# Instructional Technology in Early Childhood

by

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PAUL H. BROOKES PUBLISHING CO.

Baltimore • London • Sydney

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# About the Editors

**Howard P. Parette, Jr., Ed.D.,** is Professor and Director of the Special Education Assistive Technology (SEAT) Center, Department of Special Education, at Illinois State University, and formerly Kara Peters Endowed Chair in Assistive Technology (2003–2011). Having an array of teaching experiences in his early career, including work in early intervention settings, he has taught both early childhood special education and special education courses at four institutions of higher learning, and was Dean of Graduate Studies and Research at Southeast Missouri State University (2000–2002). Recognized as University Researcher of the Year in 2009, he is also the founding editor of the online journal, *Assistive Technology Outcomes and Benefits*, a collaboration between the SEAT Center and the Assistive Technology Industry Association (2004 to present). He coauthored many grants and published hundreds of peer-reviewed articles, with a preponderance of scholarship focused on assistive technology issues, and, more recently, on the role of universal design for learning and readily available technology integration in 21st century early childhood settings. In addition to teaching assistive technology courses for special education majors, he developed and teaches a unique course—Technology for Young Children with Disabilities—designed for early childhood education majors.

**Craig Blum, Ph.D.,** has taught young children in Los Angeles and is currently Associate Professor in the Special Education Department at Illinois State University. He has taught and worked in many different types of settings ranging from adults with development disabilities, vocational training programs, mental health programs for young children with behavior disorders, inclusive education programs with children of all ages, and young children with developmental disability. Dr. Blum has provided extensive professional development to educators in schoolwide positive behavior support, and worked as part of research and professional development team on the Making a Difference for Assistive Technology project. There he worked to demonstrate the usefulness of readily available technology tools to teach phonological awareness to young children. Dr. Blum has codeveloped and established the reliability and validity of the Teacher Knowledge and Skills Survey of Positive Behavior Support. He assisted in providing the foundation for a statewide positive behavior support network in Washington State. He is actively involved in the Association for Positive Behavior Support and the work group for website development. He has obtained federal grant on schoolwide positive behavior support and has coauthored numerous federally funded grants. He has worked on numerous federal and privately funded grants including Making a Dif-

ference for Assistive Technology, which focused on implementing a technology toolkit in an early childhood education center. He has co-authored a book, *Effective RTI Training and Practices*. He has coauthored 15 peer-reviewed articles or book chapters in journals such as *Early Childhood Education Journal, Journal of Positive Behavior Support, Teacher Education and Special Education, Teaching Exceptional Children,* and *Assessment for Effective Intervention.* He regularly presents both locally and nationally at conferences such as the Council for Exceptional Children Expo, Associate for Positive Behavior Support, and the Assistive Technology Industry Association.

# 1

# The Role of Technology for Young Children in the 21st Century

Howard P. Parette, Jr., Craig Blum, and Amanda C. Quesenberry

**After reading this chapter, you should be able to**

- Describe the role of technology in the lives of young children
- Provide a rationale regarding technology integration as a developmentally appropriate practice
- Describe barriers to choices regarding integration of technology in the early childhood curriculum
- Describe elements of instructional technology
- Describe components of universal design for learning
- Identify characteristics and examples of readily available technologies
- Describe components of a classroom toolkit for technology integration

## TECHNOLOGY IN THE LIVES OF YOUNG CHILDREN

While eating breakfast, 3-year-old Sean opens an application (or "app"), Teach Me Toddler, on his father's iPad and immediately becomes engaged in practicing letters, numbers, and shapes. A little mouse provides voice prompts to find something on the screen, and a checkmark appears when Sean makes an appropriate choice. After breakfast, Sean goes to the family computer and clicks on an icon for Zac Browser, an engaging browser designed for young children. When the browser launches, Sean is delighted to see the screen change to an undersea world where an animated submarine has become his cursor. Guiding the submarine to a games menu at the bottom of the screen, Sean smiles as his submarine changes to an animated butterfly, which he then directs to an icon representing a game called ABC Instruction. After clicking the Play button, an arrow prompts Sean to trace the letters of the alphabet.

Excerpted from Instructional Technology in Early Childhood
edited by Howard P. Parette Jr., Ed.D., & Craig Blum, Ph.D.
Brookes Publishing | www.brookespublishing.com | 1-800-638-3775

Cherise, a 6-year-old kindergartner, sits at a computer terminal in her public library. She immediately clicks on the Firefox browser icon on her desktop, which takes her to the search engine Google. She types in the words *Handy Manny* and then clicks on the link that appears at the top of the search results. Because Handy Manny is used in her classroom at school, Cherise routinely visits this site to play games and watch Disney videos. She also watches Handy Manny and his friends on the television channel Disney Junior on weekday mornings before going to school. Cherise uses her Barbie digital camera to take several photos of the library so that she can share them during a show-and-tell activity in her classroom the next day.

Andy, who is 4 years old, and his mother sit in front of a laptop. Andy clicks on the Skype icon on the desktop using a child's mouse that his parents purchased for him. Andy's mother points to her father's name in a contact list that appears and says, "Click on Papa's name." Andy makes the selection and then follows his mother's prompt to "click on *Video Call*." Andy enthusiastically moves the cursor to a green Video Call button and clicks. A ringtone is heard and then a familiar face appears on the screen. "Hi, Andy," his grandfather says, as Andy smiles and reaches to hug the image on the screen.

Today, young children are growing up in a world where they are surrounded by a vast array of technologies. From morning to bedtime, young children use technologies to engage in home and community activities, prepare for school, participate in classroom activities, and interact with others in the world around them. Commercially acquired toys used in play activities are often technology-based, and children use many types of entertainment media in their homes. Computer usage by young children is increasingly common, and many families allow their children to access and engage with web-based interactive games and activities designed specifically for young children. In addition, mobile phones and other handheld devices are far more frequently used by families and regularly seen in television programs and movies, providing powerful models for young children regarding the role of technology in our lives. In these ways, technology use both influences and shapes the development of children's lives.

## TECHNOLOGIES AS TOOLS FOR LEARNING

Technologies that have the potential to support children's learning in instructional settings are of particular importance to early childhood education professionals. Discussions about the role of technology in classroom settings are couched in the current understanding of *developmentally appropriate practice* (DAP). This term refers to the knowledge held by teachers regarding 1) how children develop and learn; 2) the strengths, needs, and interests of individual children; and 3) the social and cultural contexts in which children live (National Association for the Education of Young Children [NAEYC], 2009). In 1996, the NAEYC published a position statement that provided tepid support for the use of technology in DAP. Unfortunately, these early perceptions of technology and its role in the lives of young children were confounded by such diverse issues as violence in the media, the influence of hours of television viewing, and other concerns that were intermixed with the instructional uses of technology. Since that time, however, early childhood

education professionals have developed both greater awareness and acceptance of the role of technology in the lives of young children. In 2012, NAEYC and the Fred Rogers Center for Early Learning and Children's Media at Saint Vincent College revised its position statement on technology, placing a stronger emphasis on its role as DAP in early childhood classrooms.

### What the Research Says

The position statement from the NAEYC and the Fred Rogers Center (2012), *Technology in Early Childhood Programs Serving Children from Birth through Age 8,* defined technology broadly but primarily focused on principles and practices related to current technologies. The position statement summarized existing research in numerous areas, and key findings concluded that 1) developmentally appropriate technology can enhance children's cognitive and social abilities; 2) technology integration is effective when integrated into the "environment, curriculum, and daily routines" (p. 8); and 3) technology can help strengthen home–school connections.

For example, during her preschool circle time activity, Mrs. Hearns uses a digital projector connected to her desktop computer. Because she has Internet access, Mrs. Hearns is able to use many interactive games and learning activities that are located on accessible web sites. Children love the engaging games and activities, and they are particularly attracted to the vivid colors and animation features.

Mr. Bivens, a kindergarten teacher, uses a SMART Board to begin his large-group activity, which allows him to have children physically interact with teacher-made learning activities that he has downloaded from the SMART Activity Exchange. Students attend to how other children are participating in the activities using the SMART Board and call out words of encouragement to their classmates. Mr. Bivens has noticed a change in the attending behaviors of his students since he made the transition to the SMART Board.

Ms. Steele expects her students to transition quietly to the literacy center, sit at a table, listen to her instructions regarding the use of materials, and place their products in their respective student bins on a shelf. Because Casey is very distractible and has difficulty with routines, Ms. Steele gives him a laminated task sequence chart prior to his transition to the literacy center. The chart uses five Boardmaker symbols to represent the steps in the routine—go to the literacy center, sit, listen, make a drawing, and put things away. This chart provides structure so that Casey knows exactly what sequence he is expected to follow. Ms. Steel uses similar task charts for other activities to help Casey.

