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The Effects of Technology in Early Childhood

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A Literature Review Presented

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Abstract

This literature review examines the effects of technology in early childhood. This literature review uses scholarly journals and articles to show the advantages and disadvantages of technology in early childhood. The research examines how technology can impact a child's development in the areas of (a) social emotional, (b) physical, (c) cognitive, (d) language, (e) mathematics, and (f) literacy skills. The advantages and disadvantages of technology will be reviewed in each of these early childhood developmental areas. Parents and teachers must be aware of screen time guidelines. Recommendations from the National Association for the Education of Young Children (NAEYC) and the American Academy of Pediatrics are included in this literature review. This literature concludes with early childhood applications on how teachers should plan, select, integrate, and evaluate technology to be developmentally appropriate in the early childhood classroom environment for students. Further research needs to be conducted in the area of early childhood on the effects of technology in regard to student's learning and development.

The Effects of Technology in Early Childhood

Technology has become part of our everyday life. Children's exposure to media, technology, and screen time has increased in the home and school settings. (Sharkins et al., 2016). The number of children interacting with devices has been increasing. Almost 98% of students, under the age of eight, have access to technology (McCarthy et al., 2018). Technology has prepared our children for the 21st century by providing real world experiences within the classroom environment (Bavelier et al., 2010). Technology has affected all areas of development assessed in early childhood classrooms. This literature review will focus on the effects technology has on the development of children in early childhood. Technology could have an impact on a child's development in the areas of (a) social emotional, (b) physical, (c) cognitive, (d) language, (e) mathematics, and (f) literacy skills. The advantages and disadvantages of technology will be reviewed in each of these early childhood developmental areas.

Children have been described as digital natives (Sharkins et al., 2016). Children today have been viewed as a generation of digital technology and the internet (Sharkins et al., 2016). From an early age, children have been given devices. There have been many devices available, such as computers and tablets. Children have explored and discovered new concepts when using technology. (Neumann & Neumann, 2014). Technology has been defined as a tool a student could use to learn and grow (Sharapan, 2012).

The National Association for the Education of Young Children (NAEYC) addressed the developmentally appropriate practices for technology in the early years. Technology has extended learning and met the needs of young children in the home and school setting (Radich, 2012). The purpose of this literature review will be to show the effects of technology, advantages and disadvantages, for children throughout students' learning and development in early

childhood. Technology has affected the way children develop, behave, and learn (Bavelier et al., 2010).

Social Emotional Development and Technology

Quesenberry (2016) defined social emotional learning in an early childhood classroom as demonstrating responsibility for self and others, engaging in cooperative play, sharing materials, and taking turns. Technology has provided new opportunities for social emotional development for how young students have learned, communicated, and interacted with others (Savina et al., 2017). Three recent studies have begun to provide insight into how technology has affected social emotional development in early childhood (Bracken, 2015; Ralph, 2018; Quesenberry, 2016).

Children using shared devices and playing cooperatively in early childhood settings have shown improved social interaction (Quesenberry et al., 2016). Clements and Sarama (2002) stated students spent nine times as much time in conversation with their peers on computers than while doing puzzles. Research has shown computers do not isolate children. Children displayed more interest and positive feelings when they worked together with their friends on computers (Clements and Sarama, 2002). The American Academy of Pediatrics (2016) agreed and recommended children using technology alone should be avoided.

Bracken (2015) found instruction implemented with iPad support resulted in students demonstrating collaboration, inclusion, critical thinking, and problem solving. Bracken also observed increased child-directed learning. The iPad encouraged peer collaboration and increased social interactions among the children. This experience was interactive and enjoyable for the students. In his findings, it was determined technology could be used as a social tool with appropriate integration into an early childhood classroom (Bracken, 2015).

There were concerns technology, specifically entertainment media, caused children to become violent, distracted, and addicted (Bavelier et al., 2010). The National Association for the Education of Young Children (NAEYC) believed when used appropriately, technology and media were effective. The NAEYC also emphasized technology should be educational and developmentally appropriate. Technology should be integrated into classrooms to enhance social interactions (Allvin, 2014).

