

Northwestern College, Iowa

NWCommons

Master's Theses & Capstone Projects

Education

Summer 2021

Technology to Increase Peer Interactions in Preschool

Angela McLean

Follow this and additional works at: https://nwcommons.nwciowa.edu/education_masters



Part of the [Early Childhood Education Commons](#), and the [Educational Technology Commons](#)

Technology to Increase Peer Interactions in Preschool

Angie McLean

Northwestern College

A Literature Review Presented
in Partial Fulfillment of the Requirements
For the Degree of Master of Education

Abstract

Adding technology to the preschool classroom without interfering with social interactions is a dilemma for educators. Peer interactions are an important developmental goal in preschool age students. Increased pressure to include technology in education at earlier ages is often viewed as a hindrance to social interactions in play-based curriculum, with many educators feeling unprepared in the methods to incorporate technology. The goal of this literature review is to analyze current research to discover methods that can increase social interactions among peers with the addition of technology tools in the preschool classroom. This review looked at forty-seven studies of social interactions in children and technology uses in classrooms. Examination of this research showed the importance of social interactions, the barriers for adding technology in early childhood classrooms, and techniques in which technology use been used to show social benefits. The research demonstrates that technology has the potential to increase social interactions among preschool peers. Based on these findings, it is recommended that educators receive ongoing professional development in methods of adding technology into the social curriculum. Further research is needed to develop the most effect procedures for educator education.

Keywords: technology, social interactions, preschool, teacher attitude, early childhood

Table of Contents

Abstract	2
Review of the Literature	7
Progression of Technology Use in Education.....	7
Importance of Social Interactions in Young Children	10
Opposition and Obstacles to Technology in Classrooms	12
Computers	15
Tablets	16
Interactive Whiteboards	17
Augmented Reality.....	18
Digital Citizenship in Early Years	19
Technology in the Special Needs Populations.....	19
Technology to Increase Peer Interactions	22
Conclusion	27
References.....	29

Technology to Increase Peer Interactions in Preschool

The purpose of this literature review is to determine the most effective ways to assimilate technology into the preschool curriculum while increasing social interaction. Technology has become a major factor in society and continues to grow and expand in the educational system. Over the past decade, technology has increased as a component of curriculum within classrooms across the world (Barr, 2019). There has been much debate as to whether or not technology is beneficial as an addition to curriculum for children in early childhood (Bird & Edwards, 2015). Those opposed to the addition of technology use with young children argue that technology can hinder a child's ability to interact with the world around them as it has the potential to replace social interactions (Barr, 2019; A. Sundqvist et al., 2021). Others believe that technology is disruptive to the learning environment by causing unnecessary distractions from the learning environment (Fox-Turnbull, 2019; Kay et al., 2017). As technology continues to become increasing abundant throughout the world, those who advocate for its use in education contend that children need to be introduced to the various aspects of technology at a young age in order to prepare them for digital competency for the future (Mantilla & Edwards, 2019; Zack & Barr, 2016). With the emersion of technology continuing in education, the question is no longer whether or not technology should be used in the classroom, but rather how to integrate technology in early childhood education in ways that are most beneficial to the development of young children while continuing to encourage social interactions.

The development of social skills during peer play is an important aspect in the 3-5-year age group as children must interact with their environment and others in order to learn (Bodrova & Leong, 1998; Dennis, 1970). With the suggestion that technology will impede social interaction, the question is how to best use technology in ways that encourage and enhance interactions with peers. Technology has been used for decades to enhance communication for children in special education (Oh-Young et al., 2018; Syrjämäki et al., 2019). This thought process could be beneficial when creating technology goals for all children to implement within the classroom.

As technology use increases, so does the amount of research on the topic of the effects of technology in the lives of students. This research includes effects of screen time on sleep (Chang et al., 2018), physical fitness (Carson et al., 2019), self-esteem (Hatzigianni et al., 2016), education (Sarker et al., 2019), and the behavior of children (Operto et al., 2020). With the recent COVID-19 pandemic requiring a shift to virtual learning, there has been additional research to examine how this use of technology has affected learning and social outcomes for students (Pokhrel & Chhetri, 2021). Since the introduction of smart phones and interactive tablets, research has shown that children are introduced to technology in the home environment at a very young age and begin to use them in their daily lives (Paciga & Donohue, 2017).

This literature review will examine the research that is currently available discussing the importance of social interactions in preschool and the types of technology available for many early childhood educational settings that have the potential to be used in the classroom to promote peer interactions. This review will synthesize the research to provide a timeline of the

progression of technology in education and the most age-appropriate ways to use this technology in the classroom to benefit social interaction among peers in 3-5-year-old classrooms.