These examples call attention to both the presence and potential of technology in today's early childhood classrooms. However, many teachers may not be using technology in the delivery of the early childhood curriculum, and they may not understand that its use is indeed DAP (Parette, Quesenberry, & Blum, 2010). It is well known that instruction in early childhood education settings is characterized by activities that require children to do certain things to participate in those activities. It is also well known that technology is a tool that helps people to do something they could not do using human ability alone—either more effectively (completing a task) or more efficiently (completing a task faster or in greater quantity). For example, pencil and paper are traditional tools used by young children

for writing and a book is a traditional tool for reading. However, they are not the only ways to accomplish the specific tasks of transcription (i.e., creating text) and reading. A word processing program provides an alternative to using a pencil to create text. Interactive books and iPad applications may use voice components in which works are highlighted from left to right while being pronounced, which provide powerful and engaging alternatives to reading print. Such technology alternatives are not only used at home by many young children, but they are increasingly preferred by young learners in instructional settings because they are more engaging and minimize errors made in reading, writing, and communicating with others. Most children can learn using traditional approaches to instructional delivery, so using technology to support learning in the classroom is not necessarily a better approach. However, if technology is part of a young child's culture and is a preferred method of learning, consideration must be given to its use to support instruction. Thus, its use is DAP!

## BARRIERS TO TECHNOLOGY USE: THE DISCONNECT BETWEEN WHAT YOUNG CHILDREN PREFER AND WHAT EARLY CHILDHOOD EDUCATION PROFESSIONALS DO

Teachers regularly use technologies in their daily lives outside of the classroom, so it is surprising that there is often hesitation about or resistance to using technology with young children. Admittedly, numerous issues may present barriers to the use of technology in the classroom, including cultural influences, generational differences, classroom budget limitations, attitudes about technology, and lack of knowledge and/or training.

### Cultural Influences

Public schools and early childhood education programs are distinct cultural groups with varying values, behaviors, and characteristics. These programs mirror the communities within which they reside, and it is not uncommon to encounter resistance to technology use (International Society for Technology in Education, 2009). This is particularly true if the community has values that have led to a recognized tradition of delivering the curriculum in ways that are not supported by technology. Sometimes these strongly held values among education professionals are different from the technological skills valued in mainstream culture. For example, early childhood education professionals who work in schools that have yet to embrace the use of technology may cling strongly to more traditional approaches to learning and see little value in the use of technology. To the extent that a teacher identifies with such cultural values, varying degrees of unwillingness to accept a greater use of today's technologies may be anticipated. The NAEYC (1995) has provided recommendations for the preparation of early childhood education professionals to develop skill sets related to culture, language, and diversity. Further, the NAEYC (2009) expanded understanding of DAP by emphasizing three challenges to the discipline: 1) increasing achievement and reducing children's learning gaps, 2) enhancing educational connections for preschool- and elementary-age children, and 3) emphasizing teacher knowledge and decision making as critical to the effectiveness of education. Specific guidance regarding culturally sensitive strat-

egies for education professionals have been offered in the literature (e.g., Parette & Angelo, 1998; Parette, Huer, & VanBiervliet, 2005; Parette & McMahan, 2002).

### Generational Differences

Generational differences among early childhood education professionals may impose barriers to technology use with young children, especially for teachers who developed technology knowledge and skills later in life. Younger teachers from the Millennial generation (born after 1976; Howe & Strauss, 2000) grew up in a world in which they were surrounded by technologies and are typically comfortable using them. A particular challenge for the field is to understand what technologies and features are used and preferred by today's families (Parette, Meadan, Doubet, & Hess, 2010), as well as how these technologies may be effectively integrated into classroom practices (Schomberg & Donohue, 2012).

### Budget Limitations

Typically, teachers have limited classroom budgets for the purchase of consumables and technologies to support their curricula (Judge, 2006). With limited fiscal resources, programs and schools may tend to purchase only materials that have been traditionally used in classroom settings or materials that the teacher became familiar with in his or her preservice preparation. This problem is compounded by the dynamic and ever-changing array of technology that may be considered by early childhood programs; if the acquisition of technologies must be delayed until funds are available, they may become obsolete by the time the purchase can be made! Therefore, today's teachers need to be prepared to use a toolkit of free and inexpensive technologies that can support the curriculum (Hourcade, Parette, Boeckmann, & Blum, 2010).

### Attitudes about Technology

Teachers' attitudes may also impose barriers to the use of technologies in early childhood education. Some early childhood education professionals may simply feel that teaching and delivering the curriculum in traditional ways is preferable to new ways of doing things. For example, showing and reading aloud from a book may be preferred to an interactive e-book that has built-in speech. Writing on a blackboard may be preferred to use of an interactive whiteboard. There may also be the reality of differences among teachers in their ability to adopt technology-supported educational practices. Parette and Stoner (2008) observed both early adopters and late adopters among early childhood education professionals. Early adopters are interested in using technology, developing new knowledge and skills regarding its use, and integrating it readily into their classroom practices. Late adopters tend to be more hesitant about technology use; they may be slow in developing knowledge and skills about new technology and integrating it into their classroom practices. It is encouraging that many of today's teachers have grown up with technology and are therefore likely to be more receptive to its integration into the classroom. Additionally, the NAEYC and Fred Rogers Center (2012) position statement on technology and interactive media as DAP should provide guidance to teachers and facilitate attitudinal change within the discipline.

### Lack of Knowledge and/or Training

Preservice preparation of teachers has traditionally been woefully remiss in developing competencies related to the integration of technology in the early childhood curriculum. Most programs rely on a single course, or a module within a course in the undergraduate curriculum, to develop technology skills (Gronseth et al., 2010). Often, these skills are not integrated across the curriculum and early childhood education professionals may enter the field with little or no understanding of how to use technology in their classrooms. Fortunately, greater interest in the role of technology in early childhood settings is now present, as reflected in the revised NAEYC and Fred Rogers Center (2012) position statement on technology and media. In addition, specific pedagogical recommendations for effectively integrating technology into early childhood education preservice programs are available (e.g., Blum, Parette, & Travers, 2011; Parette, 2011; Peurling, 2012). However, until most teachers actually develop knowledge and skills related to technology integration in classroom settings, they will continue to rely on the expertise of consultants and/or technology specialists and professional development after obtaining their teaching degrees. For professionals who are already teaching, specific approaches for developing knowledge and skills include user groups (Parette & Stoner, 2008), summer institutes (Keengwe & Onchwari, 2009), and webinars (Schomberg & Donohue, 2012).

This book is designed to address the need for increased knowledge and skills among all early childhood education professionals. Such skills can ensure more effective use of technology to support the learning of young children in today's classrooms.

## MOVING TOWARD AN UNDERSTANDING OF INSTRUCTIONAL TECHNOLOGY

Considerable literature advocates the use of instructional technology (IT) to develop important skills to support young children's learning, particularly in emergent literacy areas. However, there is also emerging evidence for the use of IT to support the learning of young children in the areas of writing, communication, social behavior, and play.

### What the Research Says

In early childhood classrooms where IT has been used, gains in children's developmental progress have been reported. In a large-scale study by Penuel et al. (2009), preschool children who participated in a media-rich curriculum incorporating public television, video, and games into classroom instruction developed early literacy skills (letter recognition, letter/sound association, concepts about stories), and print increased among the 4- and 5-year-olds from economically disadvantaged communities. Similarly, Pasnik, Strother, Schindel, Penuel, and Llorente (2007) reported the positive effects of media on young children's learning across numerous studies. In the area of literacy skill development, progress was demonstrated in letter knowledge, phonological awareness, word recognition, and aural story comprehension. The use of media supported improved recognition of letters,

blending and segmenting of phonemes, recognition of the onset and rhymes in words, and recognition of nonwords. Pasnik et al. also found that the use of media in instructional settings increased children's abilities to recognize printed words. Finally, studies examined in the report indicated that young children were able to recall and understand elements of stories better with the help of media.

Although an evidence base exists to support the developmental gains that can be made by children with the use of technology, much research remains to be conducted regarding the impact of instructional technologies in classroom settings. From our perspective, the issue is not whether to use instructional technologies to support instruction. Rather, the key challenge for today's teachers is how to use technologies effectively and efficiently to support learning experiences for young children in the early childhood classroom.

So just what is IT? For the learner, IT can support increased instructional effectiveness, efficiency, and appeal (Newby, Stepich, Lehman, & Russell, 2006). As previously noted, technologies are tools that help children do things either more effectively or more efficiently. With IT, children may learn more effectively or do something better than they would without the help of technology. The previous example of using a word processing program to create text is an effective way to transcribe—that is, it allows a child to generate text that the child might have difficulty creating with a pencil and paper. Other technologies result in greater efficiency, allowing the same amount of (or more) learning or task completion in a shorter amount of time. In the example of the word processing program, more text might be created in a shorter period of time using the word processing program, particularly for young children who may be developing skills in writing and thus require more time for handwriting.

