1.4: Incorporating 21st Century Technology in the Early Childhood Education

The rapid development of technological devices such as computers, smart-phones, tablets, and gaming systems has dramatically changed people’s daily lives at home and at work. New technologies and electronic media provide tools for communication and social-networking, for searching and documenting information, and for learning and entertainment. Young children are growing up surrounded by technology and electronic media. At least two-thirds of homes with children (birth to age six) have computers and Internet access (Gutnick et al. 2010; Roberts and Foehr 2008). Moreover, according to a national survey by Common Sense Media in 2011, 52 percent of young children (birth to age eight) have access to smartphones or tablets (Rideout 2011). Young children are active media users (Roberts and Foehr 2008). They acclimate with ease to digital devices and show confidence in using software (Clements and Sarama 2008). With the prevalence of technology and electronic media in their environment, young children are spending an increasing number of hours in front of screen technologies, particularly television, but also computers and other devices, with an average of 2.2 hours per day of screen time for children between the ages of two and five (Roberts and Foehr 2008).

Children from low-income families, families with less education, and black, Hispanic, and rural families are less likely to have access to the newest technologies and to broadband connections to the Internet (U.S. Department of Commerce 2011). Inequality in access to technology has narrowed over the years, but the “digital divide” still exists (Roberts and Foehr 2008).

The pervasiveness of electronic media in the lives of many young children makes educators, parents, and advocates question the value of technology in children’s development. Some electronic media such as certain television programs, videos, and DVDs are non-interactive and involve passive viewing. Other forms of electronic media such as software programs, applications, the Internet, e-books, and certain television programs facilitate active and creative use by young children. These latter forms are referred to as interactive media (NAEYC and FRC 2012). There is limited research on the impact of newer technology, such as computer software, handheld devices, interactive applications for mobile
devices, and wireless technology, on children’s development. Most of the research on the impact of media on young children has focused on television and video. Studies of infants and toddlers suggest that videos have no language benefits for infant and toddlers.

Young children learn much better from real-life experiences than from watching videos. Moreover, excessive exposure to electronic media may have a negative effect on attention development, particularly for children younger than two (Kirakorian, Wartella, and Anderson 2008). Research indicates that the impact of electronic media on older children depends on the age of children, the context in which they use media, the content of the media, and the amount of time they spend with screens (Kirakorian, Wartella, and Anderson 2008; Campaign for Commercial-Free Childhood, Alliance for Childhood, and Teachers Resisting Unhealthy Children’s Entertainment 2012).

By age three, children can benefit from well-designed, age-appropriate electronic media, especially when a caring adult views the program with the child and is actively involved in the child’s experience. Research emphasizes the importance of developmentally appropriate content being offered to children, whether on television or other interactive media software. Educational television programs that were designed around a curriculum with a specific goal to communicate academic or social skills were linked to various cognitive and academic enhancements, with potentially long-lasting effects (Fisch 2004). For example, research demonstrates a positive association between early exposure to Sesame Street television episodes and school readiness (Zill 2001). However, television and videos with entertainment content, particularly violent content, were associated with poor cognitive development and lower academic achievement (Kirakorian, Wartella, and Anderson 2008).

Studies of preschool children’s computer play demonstrated that young children can use computers and software to support their learning. Children can understand, think about, and learn from their computer activity (Clements and Sarama 2008). Research has shown that in children’s computer play with interactive media software there is a period of discovery, which is then followed by involvement, self-confidence, and creativity (Bergen 2008). Computer-play software can offer children various possibilities, including practice (self-directed repetition to achieve mastery), pretense (symbolic play in a “pretend to be” world), and games (challenge and competition, either with a peer, with oneself, or with an imaginary opponent) (Kafai 2006).

There is limited research on how educational computer software may enhance preschool children’s academic-readiness skills. Some research suggests that software with an educational curriculum may have a positive influence on learning (Din and Calao 2001). Overall, studies indicate that, when used appropriately, technology and media can enhance children’s cognitive and social abilities (Kirakorian, Wartella, and Anderson 2008). Even so, additional research is needed to confirm the positive outcome of technology on children’s language and vocabulary, understanding of math concepts, self-regulation, and social-skills development (NAEYC and FRC 2012).