Review of the Literature

Progression of Technology Use in Education

Technology as a part of education is not a new phenomenon, but an ever changing and developing addition. The reported use of the internet among adults in the U.S. has increased steadily over the past two decades with research showing the vast majority of adults are now active users (Pew Research Center, 2021). The use of technology in the classroom has also steadily increased over the past decade as governments are now mandating additional technology tools as a part instruction (Otterborn et al., 2019; Paciga & Donohue, 2017; The National Agency for Education, 2018). An integral part of the Every Child Succeeds Act (ESSA) of 2015 was the integration and effective use of technology in the classrooms to include personalization of learning, informing instruction, and the improvement of digital literacy among students (Every Student Succeeds Act, 2015). Some governments making recommendations for education in the preschool years, state that schools should provide children with the opportunity to develop and practice basic skills needed for the use of digital technology, therefore allowing young children to the initial understanding of ways to use technology responsibly (Paciga & Donohue, 2017; The National Agency for Education, 2018).

With the increase in adult technology use within homes, children are introduced to technology and have access to mobile devices at an increasingly young age (Chang et al., 2018; T. Miller, 2018). These devices, including tablets, laptops, and smartphones, are new forms for communication between school and home, as well as options for students to share or view literacy for digitized writing and reading (Kirova & Jamison, 2018; Maureen et al., 2020).

Home use of technology takes a different role than use in the classroom setting where the goal is learning.

Assessment of preschool skills when students are engaging with technology is a new challenge. Research has long shown that children learn through play and the assessment of learning in early childhood education often occurs through observations taken during these play situations (Bodrova & Leong, 1998; Edwards & Bird, 2017a; Slot et al., 2017). As technology has entered the educational system, there has been a challenge in understanding how the interaction with these new technology tools can be assessed as a form of play (Edwards & Bird, 2017a) . Through a research study, Edwards and Bird (2017) created a Digital Play Framework as assessment tool that has given educators at tool to better understand the learning that is taking place as children use technology in play situations. As assessment through play interactions often examines both imaginative play and learning through exploration (Edwards & Bird, 2017a; Leung et al., 2020), the Digital Play Framework takes both into consideration.

Although the presence of technology is increasing in classrooms, technology use in the classroom is not evenly distributed for state to state or classroom to classroom, prompting the ESSA requirements for schools to provide access for all students (Every Student Succeeds Act, 2015). As the pressure to use technology in the classroom builds, teachers are in need of additional training on the use of technology in order to use these tools comfortably and effectively. Research has found a correlation between the amount of technology instruction provided to students in classrooms and a teacher's own confidence skills with technology (Fox-Turnbull, 2019; Johnston et al., 2018; P. Sundqvist & Nilsson, 2018). Classrooms technology

equipment is being added to classrooms as the ESSA has provided funds with its goal to increase the availability to all students (Every Student Succeeds Act, 2015).

A notable change in the in technology trends is the presence and increased use of technology with children at an increasingly early age (Otterborn et al., 2019). Studies have found that most children begin the use of smart devices when they are between 12-24 months (Chang et al., 2018; Operto et al., 2020). As many children enter school with the awareness of technology, the classroom teacher require the professional development to then continue the education for those with previous knowledge or start at the beginning for those students lacking the exposure (Kewalramani & Havu-Nuutinen, 2019; T. Miller, 2018; Otterborn et al., 2019).

The technology tools available in the education setting are rapidly changing as outdated equipment is replaced with new innovations causing school districts examine budgets to invest in these additional items as cost and availability are two main reasons for lack of use (Kormos & Wisdom, 2021). Software within interactive white boards, iPads, and computers require updates or replacement frequently which is not always feasible with budget restrictions (Kormos & Wisdom, 2021). The recent addition of Augmented/Virtual Reality technology into the education system has added a new dimension to learning as the devices have become more readily available and affordable, therefore including professional learning in this area is necessary for educators (Bower et al., 2020).

The many technology skills that required for digital competence and future use are taken into consideration as the education system and federal government plan for the futures of children. The funding to increase technology as part of the STEM based on a national goal to

have our students prepared for competitive job markets within the United States and globally (NSTC, 2018) . The National Science and Technology Council (2018) noted that other countries have shown to have advanced curriculum in science, technology, engineering and mathematics; the national goal is the increase knowledge and preparedness in these educational areas for the United States in order to meet the growing needs of the job market. Technology, especially for the youngest students, is just beginning to emerge in the curriculum planning (Lee, 2016). In the preschool age group of 3-5 year olds, Lee (2016) lists the Office of Educational Technology's recommendations of basic technology as a tool for learning that is more effective when used to interact with others, therefore in routine classroom experiences that involve active versus passive experiences.

