life science disciplinary core idea, "From Molecules to Organisms: Structures and Processes" (HS-LS1):

Outcome: Understand the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

- **Objective:** At least 95% of the students will achieve at least 80% on their oral recitation, graphical display, digital presentation, or written explanation of mitosis as scored by teacher checklist.
- **Assessment:** Use a checklist of component variables involved in a model of mitosis.

Outcome: Integrate technical vocabulary expressed in words with a visual version of the same information.

- **Objective:** All students will use at least five technical vocabulary terms in their final presentation.
- **Assessment:** Use a checklist of technical vocabulary words and rubric.

Figure 9.1 Ms. Ravenscroft's and Ms. Ethelbart's RATified Lesson

	Instruction	Learning	Curriculum
Replacement Technology is a different means to same end.		• StudyBlue allows vocabulary quizzing	
Amplification Technology increases or intensifies efficiency, productivity, access, capabilities, etc., but the tasks stay fundamentally the same.	• Mitosis simulation provides another representation of content concept	• Video lecture provides more access to teacher instruction and knowledge • Instruction offers multiple ways for students to show mastery of content	
Transformation Technology redefines, restructures, reorganizes, changes, and creates novel solutions.		• Filmed student role-play of mitosis makes students' enactment part of the content resource materials	

Step 5: Design integration strategies and determine relative advantage

The teachers decided to combine directed and constructivist instructional approaches in the lesson while providing the multiple content representations and multiple ways for students to show mastery of the content. Their plan involved the following:

Day 1: The teacher introduces the unit, uses the lectures (filmed), and encourages the use of StudyBlue to generate vocabulary flashcards.

Day 2: The teacher shows the computer simulation. The video lecture and simulation become available on the teacher's website. The students form groups and plan how to enact mitosis.

Day 3: Student groups role-play the process of mitosis, which they film.

Day 4: The role-play videos are added to the teacher's website. Students begin developing their final projects.

Day 5: Students complete work on final presentations.

Day 6: Students enact oral recitations in class followed by peer review. Students who completed graphic organizers, presentations, or written essays submit their presentations to the teacher who assigns peer review as homework.

Relative Advantage

In thinking about the challenge associated with raising scientific understanding and achievement among students with learning disabilities, Ms. Ravenscroft and Ms. Ethelbart together RATified her proposed lesson. Figure 9.1 shows the aspects of instruction, student learning, and curriculum that they felt would be impacted by this technology-based lesson. They were satisfied with the replacement, amplification, and transformation, especially for student learning in the lesson. They felt there was relative advantage to conduct the lesson as planned.

Step 6: Prepare instructional environment and implement lesson

The key to the lesson's success was setting up the environment with appropriate materials. Ms. Ravenscroft and Ms. Ethelbart identified the mitosis simulation in advance. They collaborated with a film teacher to have his students' film and produce the teacher lecture videos. The teachers made sure the five classroom computers had software for creating presentations, graphic organizers, and word processing. They uploaded an explanation of the unit to the classroom website so that parents would see the lesson goals, activities, and the videos (when produced) for all students.

PHASE 3 Post-Instruction Analysis and Revisions

Step 7: Analyze lesson results and impact

At the end of the lesson, the teachers reviewed the students' work. Ms. Ravenscroft found that the results for most of her science students were at or above those in previous years for the same content topic. Results for the students with special needs were much improved as compared with those of past years. She and Ms. Ethelbart discovered that all students with learning disabilities demonstrated understanding of the mitosis process and integrated at least five scientifically technical words in their final work.

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Step 8: Make revisions based on results

Ms. Ravenscroft and Ms. Ethelbart felt that it might help students with learning disabilities to make faster progress if there was a more structured sequence of steps that these students could follow to complete the final evidence of mastery. The teachers planned to create templates for presentations, graphic organizers, oral recitations, and written essays so these students could focus more on presenting their knowledge and understandings and less on the logistics of creating the digital materials. They decided to implement these ideas in future lessons to see the impact of these modifications on their outcomes.

Step 9: Share lessons, revisions, and outcomes with other peer teachers

Ms. Ethelbart was delighted to collaborate with Ms. Ravenscroft and see so much successful learning among all students and those with learning disabilities. Ms. Ethelbart felt she could get support for expanding these instructional changes to science and other content areas. The two teachers planned to share their lesson and its success in an upcoming team meeting with science teachers.

SOURCE: Based on ideas from Grumbine, R., & Brigham Alden, P. (2006, February 23). Teaching science to students with learning disabilities. Retrieved from http://www.nsta.org/publications/news/story.aspx?id=51706.

Introduction

This chapter is unique in that it cuts across teaching and learning activities of all school content areas. It has three major sections. It begins with background information about special education that gives readers a context and framework for reading about this topic. Next, the chapter reviews major issues and challenges in the field that shape how technology can be integrated. Finally, it describes the integration strategies specific to teaching special education topics and discusses how teachers can improve their knowledge and skills in integrating technology most effectively in this important area. The chapter provides a helpful rubric for self-assessment of growth in how well a teacher is able to integrate technology in special education called, "Rubric to Measure Teacher Growth in Technology Integration for Teachers of Students with Special Needs."

For a person with a disability, technologies transform lives because they make living and learning richer. Technologies continue to improve the quality and reach of assistive devices and expand access to learning opportunities for all individuals with special needs. In this chapter, notice the way that technologies improve access to quality of life and learning. Pay special attention to concepts such as **multiple means of representation (MMR) and universal designs for learning (UDL)**.

Introduction to Special Education

In the Individuals with Disabilities Education Act (IDEA) (IDEA, 2004), the federal law protecting the rights of children and youth with a **disability** and their parents, **special education** is defined as "specially designed instruction, at no cost to parents, to meet the unique needs of a child with a disability" (Section 602, p. 10). Special education is reserved for students whose needs cannot be satisfied in general education because of their disabilities (Turnbull, Turnbull, & Wehmeyer, 2010). All children and youth with disabilities, no matter how severe, have the right to free appropriate public education.

According to the National Center for Education Statistics (Snyder, de Brey, & Dillow, 2016), approximately 6.5 million students with disabilities are served under IDEA for special education. Students with disabilities may be identified as having 1 or more of the following 13 categories listed in IDEA: specific learning disability (39%), speech language impairment (18%), other health impairment (14%), autism (9%), intellectual disability (7%), emotional disturbance (6%), developmental delay (2%), multiple disabilities (2%), hearing impairment and deafness (1%), deafness and blindness (<1%), orthopedic impairment (<1%), traumatic brain injury (<1%), and visual impairment or blindness (<1%). The number of students with disabilities spending the majority of their time in general education settings has increased continually. For example, in 2013–2014, approximately 95% of students with disabilities who were served under IDEA were enrolled in regular schools, and about 60% of these students spent most of their time (i.e., 80% or more of school time) in a general education setting (Snyder et al., 2016).

To meet the unique needs of each student with disabilities, it is usually necessary to provide not only **individualized instruction** but also **related services** (e.g., occupational therapy, speech-language pathology). The related services also include **assistive technology service**, which involves "any service that directly assists a child with a disability in the selection, acquisition, or use of an assistive technology device" (IDEA, 2004, Section 602). To provide appropriate devices and service, it is essential that all educators, not only special educators, be informed of and involved with using special education technology for students with disabilities. According to the law (IDEA), an **assistive technology device** is "any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve functional capabilities of a child with a disability" (Section 602). This chapter focuses on providing information regarding a variety of technologies and strategies for teaching students with disabilities.