Technology and Interactive Media in the Preschool Environment

Technology has many uses in early childhood settings. On any given day, teachers may use technology to support children’s learning, to record and document children’s development, to expand their own knowledge in different areas, to maintain ongoing communication with families, and to link homes with school. The focus in this chapter is on the use of technology and interactive media in preschool settings for the purpose of supporting and enhancing children’s learning.

A growing number of early childhood educators use technology and interactive media in their programs as tools to sup-
port children's learning and development (Wartella et al. 2010). In a recent survey by the Fred Rogers Center (Wartella et al. 2010) about technology in the lives of teachers and classrooms, nearly 60 percent of early childhood teachers reported having a computer, and 45 percent have computers with Internet access in their classrooms. More than half of the early childhood teachers indicated that children should be introduced to technology in the classroom between ages three and four, and about one-third of the teachers reported using computers with children on a daily basis (Wartella et al. 2010). With the increasing interest and use of technology in preschool settings, early childhood educators need guidance on how to use technology and interactive media wisely and effectively. Several important questions come to mind:

- Which technology and media tools are effective tools for learning?
- In which domains of development can the use of technology be most effective?
- How do early childhood educators appropriately integrate technology and media into preschool settings?
- How can technology be used to support children's learning?

A joint position statement issued in 2012 by the National Association for Education of Young Children (NAEYC) and the Fred Rogers Center (FRC) offers guidance. Based on research, the statement addresses both the opportunities and the challenges related to using technology and interactive media in early childhood programs. The following section presents key messages from the NAEYC/FRC position statement on technology. A set of strategies consistent with the approach articulated in the position statement is provided to guide administrators and teachers in integrating technology and interactive media into preschool programs.

The Benefits and the Challenges of Using Technology and Interactive Media

Technology and interactive media have the potential to make many contributions to early childhood education. Technology can provide children with additional ways to explore, create, communicate, problem-solve, investigate, and learn. Computer technology, for example, offers young children a range of learning opportunities—from solving math problems to listening to interactive stories, taking a photo, recording a story, creating a digital book, making music, and engaging in other age-appropriate learning activities (Blagojevic et al. 2010). Many educational applications for young children are designed to help children develop skills and knowledge in specific domains, particularly in areas such as...
language, literacy, and mathematics (Buckleitner 2011). Such programs can provide individualized learning opportunities for children. In mathematics, computer programs present children with tasks, give feedback, and help young children develop concepts and skills in areas such as counting, number relationships and operations, sorting and patterning, measurement, and geometry (Clements and Sarama 2008; McCarthy, Li, and Tiu 2012). In language and literacy, computer software can enhance vocabulary learning (Segers and Vermeer 2008) and support learning of listening, speaking, writing, and reading skills (Guernsey et al. 2012). Dual language learners can also use computers to enhance their home language and acquire English (Blagojevic et al. 2010; Nemeth 2009).

The use of technology can also enrich the science curriculum. Cameras and recording devices provide valuable educational experiences by allowing children to take photos and videos to document objects and events and track changes in objects and materials. Digital microscopes allow children to save images of objects they explore and to share and discuss such images with their peers. Robotics with manipulative motors and gears engage young children in designing their own robotic creations, providing them with opportunities both to be creative engineers and to explore abstract mathematical and science concepts in concrete ways (Bers 2008).

The use of technology in preschool settings also creates opportunities for equitable access to technology tools and interactive media experiences for children from different economic backgrounds, including children in families with few resources and little or no access to the latest technologies (NAEYC and FRC 2012). Furthermore, technology has many potential benefits in supporting inclusive practices for children with disabilities or other special needs (Mulligan 2003).

A variety of assistive and adaptive technologies (e.g., electronic communication boards, switch-activated toys, recordable devices) enhance children’s participation and learning with peers. For example, a child who enjoys playing with bubbles can operate an electronic bubble-blower for other children to chase (Mistrett 2004). Another child can let a peer know which game she wants to play by indicating it on the electronic tablet that has photos taken by her teacher. By using assistive technology, early childhood educators can help children with disabilities or other special needs become more independent. Children with special needs can use technologies to support their ability to communicate and interact with others, move throughout the environment, manipulate objects, and participate in daily routines and educational activities.