Many technologies are simply more appealing and engaging than traditional materials, which increases the possibility that young children will devote more time and energy to learning or doing something. For example, interactive web sites such as Sesame Street (http://www.sesamestreet.org), PBS Kids (http://pbskids.org), and Starfall (http://www.starfall.com) have activities that include animation, voices, vivid colors, and other attributes that are far more engaging for most young children than more traditional educational activities, such as a worksheet. Similarly, a digital whiteboard and a digital projector allow children to see these web-based activities in a large-screen format, which is interesting for young learners, especially those who tend to learn through visual representations.

The use of IT by the early childhood teacher also assumes that careful planning occurs to connect the curriculum being used to learning standards, instructional strategies, and assessment of child performance. Thus, IT tools are used to plan instruction, which includes 1) making decisions about relevant technologies to be used to support classroom lessons; 2) deciding how the technologies will be used with specific instructional strategies (e.g., direct instruction, modeling, scaffolding); and 3) determining how child learning will be assessed when the technologies are used (Newby et al., 2006). Other technologies used specifically for productivity are referred to as *information and communication technology* (see Table 1.1). However, for purposes of clarity, the term IT will be used throughout this book to refer to *any* technology used to plan and deliver the curriculum to young children. The primary goal of this book—and the task that confronts all teachers—is to make good decisions regarding specific IT tools to be used to support learning.

**Table 1.1.** Technologies used to support the early childhood curriculum

| Technology category | Examples |
|---|---|
| Instructional technology | Media technologies, such as computers, digital projector, SMART Board, iPad, iPod, digital audio and video recording devices |
| | Instructional process technologies, such as direct instruction, exploratory play and guided discovery, modeling, prompting, scaffolding |
| Information and communication technology | E-mail, computers, copiers, word processing and graphics software, Microsoft PowerPoint, mobile phones, text messaging, blogs, wikis, Internet |
| Assistive technology | Foam pencil grips, visual schedules, graphic organizers, electronic communication systems, wheelchairs, hearing devices, text-to-speech software, talking word processors, seating and positioning systems |

The process of making decisions about how to use IT evolves as the array of available technologies becomes increasingly versatile, requiring more thoughtful decisions about their use in the curriculum. IT is typically used in large- and small-group settings in the early childhood classroom; however, there may be instances when IT is used for individual children (e.g., if a single child has access to a computer game or activity during free play) or in a small-group activity. Most children will derive some benefit from the use of IT because it may help them to learn more effectively or efficiently. It is true that traditional learning approaches still result in learning; however, such traditional activities may not be as interesting and engaging.

### Assistive Technology

Although most typically developing young children can learn more effectively or efficiently using IT in classroom settings, children with disabilities need additional supports to participate in activities. Some children may have difficulty hearing, seeing, moving and manipulating objects, following routines, adhering to social rules, and/or communicating with others. Children with these disabilities may not have access to the learning opportunities of typically developing children and therefore need additional assistive technology supports. For example, Mrs. Hearns presents a Microsoft PowerPoint lesson on beginning sounds to her preschool class during opening circle time. Students are shown a picture of a ball and asked what the beginning sound is. When the children raise their hands, Mrs. Hearns calls on Tiffiny, who says /b/. She presents another slide, on which the children see a picture of a cat. She calls on Trevor, who is nonverbal and uses a four-message communication device. Trevor presses a button on his device, which pronounces the sound /k/.

Mr. Bivens uses his SMART Board routinely for Clicker 6 lessons presented in his kindergarten classroom. Children come to the SMART Board and touch buttons that are presented in learning grids to make selections. When it is Shanika's turn, she uses a powered wheelchair to come to the SMART Board. Because she has limited strength in her hands, Shanika grips a foam-wrapped stick that she uses to make contact with the SMART Board screen to make her selection.

In the earlier vignette regarding Ms. Steele's classroom, it was noted that there were certain expectations of children's performance in scheduled activities. Casey is very distractible and has difficulty with routines in the classroom, so Ms. Steele gives him a sheet of paper prior to his arrival in the literacy center. The paper has five Boardmaker symbols representing the steps in the routine—go to the literacy center, sit, listen, make a drawing, and put things away. This sheet provides structure so Casey knows exactly what sequence he is expected to follow. Ms. Steele uses similar sheets for other activities to help Casey.

Generally, assistive technology (AT) is "any tool that helps a child with a disability do things he or she could not do without the tool at some expected level of performance" (Parette, Peterson-Karlan, Wojcik, & Bardi, 2007, p. 22). Whether it is putting away learning materials, completing a painting, or identifying beginning sounds, performance is expected of children in completing any classroom task. Thus, when AT is provided to help a child do something that is expected, it becomes compensatory. AT is individually matched to and uniquely required for a child to participate in the curriculum or classroom and make educational progress. In the preceding examples, children with disabilities were expected to participate in planned classroom activities, and they needed AT to accomplish the expected tasks. Making decisions about children with disabilities is a problem-solving process that will be discussed in greater depth in Chapter 5.

### Universal Design for Learning and Technology in the Early Childhood Classroom

IT integration hinges on several principles (NAEYC, 2008):

1. The technologies should align well with the curriculum.
2. The choice of technology should be based on how well each tool serves classroom learning and teaching needs.
3. Teachers must ensure opportunities for all children to participate and learn in the technology-rich environment.

To serve the needs of all young children in a technology-supported curriculum, a framework known as universal design for learning (UDL) can be helpful (Division for Early Childhood, 2009). Early childhood curricula that employ UDL principles are proactive and designed to provide young children with multiple means of engagement, action and expression, and representation (Rose & Meyer, 2006). With UDL, teachers use an array of strategies and materials that ensure active participation of all children. Varying strategies and materials are used in assessments, goals, curricula content, the classroom environment, instructional methods and materials, and interactions with children (Division for Early Childhood, 2007). Technology use affords teachers the opportunity to create accessible classroom settings.

A UDL framework can also help teachers understand why today's technologies are preferable to traditional educational approaches. Before technology became a central part of everyday life, educators primarily used traditional materials to develop and deliver content, with little flexibility for change. For example, reading materials were in print format only. Teachers read the text to children and

showed pictures in books, followed by oral questioning to assess children's understanding, regardless of whether the children were auditory or visual learners. Children frequently used consumables such as worksheets and line drawings (for coloring), which allowed for only a single use and little (if any) ability to make changes. Flexible adaptation was typically restricted to enlarging materials using a photocopier (and sometimes was restricted to black-and-white printing). Sharing materials among teachers, professionals, and families required a physical transfer of print materials.

Today's technologies present strikingly different learning opportunities. They are flexible, digital, shared, dynamic, and interactive, and the use of such technologies aligns with UDL principles. In today's classroom, reading materials are available both digitally and on paper. Print-based books now have digital audio components or companion materials that can be delivered via computer; other books are entirely electronic and can be delivered via laptops, tablets, or e-book readers. Young children can interact with the physical book and/or the virtual version. In the virtual form, children can have a word or a passage spoken by the device as they read along. Support materials can be created and delivered either in paper form, often using color printers; in digital file formats by teachers, using school networks or flash drives to install them on the students' desktops, laptops, or iPads; or via e-mail and web sites, which can also be used to share materials with children's families. Support materials can be shared among educational professionals on Internet activity sites (examples of these sites are discussed later in the chapter).

Finally, the computer-delivered media (unlike linear paper-based media) can react dynamically to a child's response, permitting branching or other nonlinear interactions. The use of UDL principles that incorporate technology enables teachers to provide multiple means of engagement (i.e., how the technology stimulates young children's interest and motivation for learning), representation (i.e., how the technology allows young children to present information and content), and expression (i.e., how the technology differentiates the manner in which young children can express what they know). Classroom activities designed using technology and these UDL principles support the developmental learning needs of young learners from a variety of cultural, linguistic, and economic backgrounds, as well as those who have disabilities.

***Cultural Supports*** Young children from varying cultural backgrounds may have preferences for individual or collaborative learning activities (Parette et al., 2005). Some ethnic groups come from collectivist cultures, in which conforming and contributing to the group may be a strongly held value by families of young children. Technologies that allow multiple children to participate, interact, contribute, and collaborate in classroom activities may be preferred for these children. For example, interactive whiteboards allow multiple users to participate in an activity. Many iPad applications can, by design, be both viewed and used by several children to create a product or play a game.