Importance of Social Interactions in Young Children

The early years, including preschool years are a crucial development period on the brain that impacts emotional, intellectual, and social skills (Allen & Kelly, 2015). The experiences that children have during this period affects brain development and future behavior and learning (Ferreira et al., 2021). The interactions that children have with both peers and adults forms these social and communication skills, therefore the preschool years are an important time to develop the and enhance social emotional (Ferreira et al., 2021).

Social Emotional Learning (SEL) as an educational concept has become a growing area of focus for curriculum as research has shown the benefit social and emotional skills to not only increase academic skills, later life success (Denham et al., 2017; Greenberg et al., 2017). Social interactions are a component of the Social Emotional Learning goals. For the 3-5 age group,

preschool is often the initial formal education experience. An important aspect of development at this age is peer play and interactions as they acquire social skills (Ljubetic & Maglica, 2020; Parten, 1932). Research demonstrates that positive interactions among peers is related the acceptance rates from classroom peers (Gottman et al., 1975; Ljubetic & Maglica, 2020; Uyanik Balat et al., 2019). Long term studies have shown that the development of positive social skills in early childhood correlates with positive adult outcomes to include attending college, full-time employment at 25, lower crime rate and decrease in substance abuse (Jones et al., 2015; Schonert-Reichl, 2017). The benefit of positive peer interactions in early childhood is noted as Sakyi et al. (2015) found that having a single childhood friendship reduces the chance of psychological disorders in adulthood.

Research shows there is a correlation between peer play interactions and the competency for preschool children's social skills, meaning as these social competences increase, their skills in play increase, while a decrease is seen in aggression and social withdrawal (Uyanik Balat et al., 2019; Veiga et al., 2017). This emphasizes the thought that relationships and peer interactions are a foundational skill for young children that needs the necessary development to ensure the building of other skills including academic learning (Bodrova & Leong, 1998; NAEYC and Fred Rogers Center, 2012).

As students begin to use these social interactions as part of their learning environment, skills overlap and benefit learning. Researchers agree that student collaboration increases problem-solving skills, self-regulation, and other executive functioning skills (Bodrova & Leong,

1998; Slot et al., 2017). Research by Ghavifekr (2020), found the relationship between skills in social interactions and collaborative learning to be substantial. Working with others, as opposed of individual learning, was found to not only impact the learning process positively, but the skills needed for maintaining social interactions as well (Ghavifekr, 2020; Slot et al., 2017; Yliverronen et al., 2018).

Opposition and Obstacles to Technology in Classrooms

As technology continues to become available and embedded within the educational design, there are still those who oppose the use of technology for students in early childhood, citing a variety of reasons that it is not in the best interest of the child. The arguments made by educators include their own lack of preparation (Haslip & Gullo, 2018; Kearney et al., 2018), technology becoming a distraction that will interfere with learning (Bower et al., 2020), and concerns over technology interfering with social interactions (Neiterman & Zaza, 2019).

Opposition within school settings often stems from the lack of teacher technology training which results in the lack of educator confidence (Kearney et al., 2018), lack of use within curriculum, or poor implementation (Haslip & Gullo, 2018). Technology with the use of a comprehensive plan to embed these skills for scaffolding as children progress in school, prepares children for the next level of technology to move forward (Sundqvist & Nilsson, 2018). Teacher preparation courses and ongoing professional development is needed to ensure educators proper understanding of the most appropriate application of technology skills for students (Haslip & Gullo, 2018; Rönkkö et al., 2021), as the apprehension of teachers to engage

students in technology can stem from personal beliefs and anxieties related to technology use (Mertala, 2019). Research shows that teacher apprehension of technology stems from the questions of what technology they should be introducing in the classroom as well as how this lessons should be taught in the preschool setting; results show educators in play-based classrooms wonder how this will be imbedded (P. Sundqvist & Nilsson, 2018).

The argument surrounding the concern of technology being a distraction in the classroom is found to be a common criticism among educators (Bower et al., 2020; Neiterman & Zaza, 2019). Researchers noted educators are most often concerned with the increased use of cell phones within the classrooms (Lai & Bower, 2019). Although preschool age children do not typically have access to a cell phone in the classroom, with most parents regularly using these devices, it is reported by parents that children as young as two years old are using smartphones on a daily basis (Chang et al., 2018), this number would arguably increase as smartphones are becoming more readily available throughout the world.

The aspect of technology interfering with or replacing social interactions among children has been the center of several studies. Researchers found a correlation between a discrepancy in social skills and screen time for preschool children (Carson et al., 2019) with a decrease in outdoor peer play as a factor (Hinkley et al., 2018). Other researchers disagree with finding that technology is a detriment to social interactions as they have found technology to be a tool to promote peer interactions in early childhood settings (Danby et al., 2018a; Kewalramani & Havu-Nuutinen, 2019; Tarr et al., 2018; Walker & Venker Weidenbenner, 2019).