![Figure 1.8: Technology can help children with disabilities participate in the environment and communicate.](image)

Overall, effective uses of technology and interactive media can enhance and augment children’s learning in different domains, extending children’s access to new content. However, technology is effective only when used appropriately. Although the use of technology and interactive media provides programs with opportunities to enhance quality and optimize young children’s development, early childhood educators should understand the limits of technology and be...
aware of the challenges of using technology and interactive media in the preschool environment. As stated in the NAEYC/FRC position statement, “Technology and interactive media are tools that can promote effective learning and development when they are used intentionally by early childhood educators, within the framework of developmentally appropriate practice, to support learning goals established for individual children” (NAEYC and FRC 2012, 5).

Technology and interactive media should only supplement, not replace, existing play-based materials and active play, engagement with other children, and face-to-face interactions with adults. Several professional and public health organizations have raised concerns about whether young children should have access to technology and screen media in early childhood programs (e.g., Campaign for a Commercial-Free Childhood, Alliance for Childhood, and Teachers Resisting Unhealthy Children’s Entertainment 2012). The American Academy of Pediatrics recommends avoiding any media other than video-chatting until 18 months, limiting 2 to 5-year-olds to one hour per day of high quality programming, and for ages 6 and older, placing consistent limits on time and types of media. These recommendations are focused on preventing media use from displacing physical activity, hands on exploration, and face-to-face social interaction in the real world, which are critical to learning.

This chapter follows the recommendations of the NAEYC and the Fred Rogers Center (2012) and is aligned with the public health community in discouraging the use of screen media for children under the age of 24 months in early childhood programs. Such guidance for educators working with infants and toddlers may change in the future as more research on very young children’s active use of interactive media and its effect on children’s learning and development continues to emerge (e.g., Zack et al. 2013).

Monitoring the content of interactive media is as important as setting limits on the time young children spend with technology. Although there are valuable software, websites, and other forms of interactive media for young children, some have limited educational value or may include content that is not safe or appropriate for children. The challenge for early childhood educators is “to make informed choices that maximize learning opportunities for children while managing screen time and mediating the potential for misuse and overuse of screen media” (NAEYC and FRC 2012, 3). Educators should have the knowledge, skills, and experience necessary to select and use technology tools and interactive media that suit the age and developmental level of children and can be integrated effectively in the environment (NAEYC and FRC 2012).

The following guidelines identify key considerations for programs and teachers selecting, evaluating, integrating, and using technology in preschool programs.[5]

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**Selecting Technology and Interactive Media to Enhance Children’s Learning**

The rapid development of technology platforms, including computers, laptops, multitouch tablets, and other handheld devices, and the growing selection of available educational applications, Web sites, and software present educators with many choices for integrating technology into the preschool environment. However, technology and media-based products may vary widely in quality. Intentionality is important. Thoughtful, advance planning is essential for a responsible investment in technology in early childhood settings. Early childhood educators should apply their expertise and knowledge of child development in selecting appropriate technology and media for the classroom in the same way that they select any other instructional materials (NAEYC and FRC 2012). Educators should take the time to evaluate
and select technology, to observe children’s use of the materials, and to make appropriate adoptions based on their observations. The Fred Rogers Center (2012) proposed a framework for quality in digital media (FRC 2012), recommending that educators take into account the child, the content, and the context in the selection of digital media for young children.

- **Consider children’s developmental level, interests, abilities, and cultural and linguistic backgrounds.** Teachers must be intentional in selecting the technology and interactive media they offer children in their classroom. In selecting appropriate technology and interactive media, educators make decisions that are informed by developmentally appropriate teaching practices, which means that early childhood educators consider the age, developmental level, needs, interests, linguistic backgrounds, and abilities of individual children in the group (NAEYC and FRC 2012).