Ralph (2018) conducted a study on activities with and without the use of an iPad. Three to four-year old students and an early childhood teacher were included in this research. The study focused on social exchanges and social learning theories. The study provided advantages to digital learning within an early childhood classroom. Ralph also looked at the possible negative effects of bullying, anti-social behavior, and overstimulation when using technology. The results did not seem to reveal evidence of these negative effects in her findings. Instead, positive social behavior was observed and documented. The children were engaged and motivated in their learning with each other. This recent study pointed out avoiding social media and technology was becoming just as controversial as using media and technology in an early childhood classroom (Ralph, 2018).

Hands-on experiences and technology must be balanced in the classroom for positive social emotional learning. Teachers can plan and introduce technology used in their classrooms to make sure it was developmentally appropriate for their students' well-being. Selection, integration, and evaluation were very important in making sure technology met the social and emotional needs of children in an early childhood classroom (Quesenberry et al., 2016).

Physical Development and Technology

When using a touchscreen, toddlers demonstrated motor development by: (a) 16% banging of the screen, (b) 71% tapping, (c) 41% dragging, (d) 20% swiping, and (e) 10% pinching (Bedford et al., 2016). Bedford's recent study has begun to provide insight into how technology could have a positive effect on physical development in early childhood. However, recent studies by the American Pediatrics (2016) and Mendoza (2017) suggested possible negative effects on physical development and technology in early childhood.

Bedford (2016) discovered toddlers needed to be actively engaged in play on apps by using their fingers instead of just watching and observing the device. Touchscreens provided a sensory experience for young children by using technology through scrolling. Bedford found an increase in fine motor skills and a fine motor milestone achievement of the pincer grip in his study looking at the physical development in toddlers ranging from 19-36 months of age. Bedford did not find any significant relationship between gross motor development and touch screens. More research needed to be done to determine and support these findings for physical development (Bedford et al., 2016).

There were concerns about technology and the overall health and physical development of young children. An analysis of 1,809 preschool students found screen time has been associated with obesity (Mendoza et al., 2007). It was recommended preschool children should decrease their screen time and increase their physical gross motor activities (Kracht et al., 2020). Teachers and parents should follow screen time recommendations (The American Academy of Pediatrics, 2016). The American Academy of Pediatrics stated:

> Children younger than 2 years need hands-on exploration and social interaction with
> trusted caregivers to develop their cognitive, language, motor, and social-emotional
> skills. For children 2 to 5 years of age, limit screen use to 1 hour per day of high-quality

programming, co-view with your children, help children understand what they are seeing,

and help them apply what they learn to the world around them. (Pg. 1)

Teachers could plan activities using technology in interactive ways to allow to encourage

physical activity within the classroom. The American Academy of Pediatrics (2016) encouraged

teachers to use new technologies in creative ways to promote a healthy learning environment.

Cognitive Development and Technology

Danovitch (2019) believed the exposure of technology could impact the cognitive

development of children in regard to memory, concentration, seeking information, and thinking.

The team's recent research provided insight into how technology could affect cognitive

development in early childhood. From birth to age 8, children's social and cognitive skills have

developed quickly through exploring and learning in their environment. Danovitch stated most of

the concern and information around cognitive development centered around if technology helped

or hindered memory. Although some research findings pointed out technology hindered memory

(because devices could remember everything), other researchers found basic memory functions

built into software allowed children to focus on more complex, critical thinking tasks (Ismali,

2017). Danovitch found seeking information from devices could be positive if students could

quickly and easily find answers to questions; however, it could also be negative if students

searched for answers and couldn't find what they were looking for, the students may become

frustrated or discouraged (Danovitch, 2019).

Ismaili (2017) defined assistive technology as technological devices supporting children

with physical or cognitive impairments to overcome difficulties faced in the home and school

environment. Assistive technology could be used with many different types of disorders and

disabilities (Ismaili, 2017). Attention deficit hyperactivity disorder is defined as a

neurodevelopmental disorder (Powell et al., 2017). For children with attention deficit

hyperactivity disorder (ADHD), technology has been used to strengthen cognitive development.

Computer games have been used to help with behavior and organization along with increasing

mathematical skills and improving reading speed. Powell (2017) looked at 7,545 studies,

including 14 studies specifically looking at the effect of technology on children with attention

deficit hyperactivity disorder (ADHD). Technology has the potential to guide children with

ADHD to self-monitor their impulses and hyperactivity, but more research needed to be done on

this evidence. It was also suggested from this study something other than computer games should

be researched and the technology should always be interactive (Powell et al., 2017).