***Linguistic Supports*** Numerous technologies are now available that provide content and voice in various languages that allow UDL principles to be applied in learning activities. For example, the standard version of Clicker 6 enables education professionals and children to use French, Spanish, or English for activities

created using the software. It also has numerous additional language editions (e.g., Russian, Farsi, Chinese) that may be purchased to provide voices in these languages. Inexpensive e-book apps developed for the iPad (e.g., Grimm's Red Riding Hood, Grimm's Rapunzel, Scott's Submarine) allow young learners from different linguistic backgrounds to interact with non-English text. TumbleBooks, which are popular animated books available on the Internet (http://www.tumblebooks.com), have a growing number of titles available in both Spanish and French. Publicly accessible software programs, such as VoiceThread, allow children to upload and engage with text, audio, and video in their native languages. Free and inexpensive iPad apps, such as Educreations and Doodlecast for Kids, allow children to record their own drawings and/or text, voices, and video.

***Economic Background Supports*** In many classrooms, young children from low socioeconomic backgrounds may be present. Although there may be limited technology available in these children's homes, the number of computers, smartphones, and other technologies has increased among lower income families recently. Also, the increased availability of computers in public libraries has resulted in greater access to free software and web-based games and activities that support learning.

## READILY AVAILABLE TECHNOLOGY USE IN EARLY CHILDHOOD CLASSROOMS

Given that IT use in early childhood education classrooms is developmentally appropriate, the question arises regarding both the affordability and accessibility of these technologies. Budgets are tight in many early childhood settings, so ease of use and access are important factors for teachers who are considering whether or not to use technology in their classrooms.

One solution is the use of a technology toolkit, which is a collection of readily available technologies (both hardware and software) that can be easily accessed to provide meaningful classroom learning experiences. Certain core technologies in the toolkit must be present in order to employ other technologies. Two or more technologies working together create a system that allows students to realize a technology's potential. For example, a computer and software installed on the hard drive work together with a digital projector to deliver a presentation. A computer with Internet connectivity works with a web site containing learning activities to enable children to interact and participate.

School systems and programs must provide and support a toolkit of technologies needed for teachers to effectively use technology in classrooms (Blum, Parette, & Travers, 2011). For example, a software program may be free, low cost, or downloadable, but without a computer to support its use (because a computer was not provided to the classroom), the software program is not readily available. Similarly, if a computer is available, the teacher must be able to access external resources (e.g., free and downloadable software, web sites, activity exchanges) without the burden of administrative privileges being required (often controlled by school or program information technology personnel).

Key toolkit technologies that should be considered for the classroom are a computer, Internet access, child's mouse, digital projector and/or digital whiteboard


**Figure 1.1.** Internet sites provide access to readily available classroom activities and downloadable software, such as Tux Paint. (Reprinted by permission.)

(e.g., SMART Board), printer, flatbed scanner, digital camera, iPad/iPod, and Intellikeys keyboard. At a minimum, a computer with connectivity to the Internet and some means of projection are essential.

### Computers with Internet Access

Teachers generally recognize the importance of computers in today's classrooms. Of particular importance are computer models that have built-in touchscreen capability. Touchscreens enable a young child to make direct selections by reaching out and touching the screen (i.e., interactivity). Being able to interact with manipulatives or learning materials has long been recognized as DAP for young children, particularly for sensory-motor learners. Computers also have built in accessibility features designed to provide compensatory supports to young children with disabilities who may have difficulties such as tracking an onscreen cursor, perceiving print, or using a standard mouse.

Many web sites with readily accessible teacher-made and other high-quality child activities to support learning are accessible to classrooms that have computers with connectivity (see Appendix A). Free and inexpensive software with specific educational applications can also be downloaded (e.g., Tux Paint; see Figure 1.1).

### Child's Mouse

If direct access to a computer screen is not possible, many children will need to interface with the computer using a mouse (flexibility and interactivity). From a developmentally appropriate perspective, many young children will not be able to coordinate mouse movements with a pointer on the computer screen without repeated opportunities. Special types of mouse devices that have been developed for young children are preferable to a standard mouse because they allow easier grasping and manipulating of pointer movements.

### Digital Projector and/or Digital Whiteboard

When connected to a computer, a digital projector and/or digital whiteboard (e.g., SMART Board, Promethean Board) enables the early childhood education professional to project anything seen on the computer monitor onto a large screen (see Figure 1.2). Text, pictures, videos, animations, web site activities, and other engaging information can be visually presented in an interactive and flexible format to small groups or an entire classroom. In the case of digital whiteboards, young children can physically interact with learning activities presented on a screen.

### Printer

Printers have a variety of flexible and educationally relevant uses. In many classrooms, the printer is helpful in creating learning activity manipulatives and con-


**Figure 1.2.** Interactive whiteboards, such as the SMART Board, are increasingly popular in early childhood classrooms. They afford teachers access to an array of readily available technologies. (Reprinted by permission.)

sumables, as well as permanent hard copies of lessons, data, and student work, which may be necessary for filing purposes or for reporting results.

### Flatbed Scanner

Scanners are flexible input devices (essentially highly specialized cameras) designed to capture printed text or pictures, drawings, and children's work products and convert them into digital images/data. The resulting images can be embedded in other applications, such as Microsoft PowerPoint and Microsoft Word, or uploaded to various sites and applications on the Internet.

### Digital Camera

Increasingly used in today's early childhood classrooms, digital cameras enable young children to capture images both inside and outside the classroom. Children can then download the images to a computer; embed the images in an array of other applications (e.g., Microsoft Word or PowerPoint documents); upload the images to web-based applications, such as tikatok.com to create personalized talking books; or share the images as student learning accomplishments with other students, parents, and community members. Camera features are also available on many handheld devices and tablets.


**Figure 1.3.** Intellikeys keyboard and overlays provide a larger surface area for young children to interact with the computer (http://aex.intellitools.com; reprinted by permission.)

### iPads and iPods

Handheld devices such as the iPad and iPod Touch have gained great popularity in early childhood settings in a short period of time. Many learning applications have been developed for both the iPad and iPod. For example, the APPitic directory (http://www.appitic.com) lists more than 1,800 applications for education, organized by theme, preschool content area, disability, and other categories. When connected to a digital projector or digital whiteboard, these handheld devices can provide a big-screen presentation of the activity that all children can see.

### Intellikeys Keyboard

For many young children participating in activities developed using special software applications, it is helpful to have an expanded keyboard, which provides a larger surface area to execute a keystroke (see Figure 1.3). The Intellikeys keyboard is an excellent alternative to a traditional QWERTY keyboard. It comes with a wide array of overlays, which change the visual presentation of the keyboard for the child and can be shared.

### Key Software Programs

In addition to these key systems technologies, core software programs to support the curriculum should be considered as components of the early childhood education toolkit. Flexible software programs supported by a research base include Microsoft PowerPoint, Clicker 6 (Crick Software), Boardmaker with Speaking Dynamically Pro (Mayer-Johnson), and IntelliTools Classroom Suite (Cambium Learning Technologies). Each of these readily available technologies are digital and possess one or more UDL-related strengths that support the early childhood curriculum (dynamic, flexible, interactive, shared). Many activities also have been developed using these programs, which are archived at activity exchanges on the Internet. The activities can be easily downloaded and modified if needed, and they are ready for immediate use in the classroom (see Appendix A).

***Microsoft PowerPoint*** Microsoft PowerPoint, which is standard on most computers today, provides teachers with powerful features to create highly engaging instructional activities by manipulating varying types of pictures (static and animated); symbols/text; the type of voice or sound output (synthesized or digitized); the symbol size, shape, and position of different elements; and the choice between a color or black-and-white display. The animations and other features used to emphasize elements are particularly powerful and can be used to create similar effects in activities seen on web sites. Numerous reports regarding its uses have been published, and downloadable, ready-made presentations are available at Internet activity sites (see Appendix A) (Parette, Hourcade, & Blum, 2011; Parette, Hourcade, Boeckmann, & Blum, 2008; Parette, Blum, Boeckmann, & Watts, 2009).

***Clicker 6*** Designed to incorporate the major recommendations of the National Institute of Child Health and Human Development (2000), Clicker 6 (Crick Soft-

ware) allows teachers to easily create dynamic and flexible literacy activities (see Figure 1.4). Using the templates available (or teacher-made activities downloadable from the Learning Grids World web site), activities can be created which are visually and systematically represented with groups of words or iconic symbols. Students can also make and hear selections and physically interact with the activities using an interactive whiteboard. Research provides support for its usefulness in developing emergent literacy skills among young children (Karemaker, Pitchford, & O'Malley, 2008; Parette, Hourcade, Dinelli, & Boeckmann, 2009).