✓ **Check Your Understanding 9.1**

Issues and Challenges in Special Education

In the sections that follow, issues that have an ongoing influence on how, when, and why technology is used in special education will be introduced. They will provide a context for understanding how current trends and historical issues affect the application and challenges of using technology in schools by students with disabilities and their teachers.

Special Education and Inclusion Requirements

Before the passage of Public Law 94-142 in 1975, students with disabilities were typically excluded from public schools. As special education programs began to take root in U.S. public schools in the late 1970s and early 1980s, specialized instructional services for students with disabilities were provided in separate special education classrooms (West & Whitby, 2008). However, by the mid-to-late 1980s, experts called on special education to **mainstream** students with disabilities into appropriate classes within the general curriculum (McLeskey, Waldron, Spooner, & Algozzine, 2014).

By the time the Individuals with Disabilities Education Act (IDEA, PL 101-476) was reauthorized in 1990, the mainstreaming argument had evolved into advocacy for **inclusion** that resulted in the following clarification in U.S. federal special education law:

- To the maximum extent appropriate, children with disabilities, including children in public or private institutions or other care facilities, are educated with children who are nondisabled
- Special classes, separate schooling, or other removal of children with disabilities from the regular educational environment occur only when the nature or severity of the disability is such that education in regular classes with the use of supplementary aids and services cannot be achieved satisfactorily

- The educational placement of each child with a disability is as close as possible to the child's home (Individuals with Disabilities Education Act of 1990, §300.550, §300.552, 20 U.S.C. §1412 & 1414)

In accordance with federal law, inclusion was the norm by the early 2000s, and the latest research indicates that more than 60% of students with disabilities spend the majority of their day in general education classrooms (Snyder et al., 2016). Thus, the history of special education has been described as a journey of helping students with disabilities gain access to educational opportunity through three stages: isolation, integration, and inclusion (Winzer, 2009).

One of the core principles of inclusion is the concept that individuals with disabilities should be included as valued, active participants in mainstream society and classrooms (McLeskey, Rosenberg, & Westling, 2013). Rather than treating differences as something that needs to be addressed in segregated environments, the premise is that individual differences should be considered an ordinary feature of inclusive classrooms and addressed in ways that are a typical part of classroom instruction (McLeskey, Waldron, & Redd, 2014; Tomlinson, 2013).

Efforts to include students with disabilities over the past 30 years have generally been successful because most students with disabilities are now included in general education classrooms for much of the school day (McLeskey, Landers, Williamson, & Hoppey, 2012). One consequence of this change is that, as a practical matter, special education is largely no longer under the sole control of the profession but rather is embodied in the larger context of educational reform efforts.

A comment by Judy Heumann, who was at the time assistant secretary, Office of Special Education Programs, U.S. Department of Education, captures the critical need for the specialized technologies used by individuals with disabilities: "For most of us, technology makes things easier. For a person with a disability, it makes things possible" (Edyburn, Higgins, & Boone, 2005, p. xiii). Within Heumann's statement are the five essential variables associated with special education technology: (1) the person, (2) the context/environment, (3) the task, (4) the technology tool, and (5) the outcome. In order to determine the best tool solution for an individual, it is essential to consider the individual's characteristics (e.g., abilities, needs, and preferences), characteristics of the environments (e.g., physical and instructional arrangement), and tasks required to achieve in each environment (Zabala, n.d.) to determine possible assistive technology tools to reach the desired outcome. When successful, the result is that an individual is able to complete a task that he or she previously either could not complete or did so slowly or poorly. Thus, the entire work of the field of special education technology can be summarized as searching, trialing, selecting, implementing, and evaluating technologies that augment, bypass, or compensate for a disability.

During the mid- to late 1980s when computers began arriving in K–12 schools, they were initially placed in labs for whole-class instruction. It is easy to trace two sets of technology service delivery systems within schools from the beginning: (1) general education under the direction of a school-based computer coordinator and (2) assistive technology services for students with disabilities who may need adapted hardware and/or special software. Because the two groups of students were educated separately, there was little initial concern about the inequity of this model. Unfortunately, the legacy of this historical divide persists today in most schools.

As computers became commonplace in schools, individuals with disabilities encountered access problems (usually involving the keyboard, mouse, or monitor), thereby creating an obvious need for assistive technology. By the mid-1990s, the computer manufacturing industry began to install accessibility control panels on every computer shipped in the United States. This development marked the beginning of the accessible mainstream technology movement. That is, technology developers began to explore the intrinsic barriers encountered by individuals with disabilities and sought solutions that could be built into hardware and software (e.g., keyboard shortcuts, text enlargement, text-to-speech) that would help an even wider population (e.g., young children, seniors). In time, assistive technology advocates began to view some types of assistive technology as something that could be made available to all students in an inclusive classroom to support access and engagement of diverse learners; the perspective that assistive technologies had a role in the general classroom to help many students would become known as **inclusive technologies**.

Policy Drivers of Technology Use in Special Education

The field of special education has routinely sought to implement large-scale change not through the application of research findings but by using federal education law as a tool for leveraging change (Edyburn, 2013a). In this section, we focus on the following three policies that have driven use of technology in special education: IDEA (2004), universal design for learning (UDL), and web accessibility.

THE INDIVIDUALS WITH DISABILITIES EDUCATION ACT (IDEA) Several federal legislations have addressed assistive technology, including the IDEA (2004), the Tech Act (Assistive Technology Act of 2004, 2004), and the Americans with Disabilities Act (ADA, 1990). These laws mandated application of assistive technology for people with disabilities across a life span. Most of all, the IDEA of 2004 is federal law that has had a significant impact on the application of assistive technology for education. The 1997 reauthorization of the IDEA included a requirement that students with special needs must have an **individualized education program (IEP)**, a written plan explaining how their needs will be addressed, and that **IEP teams** tasked with creating and carrying out the IEP must consider assistive technology in their planning. Advocacy for this mandate was based on the observation that the marketplace had produced many assistive technology solutions that had yet to find their way into schools and as a result, students were losing considerable opportunities for accessing and engaging in the curriculum. Hence, the assistive technology policy initiative sought to ensure that the potential of technology for students with disabilities was realized.

Edyburn (2013b) argued that this policy effectively expanded the notion of assistive technology as something more than an intervention for students with physical, sensory, and communication impairments. In essence, it added 3.8 million students with high-incidence disabilities (e.g., learning disabilities, mild or moderate intellectual disabilities, communication disorders, and emotional or behavioral disorders) to the assistive technology caseload. And, since inclusion had become the primary special education service delivery system, this altered the conversation by requiring IEP teams to consider what technology supports were needed in the general classroom to support the academic success of a student with a disability. As a result, schools today are still subject to the assistive technology consideration mandate and must work diligently to ensure that all students with special needs are adequately evaluated for appropriate assistive technology devices and services.

UNIVERSAL DESIGN FOR LEARNING (UDL) The UDL is a framework that offers equal opportunities for all students to learn. UDL is best known for its three core principles of providing: (1) multiple means of representation, (2) multiple means of expression, and (3) multiple means of engagement. It is intended to offer students multiple ways to access, engage, and demonstrate their mastery of the learning outcomes. It focuses on providing flexibility in curriculum or instruction that can meet the needs of a wide range of learners (Rose & Gravel, 2009). The allure of UDL promised not only to help students with disabilities but also to provide benefit to many other struggling students who could benefit from similar supports.