Studies have shown that many educators support the idea of incorporating technology in the early childhood classroom, but are facing obstacles that prevent this integration (Otterborn et al., 2019; Sarker et al., 2019). Researcher have found teachers lacking confidence in their own abilities to incorporate technology into the classroom instruction even when familiar with technology for personal use (Alenezi, 2017; Otterborn et al., 2019). Early childhood educators are unsure as to what should be included in the instruction and how to teach these concepts (Sundqvist & Nilsson, 2018). With studies showing that the integration of technology benefits with scaffolding and vigilant pedagogical planning (Rönkkö et al., 2021), teachers are wanting guidance in the form of professional development (Alenezi, 2017). Providing this training is a met with problems in finding the adequate time and resources, with financial burdens being particularly present in rural schools (Kormos & Wisdom, 2021).

Technology Options for Early Childhood Classrooms

Digital technology has been slow to integrate into the early childhood curriculum as there has been confusion and concern over how to include technology in a play-based program. Although these concerns remain over ways to use technology for learning as opposed to its use for playing games, one must remember that young children learn through play (Bodrova & Leong, 1998; Edwards & Bird, 2017a). The need is then to find the best versions of play that can incorporate technology. While some have shown concern over the appropriateness of technology in early childhood, the National Association for the Education of Young Children (NAEYC) in a joint position statement with the Fred Rodgers Institute discusses technology as a valuable tool in early childhood when used intentionally with the inclusion of interactive

engagement (NAEYC and Fred Rogers Center, 2012). The United States Department of Education also lists principles to guide early childhood educators recommending technology use in order to strengthen relationships, to increasing learning access, and as a tool to interact with others (Department of Education, 2015; NSTC, 2018).

Although a wide range of apps that have been created for the use of preschool age children, there remains a concern as to the appropriateness of many apps with regard to educational and developmental benefits (Callaghan & Reich, 2018; Papadakis et al., 2017). The types of technology currently being integrated in the preschool setting include computers, tablets, and interactive whiteboards, with a variety of assistive technology is available based on student needs (Davidovitch & Yavich, 2017; Nepo, 2017). The addition of options such as augmented reality tools are increasing as more affordable options are becoming available (Gecu-Parmaksiz & Delialioğlu, 2020).

Computers

Computers have been available to classrooms in the form of desktop design and more recently lap tops. Although the perception has been that computers promote solitary play or interaction, studies have shown that while in the computer area, children were engaging in collaborative learning the majority of the time; this was more than any other area within the classroom (Lim, 2012). Many simple games and interactive apps can be beneficial to education with teaching basic mouse skills and technology vocabulary.

The addition of computers in the early childhood classroom provide the opportunities for students to explore the internet, making observations that would not be available without

technology, including virtual field trips, visuals for learning, and online instructions (Cerrone et al., 2019; Crompton & Burke, 2020). Having computers available for young children to explore gives them the practice with components and tools associated with its use and provides the exposure to some of its many uses (Cerrone et al., 2019).

Tablets

Tablets, including the iPad have become readily available in classrooms over the last decade with the addition of Wi-Fi and its versatility, noted as a desirable quality by teacher when considering technology tools (Fantozzi, 2021). Tablets, having the interactive capabilities, can be beneficial in teaching both social and academic skills with a high degree of engagement to include problem-solving and creative play opportunities (Otterborn et al., 2019). The substantial number on available apps have a wide range of quality and effectiveness for educational benefits with thousands add each year (Dorouka et al., 2020; Papadakis et al., 2017). These apps allow children to independently control the activities within the apps with simple touch screen controls making the interactions easier to manipulate than the use on a mouse for small hands with developing fine motor skills.

Tables can be used as interactive learning tools for literacy and fine motor skills in early childhood (Sundqvist et al., 2021). The interactive aspect allows the students to control virtual books with the ability to choose and listen to an expanding virtual library available to educational institutions. In addition to independent use of the tablets, researchers have observed the use of tablets during free play as a tool that not only encourages social interaction and

transformations as play including the technology, but is also scaffolding these skills increase play with peers (Edwards & Bird, 2017b; Hatzigianni et al., 2018).

Interactive Whiteboards

Interactive whiteboards have been available for 2 decades, with studies having shown that the use on Smartboards within the classroom for educational purposes increases the effectiveness of instruction as it increases overall teacher satisfaction (Davidovitch & Yavich, 2017), as well as fosters learning (Mun et al., 2019). The addition of interactive whiteboards or smartboards to classrooms has made technology more present in the school settings as these large boards connect to the classroom computers to allow visibility of the computer screen to the entire class, which is often used for presentation rather than its interactive capabilities (Kearney et al., 2018). The interactive feature of the boards transforms the traditional whiteboard into a large scale touchscreen for use by both teacher and student to increase both hands-on interactions and engagement when teacher scaffolding is implemented with instruction (Bourbour et al., 2020).