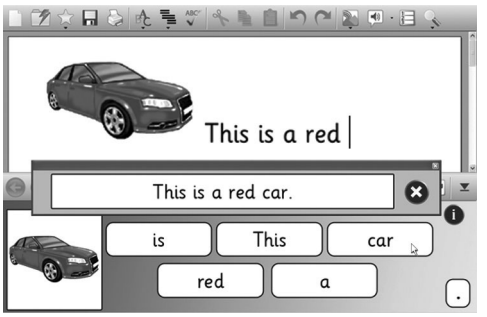


**Figure 1.4.** Clicker 6 is a grid writing program designed to support literacy activities in the classroom, and is supported by the Learning Grid World Activity Exchange (https://www.learninggrids.com/uk; reprinted by permission.)

***Boardmaker with Speaking Dynamically Pro*** One of the most commonly used software programs in inclusive early childhood education classrooms is Boardmaker with Speaking Dynamically Pro (Mayer-Johnson), which allows teachers to create a range of customized visual supports (e.g., activity schedules, task charts, power cards) for young students using Picture Communication Symbols (PCS), including communication boards, picture schedules, and instruction sheets. Activity exchanges are also available (e.g., Boardmaker Share; see Figure 1.5), which enable early childhood education professionals to download activities created by other teachers (see Appendix A).

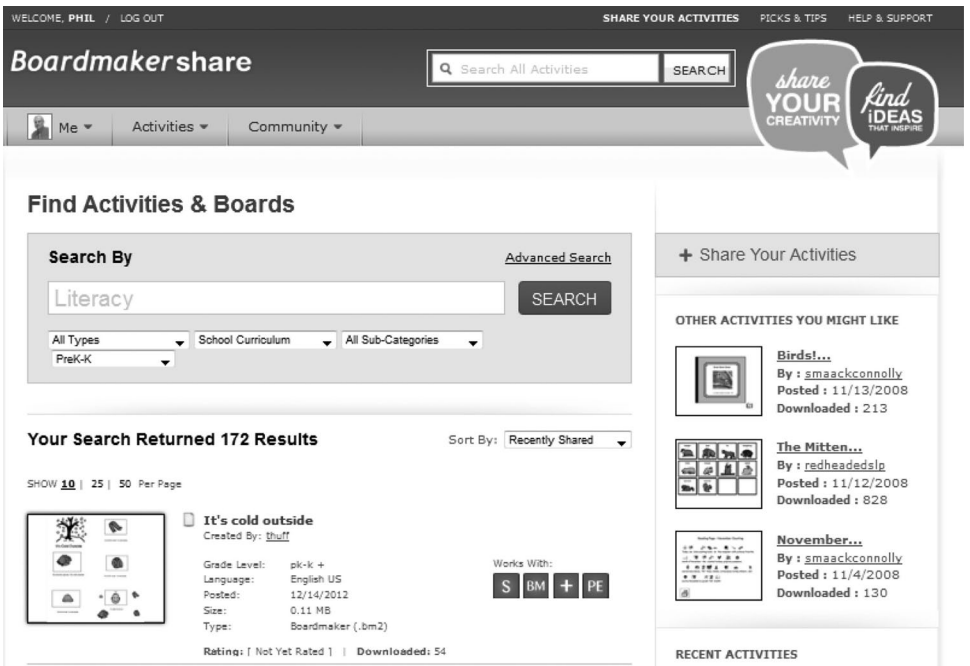


**Figure 1.5.** Boardmaker with Speaking Dynamically Pro is widely used in today's education settings to create visual and communication supports for young children. It is complemented by readymade activities at the Boardmaker Share site (http://www.boardmakershare.com/default.aspx; reprinted by permission.)

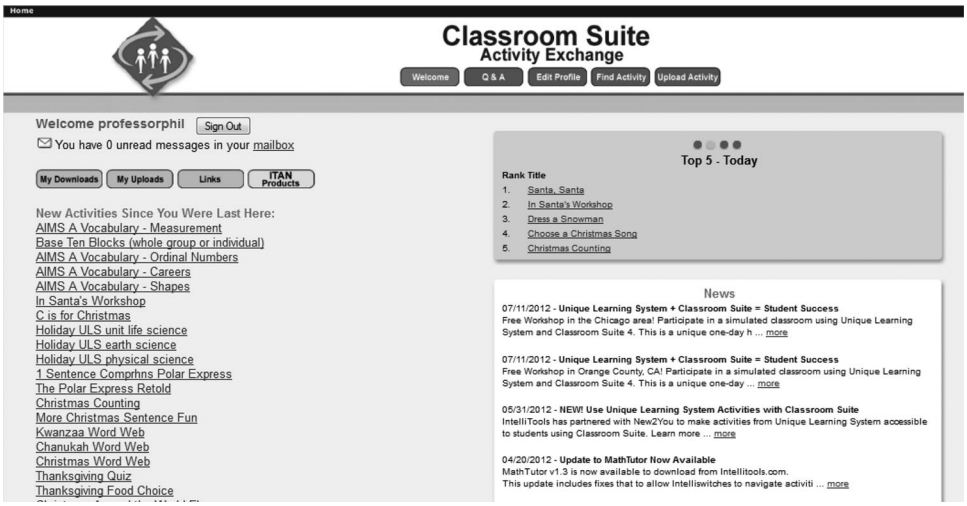


**Figure 1.6.** The IntelliTools Classroom Suite Activity Exchange site provides access to a large number of free and engaging activities created using the Classroom Suite software (http://aex.intellitools.com; reprinted by permission.)

***IntelliTools Classroom Suite*** IntelliTools Classroom Suite (Cambium Learning) is a research-based, flexible, dynamic authoring software package. It includes activity templates that can be immediately used or customized to provide engaging planned activities related to reading, writing, and other skills using explicit direct instruction, constructive practice, and embedded assessments. The IntelliTools Classroom Suite Activity Exchange (see Figure 1.6) is also available for early childhood education professionals to download ready-made activities (see Appendix A).

Once a computer with Internet access is in place in the classroom, other technologies become readily available to teachers, including free or inexpensive web tools and accessible web site resources and activities. Locally available technologies may be acquired from stores and used as part of a system to develop and deliver learning activities.

For example, Mrs. Hearns has become familiar with using Microsoft PowerPoint to develop classroom learning activities. The software is installed on her classroom computer, and its animation and emphasis features allow her to create engaging slides with many of the same characteristics as interactive web activities. She uses VoiceThread, a free web tool that allows children to record audio, video, and text to comment on materials that she has uploaded for the learning activities.

Mr. Bivens routinely downloads teacher-made activities from the SMART Activity Exchange, which can be used on his SMART Board. He can preview these activities in advance because he downloaded the free SMART Notebook software, which helps him to decide which activities will be most appealing to his kindergarten students. Mr. Bivens adds digital photos of his students and images of previous activities to enhance the SMART activity. He also uses a number of links to various technologies that are part of a UDL toolkit (see Figure 1.7).


**Figure 1.7.** Free universal design for learning literacy technology (http://udltechtoolkit.wikispaces.com; reprinted by permission.)

Ms. Steele went to her local Walmart and purchased a LeapFrog Tag reading system book for use in her literacy center. The book has a pen that, when touched to the text, activates a voice that reads the words to the students. She designs a Clicker 6 activity that focuses on comprehension questions associated with the Tag book. The children view the Clicker 6 activity on a SMART Board, which allows them to physically interact with the screen and make selections. She also routinely accesses a comprehensive free resource called *Exploring New Territories* (Florida Department of Education, 2010) to explore links to web sites with technologies that support young children both with and without disabilities.

In each of these instances, teachers used core classroom technologies to develop and deliver learning activities. Appendix A includes examples of readily available technologies that apply to the early childhood classroom. However, simply having readily available technologies for use with children is inadequate to ensure their successful integration in the curriculum. A thoughtful process is required to make decisions about the technologies used to support learning, the teaching strategies required, and how children's progress will be assessed. This process will be discussed at length in subsequent chapters.

## OUTCOMES OF INTEGRATING TECHNOLOGY IN THE CLASSROOM

Teachers who integrate technology into curricula often observe moments where both anticipated and unexpected outcomes emerge. For example, one teacher who had been provided with an array of technologies to support children's emergent literacy development commented on what both she and her children had experienced (Parette, Stoner, & Watts, 2009, p. 265):

> I just think that I strive for, "How can I put it into technology?" So, I'm constantly thinking, what will make this be a bigger picture? Like when they're laughing because they see a groundhog going through a tunnel. We talk about fast and slow or I bring in all the actions. It's real life to them on the computer and the animation that comes through instead of stick figures. I think I just see an increase in their desire to participate in the activities as students.

In this example, the teacher used a digital projector with her classroom computer and was constantly thinking of new ways to use available software and other technology supports to deliver the curriculum. She was particularly interested in the use of these supports in conjunction with research-based instructional strategies, such as direct instruction to teach specific emergent literacy skills.