- **Ensure equitable access to technology and interactive media experiences.** In selecting technology and interactive media, educators provide opportunities for all children to participate and have access to these learning tools. Educators should consider the cultural and linguistic backgrounds of the children in their classrooms. Technology resources can provide access to children’s home language and culture, especially when there are no other ways to obtain such information (NAEYC and FRC 2012). For example, children can listen to electronic books in their home language, record songs and stories, and create digital stories in their home language and English (Blagojevic et al. 2010). Educators can collaborate with family members and colleagues who speak children’s home language to gain access to appropriate interactive media in children’s home language.

- **Identify the underlying objectives of the technology.** Most electronic media targeted at preschoolers are intended to entertain rather than to teach. Technology in the preschool environment should be used only for educational activities. In evaluating any software programs, applications, or other forms of interactive media, educators should be able to identify the overall goals or purpose of the product: Is it to educate or to entertain? Is it interactive? Is it to develop particular skills, to introduce children to new information, or maybe a combination of these (FRC 2012; Campaign for Commercial-Free Childhood, Alliance for Childhood, and Teachers Resisting Unhealthy Children’s Entertainment 2012)? Understanding the intent of a digital program and the learning goals for different children in the program should guide educators’ intentional decisions in selecting materials of interactive media (FRC 2012).

- **Evaluate the quality of the content.** First and foremost, educators should evaluate the quality of the content to ensure that the use of such materials would not harm young children’s overall development or well-being in any way (NAEYC and FRC 2012; FRC 2012). Interactive media products can be used as tools to fulfill the needs of individual children and to expand children’s access to new content in areas of interest to them. In the selection process, program administrators and teachers should have information and resources regarding the nature of these tools and the implications for use with children. Program administrators and teachers should also have hands-on opportunities to explore and directly experience the technology that is being considered for use with children. Educators can apply their expertise and knowledge of child development to ensure that digital materials are developmentally and culturally appropriate for the children in the group. They should examine the educational content, format, and features and carefully consider any implicit messages communicated during the use of the software/application. Some undesirable messages (e.g., stereotypes, negative images or actions) may be biased and fail to promote social and emotional understanding in the early years (Tsantis, Bewick, and Thouvenelle 2003).
• **Select technology and interactive media that support children’s creativity, exploration, and problem solving.** In selecting activities with technology and interactive media, early educators should ask themselves: *Does it encourage children to explore, to think, to experiment and predict, to be creative, and to problem solve? Does it offer a range of experiences and a high level of interactivity? Is it open-ended or focused on skills?* Experiences with technology and other media that engage children in redundant practice and rote learning or involve passive use by children are not desirable. Effective technology and media empower children by giving them control, offering challenges through “leveled” experiences, and providing them with feedback and adaptive scaffolds (Clements and Sarama 2008).

• **Use the best available evidence in the selection process.** More research is needed to understand what young children are able to do with different digital devices and to assess the short- and long-term effects of new technologies on children’s learning. Educators are encouraged to make their decisions about the quality of interactive media products based on the best available evidence for any given product (FRC 2012).

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**Integrating and Using Technology in the Preschool Environment**

Once the desired software or appropriate technology devices for the program are selected, educators should apply their expertise and knowledge of child development to make thoughtful decisions on how to introduce and integrate the selected forms of technology into the learning environment. The teacher’s role is critical in ensuring that technology is implemented in ways that serve the teaching goals and support children’s learning appropriately and effectively.

• **Technology and interactive media are used within the framework of developmentally appropriate practice.** Developmentally appropriate practice encourages hands-on exploration; empowers children to reflect, question, and create; and honors the value of relationships between children and the adults in their lives (NAEYC 2009). Professional knowledge of developmentally appropriate practice informs and guides decision making about how to introduce and integrate any form of technology and interactive media into early childhood programs. Technology and media should not replace preschool activities such as real-life exploration, physical activity, social interactions, outdoor and indoor play, and arts. Instead, they should be used as additional tools to encourage children's problem solving, exploration, and creativity. They can also support children’s relationships with both adults and their peers and foster children’s autonomy (NAEYC and FRC 2012; Donohue and Schomburg 2012; Nemeth and Simon 2012), particularly for some children with disabilities (Mistrett 2004).