Many teachers report lack of training on how to use the full potential that many interactive white boards offer, requiring them to research capabilities on their own time in order to understand the functionality (Fox-Turnbull, 2019; Jack & Higgins, 2019; Kearney et al., 2018). This often results in classrooms missing many of the interactive quality learning activities available. Mertala (2017) suggests although many teachers are lacking in training and experience, they are in favor of the use and addition of technology within the early childhood classroom.

Augmented Reality

Augmented reality (AR) is the use of technology to enhance the real world and often a digital visual overlay onto the classroom environment. AR is a is new to many classrooms, especially in early childhood programs. This allows experiences such as digital storybook characters or alphabet letters to appear to be moving through the classroom. The addition of augmented reality (AR) in education allows for the students to engage with technology in a way that permits the inclusion of movements and less sedentary interactions (Madanipour & Cohrssen, 2020; Oranç & Küntay, 2019; Tarr et al., 2018). The many uses of AR in the classroom are increasing with new software that makes these tool assessable and interactive for everyday learning tasks and the implementation of specially designed instruction for children with social skills deficits (Madanipour & Cohrssen, 2020; Tarr et al., 2018).

Research has shown AR to be a beneficial tool to increases learning in early childhood classrooms including counting (Stotz, 2018), spatial relationships (Gecu-Parmaksiz & Delialioğlu, 2020), and collaboration . One study incorporated picture books with augmented reality and found results of better listening skills and cognition of stories (Yilmaz et al., 2017). The use of augmented reality in kindergarten classrooms for letter recognition resulted in students having higher retention of knowledge from the lesson and increased interaction (Safar et al., 2017). As with other forms of technology, researchers noted varied obstacles including the reliance on personal computers, technical problems, and lack of trained personnel as potential hindrances to its use in the classroom (Safar et al., 2017).

Digital Citizenship in Early Years

One of the twenty-first century notions for developing digitally literate students is the concept of digital citizenship (Johnston et al., 2018). The concept of Digital Citizenship covers many areas that can be incorporated into technology skills from an early age (Furman, 2017), to include the teaching children to use technology in way that are responsible, respectful and ethical (NAEYC and Fred Rogers Center, 2012). In many preschool classrooms, a large portion of the curriculum incorporates Social Emotional Learning (Jones et al., 2015; Ljubetic & Maglica, 2020); with several of the digital citizenship ideas involving SEL concepts (Furman, 2017), preschool is a natural starting age for these skills. (Johnston et al., 2018; Zabatiero et al., 2018). Although parents and educators agree with the importance of teaching the ideals of digital citizenship, including cyber-safety, within the early childhood classroom, studies show that there is a lack of knowledge as to how this should be taught in the preschool setting (Edwards et al., 2018; Zabatiero et al., 2018).

Technology in the Special Needs Populations

Children with disabilities have shown to struggle with social interactions beginning in early childhood and can continue this pattern without intervention (Deluzio & Girolametto, 2011; Kossyvaki & Curran, 2020). In children with Autism Spectrum Disorder, this can result from a lack of adaptive behavior skills affecting social skills and from communication deficits (Del Barrio, 2016). The result can be negative interactions with peers (Chen et al., 2020) or limited interactions (Deluzio & Girolametto, 2011). The importance of communication to support peer interaction was suggested by findings that preschool interactions continued when a

student received a verbal response from a peer during play situations as opposed to a nonverbal interaction (Syrjämäki et al., 2019).

Individuals with Disabilities Education Act (IDEA) and the Assistive Technology Act of 1988 ensure that students have access to any items that allow them the needed access to education which has included technology such as computers software, screen readers, switches, and augmentative and alternative communication devices (AAC) along with numerous other tools. Similar to technology throughout education, these devices have changed and evolved. This assistive technology is unique to each students Individual Education Program (IEP) on an as needed basis. Although a student with a disability may not have technology as an IEP requirement, they can still benefit from technology used in unique ways throughout the curriculum, such as music incorporated through technology (Kossyvaki & Curran, 2020; Tunçgenç & Cohen, 2018) and augmented reality tools (Oh-Young et al., 2018; Yuan & Ip, 2018).

Students with Autism Spectrum Disorder (ASD) have been shown to benefit more from Social Emotional Learning instruction that incorporates technology (Tarr et al., 2018; Walker & Venker Weidenbenner, 2019; Yuan & Ip, 2018). Research shows the use of augmented reality (AR) for the teaching and practice of modeled social skills has been effective for students with ASD (Kossyvaki & Curran, 2020; Wang et al., 2016; Yuan & Ip, 2018). With the benefits of visualization for better understanding of concepts in early child, especially for many students with ASD, several components of technology would be beneficial for learning social skills

including AR, virtual reality (VR), video modeling with the use of peers (Walker & Venker Weidenbenner, 2019).