Similarly, another teacher who worked with a nonverbal preschool student with autism spectrum disorder was troubled that the student could not participate in the curriculum by telling stories in the same way as other students during circle time. He had limited oral language skills coupled with deficits in social interactions. However, the teacher discovered that the child could type using the computer keyboard and a symbol-based software program to tell a story, as discussed in the following quote (Parette, Stoner, et al., 2009, p. 266):

> Well, we had just talked to parents and asked if they heard him speak more than one word because we weren't hearing it. He came over to tell me a story and usually he doesn't, but he came this day. I was modeling for him, "Tell me what you really like." And I couldn't get anything out of him and I was typing and it was showing on the big screen and he was watching and then I typed, "I love…" and just waited. He reached for the keyboard and he typed *d–i–n–o–s–r*. Yes! The previous student's story had a picture, you know the picture popped up of a dinosaur and he saw that on the screen. So I went back and respelled it so the picture would come up and that was quite a moment with that child and then he read, he read, "I love dinosaurs." And he is hyperlexic but usually he just writes, he's not verbal.

Such experiences in which teachers try things in different ways using technology and the resulting outcomes support the importance of understanding what is required to use various technologies, as well as developing a level of comfort and expertise in using them effectively with children.

Blum, Parette, and Watts (2009) reported on a group comparison study that examined phonological awareness outcomes of a curriculum using direct instruction embedded in Microsoft PowerPoint and delivered using a digital projection system. Results were reported from an early childhood center of 55 preschool children who were at risk of disability. Findings indicated that students receiving the PowerPoint-based curriculum doubled their initial sound fluency progress over the comparison group (moderate effect size with Cohen's $f$ = .28). Findings for alliteration and rhyming were inconclusive.

## SUMMARY

Because young children have many experiences with and preferences for technologies prior to coming to any early childhood setting, the use of technology in classroom activities must be considered an important facet of DAP. Cultural influences, generational differences, classroom budget limitations, attitudes about technology, and teachers' lack of knowledge and/or training potentially present barriers to acceptance of technology in today's classrooms. Many of these technologies are, by

design, instructional and result in increased instructional effectiveness, efficiency, and appeal. The real challenge in today's classrooms is how to use UDL principles with IT to provide multiple means of engagement, action and expression, and representation.

## ADDITIONAL READINGS

Blanchard, J., & Moore, T. (2010). *The digital world of young children: Impact on emergent literacy*. New York, NY: Pearson Foundation. Retrieved September 22, 2012, from http://www.pearsonfoundation.org/downloads/EmergentLiteracy-WhitePaper.pdf

Burdett, C. (2010). Technology and literacy in early childhood educational settings: A review of research. *Journal of Early Childhood Literacy, 10,* 247–270.

Glaubke, C. (2007). *The effects of interactive media and preschoolers' learning: A review of the research and recommendations for the future.* Oakland, CA: Children Now. Retrieved January 4, 2013, from http://www.childrennow.org/uploads/documents/prek_interactive_learning_2007.pdf

Li, X., Atkins, M., & Stanton, B. (2006). Effects of home and school computer use on school readiness and cognitive development among Head Start children: A randomized controlled pilot trial. *Merrill-Palmer Quarterly, 52,* 239–263.

McLuhan, M. (1964). *Understanding media: The extensions of man.* New York, NY: New American Library.

Papert, S. (1980). *Mindstorms: Children, computers and powerful ideas.* New York, NY: Basic Books.

Rideout, V., Vandewater, E., & Wartella, E. (2003). *Zero to six: Electronic media in the lives of infants, toddlers and preschoolers.* Menlo Park, CA: Kaiser Family Foundation.

## REFERENCES

Blum, C., Parette, H.P., & Travers, J. (2011, April). *Future of instructional technology in early childhood special education.* Paper presented at the Council for Exceptional Children Convention and Expo, Washington, DC.

Blum, C., Parette, H.P., & Watts, E.H. (2009). Engaging young children in an emergent literacy curriculum using Microsoft PowerPoint: Development, considerations, and opportunities. In A.M. Vilas, A.S. Martin, J.M. González, & J.A. González (Eds.), *Research, reflections and innovations in integrating ICT in education* (Vol. 1, pp. 41–45). Badajoz, Spain: FORMATEX.

Division for Early Childhood. (2007). *Promoting positive outcomes for children with disabilities: Recommendations for curriculum, assessment, and program evaluation*. Missoula, MT: Author.

Division for Early Childhood & National Association for the Education of Young Children. (2009). *Early childhood inclusion.* Retrieved September 22, 2012, from http://www.naeyc.org/files/naeyc/file/positions/DEC_NAEYC_EC_updatedKS.pdf

Florida Department of Education. (2010). *Exploring new territories.* Retrieved September 22, 2012, from http://www.fdlrs.org/docs/ent2010web.pdf

Gronseth, S., Brush, T., Ottenbreit-Leftwich, A., Strycker, J., Abaci, S., Easterling, W., et al. (2010). Equipping the next generation of teachers: Technology preparation and practice. *Journal of Digital Learning in Teacher Education, 27*(1), 30–36.

Hourcade, J.J., Parette, Jr., H.P., Boeckmann, N.M., & Blum, C. (2010). Handy Manny and the emergent literacy toolkit. *Early Childhood Education Journal, 37,* 483–491.

Howe, N., & Strauss, W. (2000). *Millennials rising. The next great generation*. New York, NY: Vintage Books.

International Society for Technology in Education, Partnership for 21st Century Skills, & State Educational Technology Directors Association. (2009). *Maximizing the impact. The pivotal role of technology in a 21st century education system*. Retrieved September 22, 2012, fromhttp://www.setda.org/c/document_library/get_file?folderId=191&name=P21Book_complete.pdf

Judge, S. (2006). Constructing and assistive technology toolkit for young children: Views from the field. *Journal of Special Education Technology, 21*(4), 17–24.

Karemaker, A., Pitchford, N.J., & O'Malley, C. (2008). Using whole-word multimedia software to support literacy acquisition: A comparison with traditional books. *Educational and Child Psychology, 25,* 97–118.

Keengwe, J., & Onchwari, G. (2009). Technology and early childhood education: A technology integration professional development model for practicing teachers. *Early Childhood Education Journal, 37,* 209–218.

National Association for the Education of Young Children. (1995). *Responding to linguistic and cultural diversity. Recommendations for effective early childhood education.* Retrieved September 22, 2012, from http://www.naeyc.org/files/naeyc/file/positions/PSDIV98.PDF

National Association for the Education of Young Children. (1996). *Technology and young children: Ages 3 through 8. A position statement of the National Association for the Education of Young Children*.

National Association for the Education of Young Children. (2008). *Meaningful technology integration in early learning environments.* Retrieved September 22, 2012, from http://www.naeyc.org/files/yc/file/200809/OnOurMinds.pdf

National Association for the Education of Young Children. (2009). *Developmentally appropriate practice in early childhood programs serving children from birth through age 8. A position statement of the National Association for the Education of Young Children.* Retrieved September 22, 2012, from http://www.naeyc.org/files/naeyc/file/positions/PSDAP.pdf

National Association for the Education of Young Children & Fred Rogers Center for Early Learning and Children's Media. (2012). *Technology and interactive media as tools in early childhood programs serving children from birth through age 8.* Retrieved September 22, 2012, from http://www.naeyc.org/files/naeyc/file/positions/PS_technology_WEB2.pdf

National Institute of Child Health and Human Development. (2000). *Report of the National Reading Panel. Teaching children to read: an evidence-based assessment of the scientific research literature on reading and its implications for reading instruction: Reports of the subgroups*. Washington, DC: U.S. Government Printing Office.

Newby, T.J., Stepich, D.R., Lehman, J.D., & Russell, J.D. (2006). *Instructional technology for teaching and learning: Designing instruction, integrating computers, and using media* (3rd ed.). Upper Saddle River, NJ: Pearson Merrill Prentice Hall.

Parette, H.P. (2011, November). *Readily available technology integration in early childhood education: Lessons learned.* Paper presented at the annual meeting of the Assistive Technology Industry Association, Chicago, IL.

Parette, H.P., & Angelo, D.H. (1998). The impact of assistive technology devices on children and families. In S.L. Judge & H.P. Parette (Eds.), *Assistive technology for young children with disabilities: A guide to providing family-centered services* (pp. 148–183). Cambridge, MA: Brookline.

Parette, H.P., Blum, C., & Watts, E.H. (2009). Use of Microsoft® PowerPoint™ and direct instruction to support emergent literacy skill development among young at risk children. In A.M. Vilas, A.S. Martin, J.M. González, & J.A. González (Eds.), *Research, reflections and innovations in integrating ICT in education* Vol. 2 (pp. 864–868). Badajoz, Spain: FORMATEX

Parette, H.P., Hourcade, J.J., & Blum, C. (2011). Using animation in Microsoft® PowerPoint™ to enhance engagement and learning in young learners with developmental delay. *Teaching Exceptional Children,* 48 (4), 58–67.