Language Development and Technology

For children 2 to 3 years of age, vocabulary development was very important, including

expressive and receptive language (Vatalaro et al., 2017). Vatalaro (2017) defined expressive

language as words mentally retrieved and expressed aloud. Receptive language focuses on

understanding words as they are heard or read. Two recent studies have begun to provide insight

into how technology could affect language development in early childhood (Crowe, 2017;

McPacke, 2013).

Technology could be used to communicate in a variety of ways including texts, videos,

pictures, symbols (emojis), and sound. Digital tools allowed children to be creative in their

message of communicating if the children were not able to read and write yet (McPacke et al.,

2013). By using digital tools, teachers could provide all students with a voice to communicate.

Early childhood educators were expected to help preschool students with speech delays

be successful in the classroom setting. Speech Sound Disorders (SSD) has impacted children's

ability to communicate with others in a meaningful way (Crowe et al., 2017). Computers or

tablets could be an effective intervention for students who struggle to communicate. Children understood the purpose of technology even if the children didn't fully know how to use it yet. For example, in play a child might have pretended to talk on the phone or played on an old non-working computer. Children observed technology in their everyday environment being used by adults or older children all the time (McPake et al., 2013).

Children with communication delays often have difficulty interacting and sharing with both peers and adults within the classroom Assistive technology could encourage students with disabilities, such as speech and language disorders, to communicate and interact with their peers (Ismaili, 2017). Children could also be at risk of later developing communication delays related to academic skills, such as reading and writing. Technology could help students express their wants and needs, in addition to, their thoughts and feelings. A digital device has allowed students with speech delays to play cooperatively with their peers. Play and technology has allowed children to become creators, collaborators, and communicators (Fantozzi et al., 2018).

Mathematics Development and Technology

Fokides (2018) found many students have struggled in math and have a negative attitude about learning the basic math facts and drills. Digital math games could be taught by Game Based Learning (GBL) and could eliminate the negative mindset in children about math. (Fokides, 2018). In early childhood classrooms, Lambert's (2014) research showed children were expected to use number concepts and operations, explore and describe spatial relationships and shapes, and compare and contrast and demonstrate knowledge of patterns. Fokides' (2018) and McCarthy's (2018) recent studies have begun to explain the impact on how technology could affect mathematical development in early childhood.

The impact of technology use on mathematical development in early childhood has been well researched. In Fokides' (2018) study, students grasped the math concepts better when taught with digital games than the students taught in conventional ways, and they performed slightly better on assessments. The students also reported they were motivated, and they had fun learning math (Fokides, 2018). A second study by McCarthy (2018) conducted research by using the popular character, Curious George, and digital math games along with hands-on experiences on 3-5-year-old children. An overwhelming 96% (49 children) participated in playing at least 15 out of the 16 Curious George games. The interventions were reported by the teachers as a useful addition to the classroom, highly motivated students to learn, and provided practice for basic mathematics skills for the children (McCarthy et al., 2018). These recent studies have begun to provide insight into how technology use might positively affect mathematical development in early childhood.

In most research studies involving digital games and mathematic development, children practiced math concepts but there were only small achievement gains documented. However, technology could still be integrated into the classroom since it provided enjoyment, increased engagement, and collaboration among children. The digital games should be carefully selected so they were interactive and provided opportunities for students to learn (Miller, 2018).

Teachers could purposefully plan their math lessons using technology to get their students excited and engaged. Game Based Learning (GBL) was a new and innovative way of uisng digital tools and technology for academic instruction (Fokides, 2018). Technology could encourage students to learn the rote mathematics skills needed to be practiced for mastery in a fun way within the classroom environment.

Literacy Development and Technology

Neumann and Neumann (2013) defined emergent literacy skills as letter name and sound knowledge, early writing, print concepts, and phonological awareness. These skills could be precursors for future reading and writing development. Neumann and Neumann's recent study has begun to provide insight into how technology could positively and negatively affect literacy development in early childhood. Touch screen tablets were book-like and, in the form of a writing pad, encouraged early literacy skills. Children interacted with tablets by finger tracking, pointing to words, and page turning. Teachers reported an increase in scores assessing print concepts (Neumann and Neumann, 2013).