Since UDL emerged in the early 2000s, there has been much interest in its integration in educational environments in both policy and practice (Ok, Rao, Bryant, &

McDougall, 2016). In 2015, for the first time, an endorsement and definition of UDL was included in the federal law that governs general K–12 education, the Every Student Succeeds Act (ESSA) (Elementary and Secondary Education Act, 2015). ESSA included a definition of UDL that referenced the definition used in the Higher Education Opportunity Act (HEOA, 2008) as follows:

> The term 'universal design for learning' means a scientifically valid framework for guiding educational practice that (A) provides flexibility in the ways information is presented, in the ways students respond or demonstrate knowledge and skills, and in the ways students are engaged; and (B) reduces barriers in instruction, provides appropriate accommodations, supports, and challenges, and maintains high achievement expectations for all students, including students with disabilities and students who are limited English proficient (Section 103).

To learn more about UDL, visit the National Center on Universal Design for Learning or participate in the online learning module provided by the IRIS center. Although using technology is not mandatory, in order to incorporate UDL principles in instruction, the use of technology can make applying them easier. Moreover, for some students who need personal assistive technologies (e.g., eyeglasses, wheelchairs), using technology is necessary for providing students sensory and physical access to learning environments (Rose, Hasselbring, Stahl, & Zabala, 2005). Thus, UDL provided a new way of thinking about technology as an embedded support that could be made available to all students (Edyburn, 2010).

Application Exercise 9.1 Universal Design for Learning: Creating a Learning Environment that Challenges and Engages All Students

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Overall, research indicates that using UDL for instruction has the potential to boost access to the general education curriculum and engagement in learning for students with disabilities and to improve academic and social skills of diverse learners (e.g., English language learners (ELLs), struggling students, and students with disabilities), but more research is required to verify the effects of UDL (Ok, Rao, et al., 2016). The National Education Technology Plan (Office of Educational Technology, 2016) placed a strong emphasis on the importance of using UDL as a way to incorporate personalization in learning and encourages school districts to adopt this intervention as a method for using technology effectively to meet the needs of diverse learners. This plan provides a useful blueprint for planning for future directions of technology in education and illustrates how federal education policy seeks to influence the use of inclusive technologies.

WEB ACCESSIBILITY In the last decade, educational organizations have engaged in a concentrated effort to make websites more usable by people with various disabilities. This practice is referred to as **web accessibility** and consists of designing websites with a specific set of criteria in mind, such as using text equivalents with screen readers, using large or enlargeable images for people with low vision, coloring links as well as underlining them for users with colorblindness, and making pages navigable using the keyboard only. Like UDL, the intention of web accessibility is to provide increased access to information for all users by designing websites for accessibility from the ground up. Since websites have become a primary means to search for and gather information, web accessibility is required to ensure that people with disabilities can access websites. Due the importance of web accessibility, the Department of Justice (DOJ) strives to improve accessibility by creating guidelines under the Americans with Disabilities Act (ADA) (ADA, 1990) (e.g., identifying how people with disabilities are restricted from accessing the web and taking legal action to remove those restrictions). ADA is a legislation addressing accessibility for people with disabilities, but when it was signed in 1990, web accessibility was not explicitly addressed. The DOJ's web accessibility guidelines are expected in 2018.

Educational Reform and Accountability in Special Education

Historically, students with disabilities have not performed as well as their peers. The gap between students with disabilities and their peers continues to be considerable. In 2015, President Barack Obama signed the Every Student Succeeds Act (P.L. 114-95). This bipartisan federal education law extended the commitment to offer equal opportunity to education for all children. The ESSA gave states flexibility to design their own accountability systems to meet the act's legal requirements. According to the act, states have the flexibility in their accountability systems to include wider student performance measures and can establish their own student performance goals while holding schools accountable for student achievement. States need to administer tests to assess student performance on the Common Core State Standards (CCSS) in English language arts and mathematics. ESSA still requires student achievement requirements, including for students with disabilities, to be included in state accountability systems, but it gives states fresh opportunities to gain a better understanding of the achievement of students with disabilities. In addition, the ESSA includes a requirement that states provide two options for assessing students with disabilities: (1) general assessment with accommodations as needed and (2) alternate assessment on alternate academic standards for only 1% of all of the students in the state, those with the most severe cognitive disabilities. The new ESSA plans start in the 2017–2018 school year.

Challenges in Special Education Technology

Although there are many potential benefits of using technology for teaching students with disabilities, some challenges for its appropriate use still exist. Teachers face challenges in knowing how to use and integrate technology for teaching students with disabilities. There has been an increased emphasis on the need for teachers to acquire adequate knowledge about technology to support instruction and students' learning (Teo, 2011), but technology and assistive technologies have received a low emphasis in teacher education programs (Amador, Miller, Kimmons, & Desjardins, 2015). Because of the lack of preparation, both preservice and in-service teachers express a lack of knowledge of the use of technology (Okolo & Diedrich, 2014). This lack of knowledge and skills is the primary barrier to its successful implementation (Dell, Newton, & Petroff, 2012). In addition, students with disabilities may abandon or not use assistive technology devices resulting from stigmatization, lack of training on use of the device (for students, family, and professionals who are involved in using the device), and lack of ongoing technical and maintenance support. For successful technology implementation for students with disabilities, adequate training and ongoing support are necessary.

✓ **Check Your Understanding 9.2**

Shared Writing 9.1 Policies or Laws Providing Access to Online Learning for All Students

Technology Integration Strategies to Meet Special Needs

This section provides information about general approaches to using assistive and instructional technologies for students with special needs and describes specific products that are commonly integrated into curricula for helping achieve academic, behavioral, or social goals. See Table 9.1 for the authors' Top Ten Must-Have Technologies for Special Education.

Foundations of Integration Strategies for Special Education

Special educators must be concerned with assistive technology devices as well as productivity, instructional and web-based technologies described in the first half of the book. Technology integration efforts must include all of these types of technology to find the best solutions for students. Historically, the emphasis on technology for individuals with disabilities has been in the area of **assistive technology (AT)** whose definition consists of two parts, assistive technology *devices* and *service*. Assistive technology *device* is defined as "any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve the functional capabilities of a child with a disability" (IDEA 2004, 20 U.S.C. 1401[1])). Assistive technology *service* refers to "any service that directly assists a child with disability in the selection, acquisition, or use of an assistive technology device" (IDEA 2004, 20 U.S.C. 1401[2]). Providing devices with appropriate services is significantly important for successful implementation of AT.

Table 9.1 Top Ten Must-Have Special Education Technologies

Technology Name	Description
Read and Write Gold	Software program with various support tools for both reading (e.g., text to speech, dictionary) and writing (e.g., word prediction, voice recognition). Read and Write Gold for Google Chrome is free for teachers.
Read2Go	Accessible ebook reader that can be used in conjunction with BookShare to provide individuals with disabilities access to more than190,000 books and textbooks.
Natural Reader	Free text-to-speech tool that is downloaded to the user's computer. Once it is installed, simply copy and paste text into the reader and hear an individual word, sentence, or complete passage.
Livescribe Echo Pen	Smart pen for digital note taking. The pen captures students' handwriting in Livescribe notebooks while capturing audio and synchronizing it to the handwritten text.
Anybook Reader	Digital pen designed for helping struggling readers access texts. Using special stickers designed for the pen, readers can add auditory notes to a book.
GoTalk NOW	Full-featured alternative communication system for individuals unable to communicate because of physical or cognitive impairments.
Proloquo2Go	One of the most popular augmentative and alternative communication (AAC) apps for iPads.
Inspiration & Kidspiration	Software and mobile device apps for digital graphic organizers. Users can combine pictures, text, and spoken words to brainstorm or organize their ideas for reading and writing.
Dragon Dictation	Product designed to allow users to dictate information and have it converted to text. It is useful for anyone who finds keyboarding difficult or impossible.
Laureate First Words™	Research-based intervention app that is designed to help students acquire 50 first nouns in developmental sequence.