Parette, H.P., Hourcade, J.J., Boeckmann, N.M., & Blum C. (2008). Using Microsoft® PowerPoint™ to support emergent literacy skill development for young children at-risk or who

have disabilities. *Early Childhood Education Journal,* 36, 233–239. doi:10.1007/s10643-008-0275-y

Parette, H.P., Hourcade, J.J., Dinelli, J.M., & Boeckmann, N.M. (2009). Using *Clicker 5* to enhance emergent literacy in young learners. *Early Childhood Education Journal, 36,* 355–363.

Parette, H.P., Huer, M.B., & VanBiervliet, A. (2005). Cultural issues and assistive technology. In D.L. Edyburn, K. Higgins, & R. Boone (Eds.), *The handbook of special education technology research and practice* (pp. 81–103). Whitefish Bay, WI: Knowledge by Design.

Parette, P., & McMahan, G.A. (2002). What should we expect of assistive technology? Being sensitive to family goals. *Teaching Exceptional Children, 35*(1), 56–61.

Parette, H.P., Meadan, H., Doubet, S., & Hess, J. (2010). Supporting families of young children with disabilities using technology. *Education and Training in Autism and Developmental Disabilities, 45,* 552–565.

Parette, H.P., Quesenberry, A.C., & Blum, C. (2010). Missing the boat with technology usage in early childhood settings: A 21st century view of developmentally appropriate practice. *Early Childhood Education Journal, 37,* 335–343.

Parette, H.P., & Stoner, J.B. (2008). Benefits of assistive technology user groups for early childhood education professionals. *Early Childhood Education Journal, 35,* 313–319.

Parette, H.P., Stoner, J.B., & Watts, E.H. (2009). Assistive technology user group perspectives of early childhood professionals. *Education and Training in Developmental Disabilities, 44,* 257–270.

Pasnik, S., Strother, S., Schindel, J., Penuel, W.R., & Llorente, C. (2007). *Review of research on media and young children's literacy.* Retrieved September 22, 2012, from http://cct.edc.org/rtl/pdf/RTLLiteratureReview.pdf

Penuel, W.R., Pasnik, S., Bates, L., Townsend, E., Gallagher, L.P., Llorente, C., et al. (2009). *Summative evaluation of the Ready to Learn initiative*. Newton, MA: Educational Development Center.

Peurling, B. (2012). *Teaching in the digital age: SMART tools for age 3 to grade 3.* St. Paul, MN: Redleaf Press.

Rose, D.H., & Meyer, A. (Eds.). (2006). *A practical reader in universal design for learning*. Cambridge, MA: Harvard University Press.

Schomberg, R., & Donohue, C. (2012, May 9). *Teaching with technology: Guidance from the NAEYC and Fred Rogers Center joint position statement*. Retrieved September 22, 2012, from http://www.earlychildhoodwebinars.org/presentations/teaching-with-technology-guidance-from-the-naeycfrc-position-statement/

**Appendix 1.** Readily available resources for the early childhood education classroom

| Category | URL | Description |
|---|---|---|
| Downloadable software | | |
| Tux Paint | http://tuxpaint.org | An open source, easy-to-use drawing program designed for young children. It has sound effects and a cartoon guide to offer support as children use the program |
| ZAC Browser | http://www.zacbrowser.com/ | Browser designed for the PC and specifically for children with autism spectrum disorders. Appropriate for all children |
| SMART Notebook Express | http://smarttech.com/us/Support/Browse+Support/Download+Software/Software/SMART+Notebook+Express/SMART+Notebook+Express/SMART+Notebook+Express | Software enables education professionals to open, edit, save and share SMART notebook files |
| Best Freeware Download | http://www.bestfreewaredownload.com/categories/download-education-kids-freeware-6-71-0-d.html | Provides links to free software to support varying aspects of the curriculum |
| Educational Freeware | http://www.educational-freeware.com/freeware/category-Toddlers.aspx | Presents a comprehensive listing of free, downloadable, Windows-compatible learning games designed for young children |
| Free Download Manager | http://www.freedownloadmanager.org/downloads/preschool_software/ | Archive for a variety of art-related shareware programs |
| File Buzz Download | http://www.filebuzz.com/files/Preschool_Education/1.html | Site providing 60 downloadable low-cost programs that have relevance to activities in the preschool curriculum |
| Best Software Downloads | http://www.bestsoftware4download.com/s-faycfmse-preschool-software-25-d.html | Both freeware and shareware (ranging in price from $9.95–$19.95) |
| Downloadable activities | | |
| Spectronics Activity Exchange | http://www.spectronicsinoz.com/activities | Collection of activities designed for use with a number of popular software programs, including Clicker 6, IntelliTools Classroom Suite, Boardmaker with Speaking Dynamically Pro, and the Communicate series |
| SMART Activity Exchange | http://exchange.smarttech.com/#tab=0 | Resource for downloadable teacher-made SMART Board activities |
| Classroom Suite Activity Exchange | http://aex.intellitools.com/ | Contains downloadable teacher-made activities designed specifically for use with the IntelliTools Classroom Suite |
| Boardmaker Share | http://www.boardmakershare.com | Resource site containing thousands of teacher-made Boardmaker activities searchable by activity area and grade level |
| Learning Grids World | https://www.learninggrids.com/us/WelcomePage.aspx | Free teacher-made activities designed for WriteOnline, Clicker 6, and ClosePro (Crick Software products) |

| | | |
|---|---|---|
| Talking Book Library | http://www.talkingbooklibrary.net/Matrix.htm | Site containing primary-level talking books created both by teachers and students, which can be saved and modified |
| Accessible Books | http://www.setbc.org/setbc/accessiblebooks/freebooksforyou.html | The site presents a compilation of both teacher- and student-made PowerPoint Talking Books. Microsoft Word, Clicker 6, and IntelliTools books are also represented |
| **Web-accessible learning activities and games** | | |
| Disney Junior | http://disney.go.com/disneyjunior | A Disney web site presenting animated and interactive games, music stories, and activities related to Disney characters such as Handy Manny and his friends; useful to support beginning reading skill development |
| Sesame Street | http://www.sesamestreet.org/home | Web site presenting high quality animated and interactive games, videos, and other supports for developing emergent literacy skills |
| Starfall | http://www.starfall.com | Web site presenting an array of animated and interactive activities designed to develop phonemic awareness; printable worksheets |
| Dove Whisper | http://dovewhisper.com | Curricula support links both within a computer center (math, science, literacy, and themes) and favorite links (science, math, social studies, language arts, reading, generic) pages |
| PBS Kids | http://pbskids.org | Site containing activities, games, and literacy supports related to Sesame Street, Curious George, Clifford the Big Red Dog, and other children's shows |
| VoiceThread | http://voicethread.com | A free online resource allowing teachers and students to create multimedia slide shows having images, text, audio, and video. Students can comment on the content using text, audio, and video, and work can be shared with others |
| Nick Jr. | http://nickjr.com | A free online resource for teachers or parents, providing activities connected to popular Nickelodeon television shows (e.g., *Dora the Explorer*). Includes parenting tips that pop up on the web site |
| Up to Ten | http://www.uptoten.com | This site provides access to multimedia activities, games, and stories, some of which are appropriate for preschool and kindergarten students, as well as apps for the iPad and iPhone |