For peers to build relationship groups in inclusive preschool classrooms, the quality of the interactions among peers is a predictor (Pinto et al., 2019). These quality interactions initially need the support of educators to increase engagement and independent social interactions between children that have deficient in social skills (Pinto et al., 2019; Sjöman et al., 2021). Researchers observed an increase in social communication and turn taking with the additional on a switch device to a music making activity in children with ASD (Kossyvakaki & Curran, 2020).

Preschoolers with severe hear loss (SHL) are also at risk for not engaging in social interactions as studies show that they are excluded in play interactions with peers if without adult interventions for social skills (Deluzio & Girolametto, 2011). As deficits in social development is common in children with differing degrees of hearing loss, it is recommended that these children are monitored for early intervention eligibility to build social skills (Laugen et al., 2017). To build these interactions between children with SHL and their peers, it is beneficial for social and communicative development when educators encourage interactions between all students (Deluzio & Girolametto, 2011).

Studies have analyzed the relationship between peer interaction and student participation within integrated classrooms , finding there to be a direct correlation; in order for preschool students to participate, they need to engage in peer interactions (Chen et al., 2020; Pinto et al.,

2019). For those students lacking the adaptive behavior skills to initiate interactions with peers, adult intervention is needed to facilitate (Pinto et al., 2019; Sjöman et al., 2021), which could include technology based interactive activities (Falloon & Khoo, 2014) .

Technology to Increase Peer Interactions

The use of technology has the potential to be beneficial to all students in the early childhood classroom to promote and increase peer interactions as research has shown that can (Danby et al., 2018b; Walker & Venker Weidenbenner, 2019). The right tools in the classroom and the use of quality instruction for the use of these, will help the increase the needed social skills among all students (Kirova & Jamison, 2018; Verenikina et al., 2016). As teachers implement Social Emotional Learning curriculum as routine parts of the school day, technology is being added to this curriculum on a regular basis (Schonert-Reichl, 2017; Walker & Venker Weidenbenner, 2019). This not only meets the goal for increasing technology skills and social skills, but also creates the possibility for unique and engaging activities to build upon learning goals. Learning to cooperate and collaborate with others are skills that are needed throughout life and along with technology are 21st Century skill goals for the nations education system (Department of Education, 2015).

As preschooler's developmental skills continue to grow with hands-on learning through play (Bird & Edwards, 2015; Ljubetic & Maglica, 2020), research has found that the addition of diverse technology can facilitate in the learning of new skills (Rönkkö et al., 2021). The addition of technology into play-based learning environments can enable social interactions between peers with apps requiring teamwork (Papadakis et al., 2017), technology based

synchronous movement activities (Tarr et al., 2018), and music curriculum (Kossyvaki & Curran, 2020; Tunçgenç & Cohen, 2018). Play-based classrooms adding digital story telling techniques can intertwine technology with literacy and social-emotional skills showing a significant enhancement of these skills (Maureen et al., 2020), as digital story telling can involve audio, visuals, and other digital tools for interaction (Barber, 2016). These examples show that technology does not have to be used at a specific time or for any one area of the curriculum, but can be woven throughout a preschool day.

The integration of technology in the classroom can be an efficient way to promote positive outcomes in learning and education and can assist in increased student learning (Sarker et al., 2019). In many studies examining the use of technology in the early learning environments, the technology use was shown to be supportive in both learning readiness and the social emotional development of children (Davidovitch & Yavich, 2017; Fox-Turnbull, 2019; Paciga & Donohue, 2017). The key to the integrating technology within the classroom for increasing peer interaction requires planning and the teacher having a positive attitude towards the use of technology in the classroom and well as knowledge of the tools (Kewalramani & Havu-Nuutinen, 2019; Schonert-Reichl, 2017; Syrjämäki et al., 2019). As the technology literacy of staff member is often a major factor in technology integration in classrooms (Lee, 2016), a crucial factor to the successful addition and use of technology in the play-based classroom is ongoing professional development of staff members.

The use of interactive whiteboards allows children to interact not only with the technology but with peers as the device is set up to allow multiple students to view the activity

and to take part in a lesson (Bourbour et al., 2020; Kearney et al., 2018). Devices that allow for the downloading of apps, such as the interactive whiteboards, tablets, and computers increase the choices for activities that make peer interaction possible (Falloon & Khoo, 2014; Lawrence, 2018). One type of technology embedded activity found to be advantageous in increasing positive interactions involves the planned mimicking of peer's movement (Rabinowitch & Knafo-Noam, 2015; Tarr et al., 2018). Studies have shown the positive effects of peer cooperation and interactions when students are engaged in technology based movement that require synchronous efforts (Rabinowitch & Knafo-Noam, 2015; Tarr et al., 2018). Results show an increase in positive interactions and attitudes following this synchronism with peers. The reasons for these positive social results stemmed from peers feeling similar bond to their teammate in traits, such as in appearance or their artistic choices (Rabinowitch & Knafo-Noam, 2015; Tunçgenç & Cohen, 2018). As this type of activity requires active participation with body movement, it is fulling engaging to children (Miller et al., 2017). These types of synchronous movement activities could be accessible to student pairs with the use of augmented reality software for projection on the interactive whiteboard, allowing for peer collaboration.