As described earlier in this book, **productivity technology** includes devices (e.g., computers, mobile technology) and software (e.g., presentation software) that assist learning but typically do not have curricular content built into them; **instructional technology** includes various technology software or devices (e.g., educational software with instructional content) that include sequenced instructional content, and web-based technologies offer content and opportunities for creation, communication, and collaboration. There is a trend toward having an increasing overlap between productivity, instructional, and web-based devices and software and AT because together they can be used to teach various skills as well as create a flexible learning environment that includes scaffolds for all students including students with disabilities. For example, many technology devices recently released have built-in AT features (e.g., Narrator and Magnifier for Windows). Because AT and productivity, instructional, and web-based resources can benefit students with disabilities, teachers should consider using all of these technologies.

ASSISTIVE TECHNOLOGY EVALUATION REFERRAL The value and significance of AT can be best understood when a person with a disability encounters a task that she or he is unable to complete but can successfully complete using an appropriate AT device. These devices and services enhance the performance of individuals with disabilities by enabling them to complete tasks more effectively, efficiently, and independently than is otherwise possible.

The decision to qualify a student for special education services must be made by an IEP team. Once a child qualifies for special education services, a team is developed and convened to create and oversee the child's IEP. An assistive technology team is not the same as the IEP team. Rather, an **assistive technology team** is established within a school district to provide building-based and cross-building services relative to two key functions: (1) to assess students for assistive technology (much like a referral for special education services, a referral must be initiated for an assistive technology evaluation) and (2) to facilitate the implementation of assistive technology devices and services. The caseload of an assistive technology team member is often determined though the IEP meeting. Finally, assistive technology teams may be called on to assist with significant school transitions between grades levels, new schools, and so forth (Behnke & Bowser, 2010). The assistive technology team may include assistive technology specialists, occupational therapists, physical therapists, speech-language therapists, and others.

CLASSIFYING SOLUTIONS The assistive technology evaluation process generally seeks to identify solutions on a continuum involving no technology ("no tech"), low technology ("low tech"), and advanced technology ("high tech"). The continuum is organized according to the device's price and complexity.

- **No-tech solutions**—These are strategies such as teaching a person to use his or her body in a different manner to minimize the impact of an impairment (e.g., only one hand to use for typing). The obvious advantage to solutions involving no technology is that they are available in any environment at any time at little or no cost.
- **Low-tech solutions**—These solutions are generally considered to be non-electrical. Personal word lists, highlighting markers, and organizing systems are examples of low-technology solutions that can provide a person appropriate levels of support to be successful in specific tasks. These solutions tend to be relatively inexpensive but quite flexible for enhancing individual performance.
- **High-tech solutions**—These are complex electrical or hydraulic systems (e.g., tablet computer, stair lift, powered wheelchair, voice-activated environmental control). High tech can help individuals with disabilities to accomplish tasks that require more advanced functions that could be difficult to accomplish using low tech. Clearly, high-tech solutions tend to be the most costly and have the most restrictions regarding their use (e.g., user skill level, limited portability).

Professional practice in special education calls for the evaluation of potential solutions beginning with no tech, continuing to low tech, and then going to high tech as the needs dictate. For example, the ability to spell words is most efficient when the words have been committed to memory. However, if a person displays persistent difficulty in spelling from memory (no tech), low-tech options such as personal word lists or portable dictionaries may be helpful. High-tech solutions such as electronic spell checkers should be considered only after other options have proved less satisfactory because of dependency on batteries, fragility, and so on.

MULTIPLE MEANS OF REPRESENTATION (MMR) **Multiple means of representation (MMR)** is a core principle associated with UDL and involves providing students with alternatives to acquiring information beyond a textbook. Today's teachers have many choices when it comes to presenting instructional content to students: watch a YouTube video, listen to a podcast or audio books, read text on a website, look up a topic using Wikipedia, and more. These options permit teachers to break out of the one-size-fits-all model, which assumes that all students learn in the same way, and encourage teachers to use a wider palette of information containers to reach diverse students.

When teachers seek to implement the UDL principle of MMR, they are valuing academic diversity by discarding the historical notion that a particular information source is the only one needed. In reality, providing students with a menu of information sources is thought to enhance access, engagement, and learning outcomes for both targeted students (primary beneficiaries) who we know will struggle with the content and a large number of other students (secondary beneficiaries) whom we cannot identify in advance. Technology tools and resources are critical for ensuring that diverse students have access to appropriate curricular resources to achieve CCSS or state standards.

MULTIPLE MEANS OF EXPRESSION (MME) The UDL principle of **multiple means of expression (MME)** draws attention to the need to provide students various methods of demonstrating what they know. Some teachers recognize the value of this principle when they allow students a choice of writing a paper, preparing a slideshow presentation, recording a video, and so on. The key notion is to provide students choices in how they demonstrate what they have learned and in the media they use to express themselves. Twenty-first century educators will likely need to alter their instructional practices in order to allow students to try multiple options to determine which option is "just right" for ensuring that their performance meets increasingly high standards.

This UDL principle highlights the importance of providing students with choices on how they express what they have learned. In many classrooms, teachers expect students to make presentations to the class regarding a topic that they have studied. Use of the MME principle means that the students are given a choice in the presentation tool; they can opt to learn a new tool or use one that they are familiar with or one that supports specific features (e.g., collaboration [Google Drive], visualization [Prezi], cognitively simplified interface [Kid Pix 3D]) that they want to utilize in the particular context. Because the teacher may not be an expert in the use of each product, students are directed to use each other as resources for learning about the tools and to take advantage of online help and tutorials. This frees the teacher to devote more time and energy to helping the students learn about the content and achieve performance standards. Once resources have been established that support learners' multiple means of expression, they may be reused frequently.

MOBILE DEVICES FOR STUDENTS WITH DISABILITIES As technology has evolved, mobile devices such as iPads have been widely used in special education settings. Mobile devices have many beneficial features for students with disabilities such as touch screens, portability, downloadable cost-effective apps, and built-in AT features (Korner & Leske, 2012). Recent research reported that using mobile devices is effective for academic learning and engagement of students with disabilities (Ok & Kim, 2016). The devices also allow teachers to provide individualized instruction for each student by using apps that meet the needs of that student.

SELECTING TECHNOLOGY APPS FOR STUDENTS WITH DISABILITIES All of the technology integration strategies discussed in this book have important affordances for students with disabilities. An essential consideration for all educators when planning for the needs of students with disabilities involves ensuring that the curriculum is accessible to all students. When technology is used to make the curriculum accessible, students with disabilities have the same opportunities to learn as their peers (King-Sears, Swanson, & Mainzer, 2011; Seo & Woo, 2010). Because of the great number of apps available on the market, many teachers express difficulty in selecting the appropriate ones for their students. Teachers often select free or inexpensive apps, but it is necessary to determine whether the app has effective instructional variables that meet students' unique needs (Ok, Kim, et al., 2016) because instructional variables embedded in technology-based programs are critical for effective instruction (Clark, 1983) and to consider whether the app aligns with the skills and standards to be taught (Powell, 2014).