• **Technology and interactive media are integrated into the environment, curriculum, and daily routines** (NAEYC and FRC 2012). True integration of technology and media into the preschool environment involves the use of different technology resources throughout the classroom. No period is set aside in the daily schedule for “computer time,” when technology and media are used as isolated activities. Technology and interactive media are woven into the fabric of the day and are used as tools for learning, rather than as the focus or the goal of a learning activity. Technology is one of many ways to support curriculum goals and needs, and the program offers a balance of activities to support children’s development in all domains of learning. In using a particular application or software, teachers should consider how it supports objectives for individual children in the group, how it fits into the classroom’s current curriculum project or theme of study, and how it extends other activities in ways not possible otherwise (Nemeth and Simon 2012).

• **Time spent with technology and media is limited.** Setting limits on the time young children spend with technology and interactive media is important. As previously indicated, the public health community discourages the use of passive screen media for children under two years of age and recommends limited screen time daily for children older than two (American Academy of Pediatrics 2011). Some of the public health concern is that the overuse of media takes time away from other activities that involve physical exercise. Sedentary activities are potentially a risk factor for childhood obesity (Wartella and Heintz 2007). The position statement by the NAEYC/FRC points to the following recommendation in the Early Childhood Obesity Prevention Policies: “child care [and preschool] settings limit screen time to fewer than 30 minutes per day for children in half day programs or less than one hour per day for those in full day programs (Birch, Parker, and Burns 2011).” Teachers play a critical role in
establishing clear boundaries on the use of technology and screen time in the preschool setting. They are also encouraged to share information with families on how to promote children’s healthy use of technology at home (Campaign for a Commercial-Free Childhood, Alliance for Childhood, and Teachers Resisting Unhealthy Children’s Entertainment 2012).

- **The use of technology and interactive media facilitates social interactions and relationship building.** Effective use of technology and interactive media in the classroom environment allows joint engagement, specifically viewing and participation by both children and adults and children and their peers (NAEYC and FRC 2012). Studies on the social dimension of preschool children’s computer play found that preschoolers observe each other while playing, comment on others’ actions, share and help with software-related problems, and have conflicts over turn-taking (Heft and Swaminathan 2002). The computer and other digital devices should be located in spaces that allow for joint engagement of a group of children. Some children may select technology such as the computer because it is familiar or even as a way of avoiding interaction. Careful observation is needed to monitor the use of technology and determine individual appropriate use. Effective use of technology and interactive media can promote communication and collaboration among children (Wright 1994). It often provides the context for information sharing, language development, and collaborative decision making (Tsantis, Bewick, and Thouvenelle 2003). Tech-savvy children may also become computer mentors for their peers (Blagojevic et al. 2010).

![Figure 1.9: This teacher is monitoring children using the computer together.](https://socialsci.libretexts.org/Bookshelves/Early_Childhood_Education/Book%3A_Introduction_to_Curriculum_for_Early_Child...)

- **Teachers provide support while children use technology and interactive media.** As with any learning activities, teachers play an important role in facilitating children’s involvement with technology and media. The teachers introduce children to the computer or another device (e.g., digital camera, printer, touch-screen), and explain how it works. They observe what individual children do and learn about children’s ability to use technology. Children vary in the ability to use technology and interactive media. Teachers also give children time to freely explore new technology tools, model appropriate use of technology, and help children become familiar with any new software activity. They establish rules and routines with children to guide appropriate handling and use of computer and other technological devices (Blagojevic et al. 2010; Campaign for a Commercial-Free Childhood, Alliance for Childhood, and Teachers Resisting Unhealthy Children’s Entertainment 2012). During technology-related activities, teachers carefully observe and document what children do and assess children’s learning. Teachers identify problems or opportunities for teachable moments, extending the media experience to other learning opportunities, and facilitating the experience through language-rich interactions. In addition, teachers determine when the child is ready to progress to the next level of knowledge or skill development (FRC 2012). They consider children’s varying abilities to control and operate technology and media and support children’s “technology-handling” skills, as needed. Teachers make appropriate adaptations, based on their observations, to promote positive outcomes for individual children. [8]
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