Digital cameras for exploration in early childhood settings have a multitude of options to engage peers in social interactions. The use as a form of social art can be seen as students collaborate to explore the camera through play as the create (Leung et al., 2020). With support from adults, this play can evolve in to imaginative interactions and they use cameras to collaborate for a variety of photo and video creations such as dramatic play inventions or digital book. Researchers suggest the use a technology such as digital camera would allow for

scaffolding technology knowledge by using cameras as an introduction tool (Yip & Hiniker, 2019). These researchers observed non-functional cameras were used as a tool within dramatic play areas for exploration and vocabulary, operational cameras were used as peers documented play, and discarded cameras were taken apart by groups of children for additional vocabulary and technology understanding. Social interactions were observed throughout the digital cameras scaffolding of exploration activities.

Research has found that while the use of interactive technology increased the engagement and collaboration among students in the learning environment (Blitz-Raith & Liu, 2017; Miller, 2018) and increased peer problem solving strategies among preschool students, they require educators to provide direct instruction for use with peers and the use of tablets in small groups of children as opposed to independent use (Falloon & Khoo, 2014). An educator manipulating the environment by requiring more than one student to complete a task using a tablet will encourage interaction and collaboration in peers. The role of adults in the integration of technology is not only to supply materials but also a guide to encourage learning and interaction as children construct and problem solve (Sundqvist & Nilsson, 2018). This requires advanced planning for the early childhood classroom to continue to incorporate a child-centered curriculum.

Activities for young children, including technology options, must to be both engaging and motivating to encourage students to be willingly chose the options and to stay engaged with peers while using the materials (Barber, 2016). Research demonstrates that the use of problem solving games apps to pair peers for a joint activity results in problem-solving and collaboration (Danby et al., 2018b). Developing the skills required for social interactions are enhanced

through collaborative learning which, according to Amory & Amory (2013), fosters skills for effective communication between students. Limiting materials will encourage turn taking and cooperation, but adding challenges for the groups will also create the need for collaborative problem solving.

In order for children to be prepared for the twenty-first century skills, educators must consciously plan the intentional teaching to develop skills of communication and social interactions using collaborative learning as it leads the development of important social skills (Ghavifekr, 2020). When students work together in problem solving task, researcher found students to increased involvement and communication skills (Bellack, 1997) as well as to be more likely to share ideas, have more understand and patients with peers (Ghavifekr, 2020). Studies show that the digital games required students to collaborate for problem-solving approaches to include the sharing of knowledge, creativity, and increased communication (Danby et al., 2018b). As gameplay becomes available in the preschool years and increases throughout elementary school, the games requiring multiple players will increase the social interactions among peers as it involves several social and communicative skills as the peers share multiple strategies to reach goals making the games attractive for participation (Danby et al., 2018b; Paciga & Donohue, 2017). Having games and apps for use within the classroom that require collaboration will allow students to build these many skills that will benefit the students not only in the classroom, but in everyday life.

Conclusion

The goal of this literature review was to identify strategies for using technology for the benefit of increasing social interactions among preschool students. Based on the analysis of research, studies show that technology in the preschool classroom has the potential for increasing the interactions between peers. Throughout this review of literature, there have been results showing the expected conformation of the importance on social interactions during the preschool developmental years. Research has also confirmed the apprehension of educators to add technology into the classroom as there is concern as to whether or not social interactions will decrease as technology is embedded into the curriculum in early childhood settings. An expected finding was the extent to which teacher self-reported lack of confidence and skills in technology use effects the use of technology within the classroom.

Increased recommendations for technology use in early childhood has prompted educators to add technology without feeling prepared for the most effective way to introduce the tools to young students. The results have left teachers questioning the true benefits of this addition and worry that the children will not be prepared for the desired digital literacy. Teacher report the need for additional trainings that are not occurring within in many school systems due to lack of time, resources, and planning.

Despite educator concerns, research has shown positive social impact in classrooms that have successfully integrated technology based activities into curriculums. This has been observed in classrooms that have intentionally plan interactions between students to include problem solving apps and collaborative games. Children with special needs, including autism and communication deficits have shown social skills benefits with technology tools in the

classroom. Computer areas in classrooms have been shown to include many peer interactions and to build turn taking skills.