Teachers can use app evaluation rubrics (e.g., Boyd, Barnett, & More, 2015; Ok Kim, et al., 2016) or visit app review websites such as Apps for Children with Special Needs (n.d.). Ok, Kim, et al. (2016) developed an extensive rubric for selecting apps for students with learning disabilities. They emphasize seven research-based elements that contribute to effective instruction: inclusion of clear objectives, strategies for developing skills and subskills, three or more examples for each skill, five or more skill practice opportunities, error feedback with correct answer, error analysis, and progress tracking.

Despite the increasing technological resources, Smith and Okolo (2010) argue that technology is underutilized for students with disabilities, yet these learners stand to benefit most from technological affordances. As technology continues to evolve, it holds great potential for the flexible instructional support necessary for meeting the evolving learning needs of students with disabilities. In fact, research conducted by Wehmeyer et al. (2011) suggests that technology-supported curriculum in classrooms that have students with special needs can lead to increased student involvement and enhanced self-determination. Because some applications of technology in special education are commonly associated with specific disabilities, the following sections provide a brief overview of specific examples of technology used by people with disabilities.

Technology Strategies for Students with Cognitive Disabilities

A variety of conditions can impair an individual's cognitive abilities. Such disabilities are often referred to as *cognitive disabilities, developmental disabilities,* or *intellectual disabilities.*

TECHNOLOGY STRATEGIES FOR STUDENTS WITH MILD COGNITIVE DISABILITIES Mild disabilities are considered to be the most prevalent type of disability. They include learning disabilities, emotional disabilities, and intellectual disabilities. Lerner and Johns (2014) describe the following characteristics as being associated with mild disabilities: cognitive (i.e., intellectual ability, attention deficits, memory and thinking skills), academic (i.e., reading, language arts, mathematics), and social-emotional (i.e., making friends, issues with empathy).

Typically, the important issue for these students is not physical access to the technology, but their ability to read, write, memorize, organize, and retain information. These students often experience difficulties with learning various skills (e.g., the inability to read at grade level). Thus, educators planning for the needs of students with mild disabilities often use productivity software as well as other software materials and web resources that can be used by many low-performing students (see Technology Integration Example 9.1). These can include materials for developing reading, writing, and mathematics skills. The key with all of these uses is to balance remediation of skills with activities that help develop more creative, higher level thinking skills.

Technology Integration

Example 9.1

TITLE: Kurzweil 3000-firefly

CONTENT AREA/TOPIC: Language arts, reading

GRADE LEVELS: K–2

ISTE STANDARDS•S: Standard 1—Empowered Learner; Standard 3—Knowledge Constructor; Standard 5—Computational Thinker

DESCRIPTION: The Kurzweil 3000-firefly™ is a text reader with many built-in features, all of which are designed to support struggling readers. Words can be highlighted in context as they are read aloud for the student. Words that students are typing can also be read aloud, and the program supports reading in several languages. Language tools including a multilanguage dictionary, thesaurus, syllabification, and phonetic spelling provide additional support. Use this tool for students with learning disabilities to help them focus better on what they are reading and writing and with students who have visual impairments to give them auditory access to reading and writing activities. Because Kurzweil allows students with special needs to work independently, its use builds their confidence. Instead of investing time and effort on decoding words, students can put their energy on solving problems that require higher order thinking.

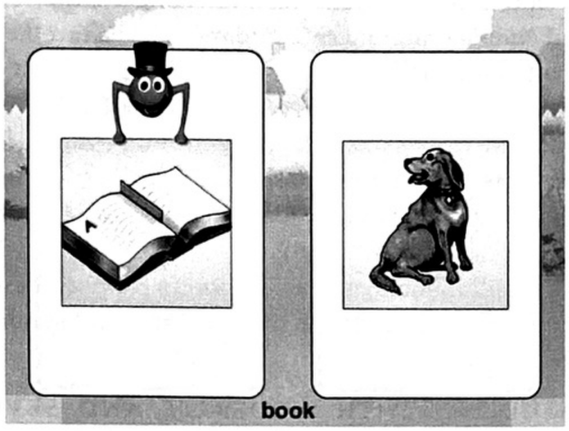
SOURCE: Based on concepts from Barbara Green and Joan Thormann's "Testing Kurzweil 3000," *Learning and Leading with Technology* (2009, March/April).

READING SKILLS FOR STUDENTS WITH MILD COGNITIVE DISABILITIES

A characteristic associated with many disabilities is difficulty in learning how to read and in developing grade-level reading skills. As a result, special education teachers tend to devote a great deal of time and energy to the teaching of reading and are likely to use a variety of devices and software products to remediate students' reading abilities. Dictionaries such as an electronic talking dictionary (Franklin Inc.) and a reading pen (Wizcom Inc.) can support students' understanding of vocabulary while reading. **Text-to-speech** products help students with poor decoding skills by reading the words aloud with the aid of the computer's speech synthesizer. These products include NaturalReader (Natural Soft Ltd.), Snap and Read (Don Johnston Inc.), and Read and Write Gold (Texthelp). The last two products provide not only text-to-speech but also support tools (e.g., dictionary, voice recognition, word prediction) for both reading and writing. Recently released computers and mobile devices (e.g., iPads, smartphones) also have built-in text-to-speech features. In addition, text-to-speech apps for mobile devices (e.g., Speak it!, Voice Dream Reader) are available. If teachers provide all instructional text in a digital format, students with disabilities and other struggling readers can copy and paste the information into talking word processors, apps, and other text-to-speech products so that they can listen to information that they cannot read.

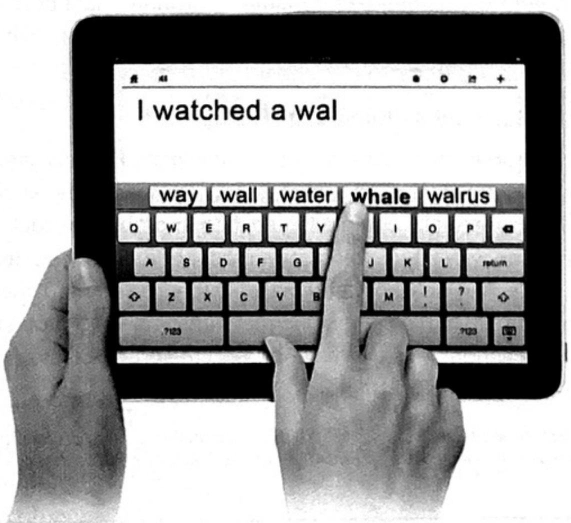
Websites including Learning Ally and Bookshare provide free audio books for individuals with reading disabilities. Teachers also can use Start-to-Finish computer books (Don Johnston, Inc.) developed for older struggling readers who need age-appropriate topics with a low level of vocabulary and less language complexity. A digital pen, Any-Book Reader (Franklin, Inc.), allows teachers to record audio using stickers specially designed for the pen. If students touch a sticker with the pen, they can listen to what was recorded on it. With the pen, any book can be an audio book. Last, software products such as MEville to WEville (Ablenet, Inc.), Simon Sounds It Out (Don Johnston, Inc.), Raz-Kids (Learning A-Z, Inc.), and apps such as Starfall (Starfall Education), First Words (Laureate Learning, Inc.) are commonly used in classrooms where emergent readers are working on acquiring specific skills. Interactive storybooks are other commonly used resources. First Words app, as shown in Figure 9.2, is a research-based intervention that is designed to help students acquire 50 first nouns in developmental sequence.