*(continued)*

**Appendix 1.** *(continued)*

| Category | URL | Description |
|---|---|---|
| Printable worksheets | | |
| Education.com | http://www.education.com/worksheets/preschool | Printable preschool worksheets covering a wide range of subjects |
| tlsbooks.com | http://www.tlsbooks.com/ | Free worksheets organized by grade level and content area |
| Kids Learning Station | http://www.kidslearningstation.com | Free printable worksheets, especially for writing printable games are available, as well as links to other sites that have free printable worksheets |
| Comprehensive resource documents | | |
| *Exploring New Territories* | http://www.fdlrs.org/docs/ent2010web.pdf | Compiled by the Florida Instructional Technology Training Resource Unit, this resource book contains a wealth of resources by content area to support children's participation in the curriculum |
| *EZ AT 2* | http://www.pacer.org/stc/pubs/EZ-AT-book-2011-final.pdf | Resource document regarding simple assistive technologies used with children from birth to 3 years old |
| Free technology toolkit for universal design for learning in all classrooms | http://udltechtoolkit.wikispaces.com/ | This wiki has links to technologies designed to support writing, literacy, study skills, and math. Other pages provide links to audio book sites, research tools, graphic organizers, multimedia and digital storytelling tools, text-to-speech, collaborative tools, universal design for learning, and additional tools |
| Off-the-shelf products | | |
| LeapPad Learning System | http://shop.leapfrog.com/leapfrog/index.jsp | An array of curricula support toys designed to support literacy; found in many stores |
| iPad Touch | http://www.apple.com/ipad/ | iPad is the first tablet computer developed by Apple Inc. and is part of a device category between a smartphone and a laptop computer |
| iPod | http://www.apple.com/ipod/ | This palm-sized electronic device was primarily created to play music, although it can serve as a backup device, a basic organizer, and an alarm clock |
| iPhone | http://www.apple.com/iphone/ | An Internet-enabled smartphone that combines features of a mobile phone, wireless Internet device, and iPod into one device |
| VTech | http://www.vtechkids.com/ | An array of curricula support toys designed to support literacy; found in many stores. Vtech tablets are more durable than typical tablet computers |

| | | |
|---|---|---|
| **Widely available programs** | | |
| Microsoft PowerPoint | http://office.microsoft.com/en-gb/powerpoint/ | Presentation software having an array of features to enhance the delivery of content, including animation |
| Microsoft Word | http://office.microsoft.com/en-us/word/ | Word processing program having numerous features enabling manipulation of text and contrast, embedding sounds and web links, and other features to support delivery of curricula |
| **Mobile applications** | | |
| Best Apps for Kids | http://bestappsforkids.com/category/apps-for-education/early-learning-apps/ | An array of free apps, selected by parents, that hold potential for facilitating learning |
| APPitic | http://appitic.com/ | Compilation of more than 1,300 apps that have been vetted by Apple Distinguished Educators; categorized by preschool, special education, themes, multiple intelligences, Bloom's Taxonomy, and National Education Technology Standards |
| Moms with Apps | http://momswithapps.com/ | A collaborative group of family-friendly developers seeking to promote quality apps for kids and families. Links to a wide array of apps are provided |
| Touch Screen Preschool Games | http://www.touchscreenpreschoolgames.com/games | Provides links to a compilation of apps for the iPhone, iPod, and iPod Touch |
| SNApps4kids | http://snapps4kids.com/ | Categorized listing of apps designed for use with children having disabilities |
| Apps in Education | http://appsineducation.blogspot.com/2011/12/more-kindergarten-ipad-resources.html | Blog providing apps and web site links to supports for both preschool and kindergarten children |
| Free and Low-Cost Preschool/Kindergarten Apps for iPad Instruction and Curriculum Integration | http://www.danking.net/iPad/docs/Free%20and%20Low%20Cost%20PreK%20and%20Kindergarten%20Apps%20for%20iPad%20Master%20List%205-25%282%29.pdf | Listing of iPad resources and iPad communities having links and other resources |
| Apps 4 Children with Special Needs | http://www.livebinders.com/play/present?id=170107 | Variety of resources related to apps for children with disabilities |
| SpedApps2 | http://spedapps2.wikispaces.com/ | Wiki site maintained by therapists with recommendations regarding apps used with children with disabilities for communication and language, reading, writing, math, science/social studies, art/creativity, music, motor, and cortical vision impairments |

*(continued)*

**Appendix 1.** *(continued)*

| Category | URL | Description |
|---|---|---|
| Apps4Stages | http://apps4stages.wikispaces.com/ | Wiki site dedicated to stages of child characteristics and recommendations for features to consider in computer software for learning, along with teaching strategies that match and scaffold student need |
| TCEA-Recommended iPod Apps | https://docs.google.com/spreadsheet/ccc?key=0At6rnmB5cDEPdDFkcmhoTUpQNUZzMlZMNXc3SEwyRmc#gid=0 | Google document created by the Texas Computer Education Association containing recommended e-book apps |
| Instructional materials development | | |
| Kerpoof | http://www.kerpoof.com/# | Provides an array of tools enabling young children spell pictures; make movies, cards, drawings, and pictures; and tell stories. All products are printable |
| Story Bird | http://storybird.com/ | Enables children to create high-quality books, play them like games and send them as cards |
| Bubblejoy | http://www.bubblejoy.com/create.php | The application allows children to create a video greeting card using their own videos; they can choose from different card designs that will support a curriculum topic |
| Moshi Monster | http://www.moshimonsters.com/ | Young children can adapt their own monsters, give them a name, and design their color schemes. The monster makes new friends, chats with others, plays games, and develops its own personality through its growth |
| Shidonni | http://www2.shidonni.com/v2/LandingPage.aspx | Children can create their own animals and watch them come to life, providing opportunities for discussion or show-and-tell activities |
| Volki | http://www.voki.com/ | Children can create animated and speaking avatars using their voices or using a text-to speech application. They can fully customize their characters, which move their heads and eyes with the movement of the mouse |
| Talking Pets | http://www.talkingpets.org/ | Similar to Voki, the characters on this site are limited to animals and the child can use the text-to-speech application (e.g., children might be surprised by making a cat talk and hearing the cat ask questions to them) |
| Fotobabble | http://www.fotobabble.com/ | This site presents a way to make photos talk. The child uploads pictures, records his or her voice, and publishes it—providing a way to motivate children to speak |

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|---|---|---|
| **Resource sites** | | |
| National Association for the Education of Young Children (NAEYC) Technology and Young Children Interest Forum | http://www.techandyoungchildren.org/ | Links and resources for technology applications provided by members of NAEYC |
| Tots 'n Tech | http://tnt.asu.edu/ | This web site, maintained by a federally funded project, provides links to resource sites, low-tech solutions for infants and toddlers, resource briefs on assistive technology, and other supports |
| Ele: Fred Rogers Center Early Learning Environment | http://ele.fredrogerscenter.org/ | Library and "playroom" with an online community that has professional development activities for educators of young children up to 5 years; includes high-quality resources for parents and teachers, video, multimedia, and interactive resources |
| **Other common technologies** | | |
| Clicker 6 | http://www.cricksoft.com/uk/products/tools/clicker/home.aspx | Authoring software providing reading and writing supports |
| IntelliTools Classroom Suite | http://store.cambiumlearning.com | Authoring software providing reading, writing, and math supports; contains embedded assessments to monitor progress |
| Boardmaker Plus | http://www.mayer-johnson.com/boardmaker-plus-v-6/ | Software used to create visual strategies, including communication boards |
| **Assistive technology** | | |
| Family Center on Technology and Disability | http://www.fctd.info/ | Comprehensive technology site providing information and resources to families and service providers. Links to fact sheets, PowerPoint presentations, resource guides, member organizations, and reviews of instructional and assistive technologies |
| Assistivetech.net | http://assistivetech.net/webresources/stateTechActProjects.php | Provides links to State Tech Act projects that may have equipment loan programs and other classroom supports |

*(continued)*

**Appendix 1.** *(continued)*

| Category | URL | Description |
|---|---|---|
| Universal design for learning | | |
| OS X Accessibility Features | http://www.apple.com/accessibility/macosx/vision.html | Description of various accessibility features on the Apple OS X including voiceover, screen magnification, cursor magnification, high contrast and reverse video, Safari reader, finder views, view options, dock magnification, talking alerts, talking calculator, talking clock, converting text to speech, and cascading style sheets |
| Windows Accessibility | http://windows.microsoft.com/en-us/windows/help/accessibility | Description of various accessibility features on the Windows operating system, including display and readability, sounds and speech, and keyboard and mouse options |
| Accessibility in Windows 7 | http://www.microsoft.com/windows/windows-7/features/accessibility.aspx | Description of accessibility features on Windows 7, including speech, magnifier, on-screen keyboard, narrator, and visual notifications |
| Subtitling Add-In for Microsoft PowerPoint | http://sourceforge.net/projects/stamp-addin/ | Adds closed captioning to a PowerPoint presentation in embedded videos (Windows) |
| Text-to-speech for Microsoft Office 2010 | http://office.microsoft.com/en-us/onenote-help/using-the-speak-text-to-speech-feature-HA102066711.aspx#_Toc282684835 | Allows highlighted text to be read by the built-in computer voice when displayed on the screen. Compatible with Word 2010, Outlook 2010, PowerPoint 2010, and OneNote 2010 |
| Read Please | http://www.readplease.com/english/readplease.php | Free online reader allowing digital text to be read to a child; has adjustable voice speed and low-vision color option |
| Mozilla Firefox add-ins | https://addons.mozilla.org/en-US/firefox/ | Provides an array of Mozilla Firefox add-ins to make the Internet more accessible |
| Digital text | | |
| Project Gutenberg | http://www.gutenberg.org/catalog/ | Archive for thousands of books available in digital format |
| Bookshare | http://www.bookshare.org/ | Free site providing access to digital books for children with disabilities |