Recent research has shown there were only a few applications which promoted emergent literacy skills for children. According to the study conducted by Orrin and Olcese (2011), only 56 out of 315 Apple apps were labeled under the "Education" heading (Neumann and Neumann, 2013). There have been three types of apps identified to help young children: 1. gaming apps, 2. creating apps, and 3. e-book (digital books) apps. Gaming apps usually kept score. Creating apps allowed for creativity. E-books were usually read-aloud stories (Neumann and Neumann, 2013). Some research suggested e-books decreased comprehension and interactions due to the visual and interactive distractions. Sesame Workshop and Public Broadcasting Service (PBS) apps have been shown to be effective in teaching literacy skills to young children (American Academy of Pediatrics, 2016).

Reading and writing were two components crucial for literacy development. By using technology, children were able to discuss and participate in storytelling. Digital storytelling was portable and could be used anywhere. It was an easy way to share a student's work with other students. There were many digital tools students could use including pictures, sound, music, cameras, and scanners to create narratives (O'Bryne et al., 2018). Dunn and Sweeny's (2018)

study showed students were tired and bored with the typical tool, a pencil, when it came to

writing. When the students were allowed to use digital text and tools, they were motivated and

engaged (Dunn and Sweeny, 2018). Another benefit of using technology was with oral

communication skills and the ability to retell a story in sequential order with the use of a device.

Comprehension, for example learning sight words, increased due to videos, animations, and

sounds students saw and heard when using technology (Oakley et al., 2018).

     For literacy development, teachers were still encouraged to use a balanced approach for

reading and writing (Dunn and Sweeny, 2018). Paper, pencils, cameras, pictures, crayons,

markers, and stylus were all tools available for children to use and explore in an early childhood

classroom. The selection of materials, manipulatives, and apps were very important when

planning literacy lessons for young children.

Application

     Technology use needs to be considered in early childhood (Quesenberry et al., 2016).

Research showed the efficacy of a plan to implement technology into an early childhood

classroom. Technology needs to be balanced in early childhood classrooms. Technology alone

cannot meet all of the developmental needs (social emotional, physical, language, cognitive,

literacy, and mathematics) of every student. Technology can be an influential piece of the puzzle

for educators to make the instruction and application of learning complete.

     Technological tools and how each are used needs to be carefully selected by educators in

early childhood classrooms (Quesenberry et al., 2016). Teachers carefully consider technology to

determine if using it is meaningful, engaging, and developmentally appropriate to meet the needs

of each student. Teachers can plan what types of devices and apps work best in their learning

environment. A variety of different tools can be used, such as, computers, tablets, and interactive

whiteboards. There are also many different apps to choose from when teachers are planning their lessons and activities. Technology can encourage the development (social emotional, physical, language, cognitive, literacy, and mathematics) of children and meet the needs of all learners so they can be socially and academically successful in their classroom environment.

How technology will be used needs to be integrated in early childhood classrooms (Quesenberry et al., 2016). Technology can be integrated into the daily classroom schedule in all the different areas (social emotional, physical, language, cognitive, literacy, and mathematics) of early childhood instruction and development. Teachers can monitor the outcomes and provide developmentally appropriate learning opportunities.

Technology needs to be evaluated in early childhood classrooms (Quesenberry et al., 2016). Before and after teachers have used a piece of technology or software with their students, developmental milestones can be monitored to determine the efficacy of the tools. As with all aspects of the curriculum, educators will need to reflect and evaluate this data.

Conclusion

Using technology in the classroom effects the development of students in the areas of (a) social emotional, (b) physical, (c) cognitive, (d) language, (e) mathematics, and (f) literacy skills in early childhood. Researchers explored the advantages and disadvantages of technology. When planned, selected, integrated, and evaluated appropriately, technological tools had positive effects on the learning and development of children (Quesenberry et al., 2016).

Parents and teachers can follow the recommendations from the American Academy of Pediatrics and the National Association for the Education of Young Children (NAEYC) on technology use in early childhood. Technological tool use with young children can be balanced in both the home and school environment (American Academy of Pediatrics, 2016). By using

developmentally appropriate technology, research showed children engaged in social

interactions, improved fine motor skills, increased cognitive memory, built good communication

skills, and engaged in literacy and mathematics instruction and application. Students can use

technology as a tool to learn and grow (Sharapan, 2012), and continue to grow as successful

digital consumers and creators in the 21st century (Sharkins et al., 2016).

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