Figure 9.2 Laureate's First Words App



WRITING SKILLS FOR STUDENTS WITH MILD COGNITIVE DISABILITIES Many tools have been developed to support students who struggle in various phases of the writing process. Many students with cognitive disabilities struggle with brainstorming or organizing ideas for writing. Graphic organizer software such as Inspiration or Kidspiration (Inspiration Software, Inc.) can help such students to organize their ideas using multimedia (e.g., audio, picture, text). For students who are unable to write by hand, who have illegible handwriting, or who find handwriting extremely tedious, there are voice recognition software (e.g., Nuances's Dragon Naturally Speaking) and numerous mobile apps (e.g., Dragon Dictation, Voice Assistant). Computers and mobile devices recently released also have a built-in voice recognition feature (e.g., Narrator, Dictation). Some students who are slow typists or have difficulty spelling can benefit from word prediction software, such as Co:Writer (Don Johnston, Inc.), as shown in Figure 9.3, Read and Write Gold (Texthelp, Inc.), or mobile apps (e.g., Predictable, Abilipad), which offer word choices to complete the first few letters the student types. Also, talking word processors, such as Don Johnston's Write:OutLoud, feature speech synthesis to allow students to hear what they have written. Digital pens such as Livescribe Echo (Livescribe Inc.) can be used for digital note taking. While taking notes, the pens simultaneously capture audio and synchronize it to the handwritten text. The pen can benefit students struggling with writing.

Figure 9.3 Don Johnston's Co:Writer



MATH SKILLS FOR STUDENTS WITH MILD COGNITIVE DISABILITIES Calculators are an important intervention for students with disabilities. A specialized calculator, the Coin-U-Lator® (PCI Education), was developed to assist students having difficulty counting coins and making change. Other strategies have been developed around simple graphing software materials as well as drills, games, and tutorials. Again, numerous mobile apps are available to assist learners with math skills. Apps such as Math Drills (Instant Interactive) and Math Racer (i4software) allow learners to acquire math skills more easily through games that maximize visual depictions of math facts. In addition, students with cognitive disabilities often experience difficulties developing a conceptual understanding of mathematical topics. Virtual manipulatives, such as interactive visual models (e.g., National Library of Virtual Manipulatives, Illuminations), can be used to support these students' learning of skills and concepts that are needed to solve abstract and symbolic math problems (Shin et al., 2016).

SKILLS FOR STUDENTS WITH MODERATE AND SEVERE COGNITIVE DISABILITIES Considerable effort is devoted to ensuring that individuals with moderate and severe cognitive disabilities acquire daily living skills such as personal hygiene practices, shopping, and use of public transportation. In addition, software and mobile device apps are available to help teach important functional skills such as money and time management. For example, the Time, Money, & Fractions On-Track (School Zone Publishing); Jungle Time (Andrew Short); and Dollars & Cents (Attainment) apps allow learners to acquire skills for managing money and/or time. Apps such as Living Safely, Everyday Skills (AbeLink Technologies, Inc.), and Model Me Going Places (Model Me Kids, LLC) can be used to teach daily living skills. Teachers have also used video software to engage students in video self-monitoring of functional activities (Burton, Anderson, Prater, & Dyches, 2013) as illustrated in the Technology Integration Example 9.2.

Teachers working with students with moderate and severe cognitive disabilities need to be familiar with an array of devices that provide an alternative means for accessing the computer or mobile device because the typical keyboard may be problematic for

Technology Integration

Example 9.2

TITLE: Video Self-Monitoring with iPads

CONTENT AREA/TOPIC: Mathematics

CONTENT STANDARDS: CCSM 7.EE – Solve real life and mathematical problems using numerical and algebraic expressions and equations

GRADE LEVELS: 6–8

ISTE STANDARDS•S: Standard 1—Empowered Learner; Standard 3—Knowledge Constructor

DESCRIPTION: In a self-contained special education classroom, students with autism, intellectual disabilities, or functional reading skills participate in a video-self monitoring (VSM) activity. The activity's purpose is to increase students' academic performance by having them view themselves successfully completing academic problems, such as math problems. In advance of the lesson, teachers (in collaboration with a technology specialist and/or other students) film, edit, and create several videos of the target students successfully solving mathematical story problems. These videos are used as a resource in the classroom as students continue to engage in reading mathematical story problems such as understanding the price tags on items and giving exact change. As students engage in the problem, they may read it and access the VSM as many times as needed to support their solution to it.

SOURCE: Based on concepts from Burton, C. E., Anderson, D. H., Prater, M. A., & Dyches, T. T. (2013). Video self-modeling on an iPad to teach functional math skills to adolescents with autism and intellectual disability. *Focus on Autism & Other Developmental Disabilities, 28*(2), 67–77. doi: 10.1177/1088357613478829.

Figure 9.4 Alternative Keyboard Input

Special software can allow students alternative ways of interacting with on-screen information.
(Photo by of W. Wiencke)

many students. To simplify the physical or cognitive demands of interacting with the computer, **alternative keyboards**, such keyboards with enlarged keys to provide more space for the student to press a key and keys with high-contrast colors, and multistep functions such as save, print, or quit, can be programmed into a single key press. Companies such as AbleNet assist teachers in integrating assistive technology into instruction. Figure 9.4 shows a student using special software and an alternative keyboard to interact with on-screen information.

Application Exercise 9.2 Technology Integration Solutions for Students with Mild and Moderate to Severe Cognitive Disabilities

Technology Strategies for Students with Physical Disabilities

Physical disabilities typically affect a person's mobility and agility. Difficulties with motor movements may involve gross or fine motor movement and frequently exist concurrently with other disabilities. Assistive technology for individuals with severe physical disabilities may take the form of a power wheelchair operated by a **joystick**, a device with a handle that moves in all directions. Joysticks can also control the movement of the cursor or pointer on a computer screen.

To provide access to a computer, it is often necessary to offer an alternative (e.g., one-handed keyboard) to the typical keyboard. **Switches** are also commonly used for controlling and gaining input from the computer as well as activating environmental control systems (e.g., to open/close doors, control a TV). Switches allow individuals with physical disabilities to perform many daily tasks and make choices more independently. After providing alternative methods of access, teachers should be sure to:

- Determine the best placement of adaptive technologies and provide training to ensure that the student is able to operate them independently.
- Monitor the function to ensure that the maximum level of participation is obtained without undue physical demands.

Video Example 9.1 Using a Joystick to Operate a Wheelchair

In this video, see how Jose Mendez, a kindergarten student who is severely disabled, has learned to operate a wheelchair designed for his needs. Pay attention to how he uses the joystick to operate his wheelchair.

In the photo in Figure 9.5, a student uses a switch to press with his left hand to give input to the computer.

Technology Strategies for Students with Sensory Disabilities

Sensory disabilities involve impairments associated with the loss of hearing or vision. If there is a complete loss of vision, a person is considered blind. An individual is considered partially sighted if he or she has some visual acuity. Similarly, if there is a complete loss of hearing, a person is considered deaf. *Hearing impaired* is the term used to describe an individual with some hearing.

Figure 9.5 Using a Switch with a Computer

Switches like the one this student is pressing (with his left hand) offer an alternative to the typical keyboard for controlling and getting input to the computer.

(Ablenet, Inc. Blue2™ Bluetooth Switch)

TECHNOLOGY STRATEGIES FOR STUDENTS WHO ARE BLIND For an individual who is blind, four kinds of technology facilitate independence and access to environments and information:

1. **Canes and sensor technology**—These are used to provide the person mobility and orientation information when navigating various environments.
2. **Tools to convert printed information**—These tools convert printed information into audio so that a person who is blind can gain information by listening rather than reading. This conversion is accomplished through the use of a scanner with **optical character recognition (OCR)** software that scans print and translates it into a word processed file that can provide speech synthesis. It works by placing text material on a scanner and scanning the material into the computer. The OCR software then converts the scanned information into digital text, and the speech synthesis tools read the material aloud.
3. **Screen readers**—**Screen readers** work as utility software in the background of the computer operating system and read any text that appears on the screen—for example, menus, text, or web pages. Examples of screen readers include SuperNova Screen Reader (Dolphin Computer Access) and JAWS for Windows (Freedom Scientific).
4. **Braille typing device and braille printer**—Blind people who use braille often use braille-typing devices for writing. Using a braille printer, these individuals can print their or others' writing in braille to be read with their fingers. Using translation software such as Duxbury (Duxbury system Inc.), documents in English text can be translated into braille text and vice versa. The software helps them to extend the use of braille documents to non-braille readers.

TECHNOLOGY STRATEGIES FOR STUDENTS WHO HAVE PARTIAL SIGHT Partially sighted individuals must have text information enlarged or the contrast altered in order to perceive printed information. When information is in printed form (e.g., books, magazines) a **closed-circuit television (CCTV)** magnification system can be used. CCTV has a video camera mounted on a frame connected to a television monitor. Users place materials on the desktop below the camera, set the desired magnification level, and move the materials around as necessary so that the information appears on the monitor in a font size that can be read comfortably. Users also can customize the color contrast. CCTV can also use various types of magnifiers (e.g., a portable electronic magnifier) to read printed documents. Many partially sighted individuals can see print on a computer screen by simply activating the built-in screen magnification control panel. This function allows users to select the desired magnification of everything appearing on the screen. In addition, they may need alternative keyboards with enlarged letters and color contrast to access the CCTV-enabled computers.

TECHNOLOGY STRATEGIES FOR STUDENTS WHO ARE DEAF Individuals who are deaf often can use most technologies without significant modifications. However, two problematic areas involve the use of audio feedback (i.e., error messages) and the reliance on sound in multimedia software. When designers provide essential information only in audio form, this information is inaccessible to deaf individuals. As a result, advocacy and design initiatives encourage that all information be available in multiple formats (e.g., auditory error messages should also be produced visually on screen and multimedia software or video should include closed captioning of audio tracks).

Individuals with hearing impairments often wear hearing aids to help them hear sounds more clearly and audibly, and they need few modifications to be able to use computers. However, a technology that is being used in classrooms today is a **FM amplification system** (Lewis, 2010). These systems, also referred to as **assistive listening devices**, require the wearing of a wireless microphone by the teacher and a receiver by each student with a hearing impairment or with a learning disability

Video Example 9.2 Using an Interactive Whiteboard with Students with Hearing Impairments

In this video, a teacher uses an interactive whiteboard activity for students with hearing impairments in a lesson.

involving auditory processing difficulties. The receivers amplify the teacher's voice and serve to focus attention on it. Research suggests that sound amplification technology may benefit all students, not just those with diagnosed hearing impairments, by focusing their attention. In a study conducted by Millett and Purcell (2010) in which classrooms were equipped with sound-field amplification systems and the teacher wore a transmitter, teachers reported higher levels of student attentiveness, a decreased need for repetition, and fewer classroom management challenges. In active classrooms in which noise levels tend to rise, all students benefit from being able to listen and hear more effectively. An Ubiduo (sComm, Inc.), a chatting device that consists of two keyboards with screens, allows people with hearing impairments to carry on a conversation with hearing people face to face without any barriers.

Technology Strategies for Students with Speech and Language Impairments

Individuals with speech and language impairments (also known as *communication disorders*) have problems with communication, such as articulation, fluency, and voice. People with severe autism, physical disabilities, or multiple disabilities often have limited speech or absence of speech. To maximize their communication skills for functional and effective communication, they often rely on using augmentative and alternative communication (AAC) devices. The variety of AAC devices ranges from low tech to high tech. For example, students can use low-tech items, such as an **eye gaze board** or **picture exchange communication book**; mid-tech devices, such as a **BIGmack** (Ablenet) or **Go Talk NOW** (Attainment) (see Figure 9.6); and high-tech items, such as Dynavox (Tobii) and Springboard (PRC). These are speech-generating devices activated with touch or a switch. Recently, mobile device AAC apps, such as Proloquo2go (AssistiveWare) and Sono Flex (Tobii Dynavox LLC), have also been widely used for individuals with communication disorders.

Technology Strategies for Students with Gifts and Talents

Although **gifted and talented students** are not included in IDEA, they are viewed as exceptional. The federal definition of gifted students was developed in the 1972 *Marland*

Figure 9.6 Attainment's GoTalk

Report to Congress and has been modified several times since then. The current definition reads:

> Students, children, or youth who give evidence of high achievement capability in areas such as intellectual, creative, artistic, or leadership capacity, or in specific academic fields, and who need services and activities not ordinarily provided by the school in order to fully develop those capabilities (ESEA, ESSA P.L. 114-95, Title VIII, Part A, Section 8101[27], 2015).

In reviewing research and best practices for using technology to enhance gifted education, Periathiruvadi and Rinn (2012–2013) found that technologies can improve the quality of education for students with special gifts and talents by providing (1) differentiated instruction and (2) a creative outlet for their works. Some of their key findings on technology in gifted education are briefly summarized here:

- **Attitudes toward technology uses**—Students in lower grades report higher levels of satisfaction with using technology than do students in higher grades. Males express more confidence in their use of technology than do females, but all had high interest in using technology for problem solving.
- **Impact on writing**—Research indicates that not only do gifted boys write more when they use word processing than they would otherwise but also the quality of their writing, which is usually less than that of girls, seems to increase to be equal with girls.
- **The role of technology in assessment**—Research shows that computer-based games and activities are effective in assessing the higher level skills of gifted students. For example, studies assessed strategic thinking, ability to focus, and resisting distractions. Also, online assessments were especially useful in helping teachers track how much time gifted students were spending on various assignments in order to gain an idea of the difficulties they might be having.
- **Gifted students in online learning**—The greatest single benefit that online learning offers gifted students is access to advanced and elective courses they would like to take but are not available locally. These courses also offer flexible learning environments that gifted students value. Swan et al. (2015) found that online learning

instruction offered in the physical schools as a virtual learning lab was effective in providing accelerated coursework for gifted middle school students in a rural school district.

Chen, Dai, and Zhou (2013) suggest integrating technology into education for gifted students using three strategies: enabling, enhancing, and transforming:

- **Enabling strategies**—These include the kinds of online learning opportunities that enable differentiated instruction and for building online learning opportunities (Periathiruvadi & Rinn, 2012–2013).
- **Enhancing strategies**—These include curriculum enrichment activities, such as online explorations, group training activities, and individual and small-group problem solving.
- **Transforming strategies**—Technologies can also allow gifted programs to offer more tailored services to meet diverse needs among this population. Chen et al. (2013) noted that technologies can radically alter the way we think of giftedness, changing its focus from individual knowledge to communities of learners working together. Advanced technologies such as simulations and intelligent tutoring can transform methods used to teach and assess gifted students (Chen et al., 2013; Periathiruvadi & Rinn, 2012–2013). Siegle (2015) described the benefits of involving gaming to differentiate instruction for gifted and talented students through engagement with content, increased motivation through a growth mindset, and varied assessments.

Application Exercise 9.3 Technology Integration Strategies for Students with Diverse Special Needs

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Teacher Growth in Technology Integration Strategies for Students with Special Needs

Teachers of students with special needs have two kinds of challenges when matching technology solutions to each student need.

1. To become familiar with the array of resources available and the strategies that they enable.
2. To identify how to gain access to these resources, which can be expensive to purchase and implement.

Although the information in this chapter introduced key issues, strategies, and resources, as a teacher, you should continue working toward fully understanding these issues, articulating your own plan for addressing various special education issues in your teaching and designing new ways to integrate the strategies throughout the curriculum to transform your teaching and your students' learning. Review the rubric in Table 9.2 that assists in measuring teachers' progress in integrating technology in special education.

For continued growth, teachers and those who support them need to identify and keep in touch with state and federal agencies. For example, the U.S. Department of Education's State Grants for Assistive Technology Program supports providing assistive technology to individuals with disabilities. Consider joining the professional organization Council for Exceptional Children (CEC) for updated knowledge, resources,

Table 9.2 Rubric to Measure Teacher Growth in Technology Integration for Teachers of Students with Special Needs

Part I: Teachers Knowledge of Special Education Issues and Challenges			
	Basic Knowledge (1–2 points)	**Intermediate Knowledge (3–4 points)**	**Advanced Knowledge (5–6 points)**
	I can articulate the nature of the issue/challenge.	I can both articulate the nature of the issue/challenge and identify some of the possible ways to address it.	I can articulate and implement my own plan for addressing the issues/challenges in my own teaching.
Special education and inclusion requirements	☐	☐	☐
Policy drivers of technology use in special education	☐	☐	☐
Educational reform and accountability in special education	☐	☐	☐
Challenges for teachers in using technology solutions for special education	☐	☐	☐
Part II: Teachers' Technology Integration Strategies for Special Education			
	Basic Knowledge (1–2 points)	**Intermediate Knowledge (3–4 points)**	**Advanced Knowledge (5–6 points)**
	I can describe the strategies and identify technologies to carry them out.	I have designed at least two activities based on these strategies to enhance my teaching and my students' learning.	I have designed and implemented my own plan for integrating these strategies throughout my curriculum to enhance my teaching and my students' learning.
Strategies for students with cognitive disabilities	☐	☐	☐
Strategies for students with physical disabilities	☐	☐	☐
Strategies for students with sensory disabilities	☐	☐	☐
Strategies for students with speech and language impairments	☐	☐	☐
Strategies for students with gifts and talents	☐	☐	☐
Teacher growth in integration strategies	☐	☐	☐
Total Points	________ **of 60 possible points**		

standards, and professional development to support continued insights into the issues, challenges, and integration strategies outlined in this chapter. Finally, teachers can engage in professional learning by following some of these Twitter hashtags:

- #sped and #spedchat
- #ld and #ldchat
- #atchat or #AssistiveTech
- #specialneeds
- #dyslexia
- #gifted
- #autism
- #aspergers

✓ Check Your Understanding 9.3

Chapter 9 Summary

The following is a summary of the main points covered in this chapter.

1. **Introduction to Special Education**—Special education is reserved for students who cannot be educated satisfactorily in general education because of their disabilities.
2. **Issues and Challenges in Special Education**—These issues include special education and inclusion requirements, policy drivers of technology use in special education, educational reform and accountability in special education, and challenges for teachers in using technology solutions for special education.
3. **Technology Integration Strategies to Meet Special Needs**—Integration concepts in this section include:
   - Foundations of integration strategies for special education include the definition of *assistive technology device and service*; the way an assistive technology evaluation referral works; the way solutions are classified; multiple means of representation (MMR), alternatives to acquiring information beyond a textbook; multiple means of expression (MME), multiple methods of demonstrating what students know; and the importance of evaluating mobile device apps.
   - General requirements of integration strategies for all students include making curriculum accessible and offering flexible instructional support.
   - Integration strategies are specific to disabilities including those for students with cognitive, physical, sensory, and communication disabilities.
   - Strategies for gifted and talented students focus on enabling, enhancing, and transforming their education. Research-based practices emphasize boys' and girls' interest in technology, games, and problem solving. Technology offers innovative and effective ways to offer advanced content, assess student progress, and unique access to learning opportunities and connectivity with learning communities.
   - Continued teacher growth in understanding issues and integration strategies for special education can be facilitated by following opportunities set by state and federal governments and joining professional communities.

Technology Integration Workshop

1. Apply What You Learned

In this chapter, you learned about teaching and learning with technology in special education. Now apply your understanding of these concepts by completing the following activities:

- Reread Ms. Ravenscroft's lesson *Mitosis* at the beginning of this chapter. Pay close attention to Step 3 of Ms. Ravenscroft's and Ms. Ethelbart's Turn-Around Technology Integration Pedagogy and Planning (TTIPP) when they identify the technological possibilities for her problem of practice: assisting students with learning disabilities to achieve a high level of content knowledge. Using your knowledge about technology integration strategies for students with cognitive disabilities introduced in this chapter, generate at least one new technological possibility for targeting Ms. Ravenscroft's problem of practice.
- Review how Ms. Ravenscroft and Ms. Ethelbart RATified the lesson in Step 5 of her TTIPP as represented in Figure 9.1. Use the RAT Matrix to analyze the role(s) and relative advantage your new technological possibilities (identified in the last step) would play in the lesson. You must reflect on the roles your identified technological possibilities play as replacement, amplification, and/or transformation of instruction, student learning, and/or curriculum. Do you feel that your proposed technology would provide relative advantage?

2. Technology Integration Lesson Planning: Evaluating Lesson Plans

Complete the following exercise using Technology Integration Examples 9.1 and 9.2, any lesson plan you find on the web, or one provided by your instructor.

a. Locate lesson ideas: Identify three lesson plans that focus on any of the assistive technologies you learned about in this chapter, for example:
   - Using adaptive input devices for students with impairments
   - Using technologies to allow multiple means of representation
   - Using technologies to allow multiple means of expression

- Using voice recognition and word prediction software
- Engaging gifted students through problem-based learning environments

b. Evaluate the lessons: Use the Technology Lesson Plan Evaluation Checklist and the RAT Matrix to evaluate each of the lessons you found. Based on the evaluation and your RATification of the lessons, would you adopt these lessons in the future? Why or why not?

3. Technology Integration Lesson Planning: Creating Lesson Plans With The TTIPP Model

Review how to implement the TTIPP model (see Figure 2.6) for technology integration planning and use Ms. Ravenscroft's and Ms. Ethelbart's lesson *Mitosis* in this chapter as a model. Create your own technology-supported lesson that uses assistive technologies to support learning by students with disabilities by completing the following activities:

a. Describe Phase 1—Analysis of Learning and Teaching Assets and Needs:

- What is the problem of practice or main content topic in your lesson?
- What are the technology resources your students, their families, you, and your school could bring as assets for the lesson?
- What are the technological possibilities for helping to solve or help to address the identified problem of practice? Identify the technology(ies) you will integrate into the lesson and ensure that you have skills and resources you need to carry it(them) out.

b. Describe Phase 2—Design of the Integration Framework:

- What are the objectives of the lesson plan?
- How will you assess your students' accomplishment of the objectives?
- What integration strategies are used in this lesson plan?
- What is the relative advantage of using the technology(ies) in this lesson?
- How would you prepare the learning environment?

c. Describe Phase 3—Post-instruction Analysis and Revisions:

- What strategies and/or instruments would you use to evaluate the success of this lesson in your classroom in order to determine revision needs?
- Add lesson descriptors—Create descriptors for your new lesson (e.g., grade level, content and topic areas, technologies used, ISTE standards, 21st-century learning standards).
- Save and share your new lesson—Save your lesson plan with all its descriptors and TTIPP model notes and share it with your peers and teacher if not others.

When you use your new lesson with students, be sure to assess it using the Technology Impact Checklist.