This research gives educators the assurance of the possibility of technology inclusion in early childhood to benefit the social skills of students. The key to these successes are in the intentional planning on the part of the classroom instructors. Additional research is needed in areas to improve teacher preparation for technology planning to increase confidence and skills. Future research could also assess options for an early childhood technology curriculum based on social skills.

References

- Alenezi, A. (2017). Obstacles for teachers to integrate technology with instruction. *Education and Information Technologies*, 22(4), 1797–1816. <https://doi.org/10.1007/s10639-016-9518-5>
- Amory, A., & Amory, A. (2013). The Collaboration-Authentic Learning-Tool Mediation (CAT) Framework: Shifting... *EdMedia + Innovate Learning*, 2013(1), 1490–1499.
- Amos Ochayi Onojah, & Adenike Aderogba Onojah. (2020). Inspiration of Technology ; Effect of COVID-19 Pandemic on Education. *AIJR Preprints*, 120, 1–10.
- Barber, J. F. (2016). Digital storytelling: New opportunities for humanities scholarship and pedagogy. *Cogent Arts and Humanities*, 3(1), 1–14.
<https://doi.org/10.1080/23311983.2016.1181037>
- Barr, R. (2019). Growing Up in the Digital Age: Early Learning and Family Media Ecology. *Current Directions in Psychological Science*, 28(4), 341–346.
<https://doi.org/10.1177/0963721419838245>
- Bellack, A. S. (1997). Social skills deficits and social skills training: New developments and trends. In *Towards a comprehensive therapy for schizophrenia*. (pp. 137–146).
<https://psycnet.apa.org/record/1997-97346-010>
- Bird, J., & Edwards, S. (2015). Children learning to use technologies through play: A Digital Play Framework. *British Journal of Educational Technology*, 46(6), 1149–1160.
<https://doi.org/10.1111/bjet.12191>
- Blitz-Raith, A. H., & Liu, J. (2017). Interactivity in Educational Apps for Young children: A

Multimodal Analysis. *International Journal of Instruction*, 10(4), 237–254.

<https://doi.org/10.12973/iji.2017.10414a>

Bodrova, E., & Leong, D. J. (1998). Development of dramatic play in young children and its effects on self-regulation: The vygotskian approach). *Journal of Early Childhood Teacher Education*, 19(2), 115–124. <https://doi.org/10.1080/0163638980190204>

Bourbour, M., Högberg, S., & Lindqvist, G. (2020). Putting Scaffolding Into Action: Preschool Teachers' Actions Using Interactive Whiteboard. *Early Childhood Education Journal*, 48(1), 79–92. <https://doi.org/10.1007/s10643-019-00971-3>

Bower, M., DeWitt, D., & Lai, J. W. M. (2020). Reasons associated with preservice teachers' intention to use immersive virtual reality in education. *British Journal of Educational Technology*, 51(6), 2214–2232. <https://doi.org/10.1111/bjet.13009>

Callaghan, M. N., & Reich, S. M. (2018). Are educational preschool apps designed to teach? An analysis of the app market. *Learning, Media and Technology*, 43(3), 280–293. <https://doi.org/10.1080/17439884.2018.1498355>

Carson, V., Lee, E. Y., Hesketh, K. D., Hunter, S., Kuzik, N., Predy, M., Rhodes, R. E., Rinaldi, C. M., Spence, J. C., & Hinkley, T. (2019). Physical activity and sedentary behavior across three time-points and associations with social skills in early childhood 11 Medical and Health Sciences 1117 Public Health and Health Services. *BMC Public Health*, 19(1), 1–8. <https://doi.org/10.1186/s12889-018-6381-x>

Cerrone, M., Lees, K., & Pasnik, S. (2019). Integrating Technology into Exemplary Preschool Settings: A Report on the Apple and ConnectED Initiative. In *Education Development*

Center, Inc.

- Chang, H. Y., Park, E. J., Yoo, H. J., Lee, J. W., & Shin, Y. (2018). Electronic media exposure and use among toddlers. *Psychiatry Investigation, 15*(6), 568–573.
<https://doi.org/10.30773/pi.2017.11.30.2>
- Chen, J., Justice, L. M., Rhoad-Drogalis, A., Lin, T. J., & Sawyer, B. (2020). Social Networks of Children With Developmental Language Disorder in Inclusive Preschool Programs. *Child Development, 91*(2), 471–487. <https://doi.org/10.1111/cdev.13183>
- Crompton, H., & Burke, D. (2020). Mobile learning and pedagogical opportunities: A configurative systematic review of PreK-12 research using the SAMR framework. *Computers & Education, 156*, 1–15. <https://doi.org/10.1016/J.COMPEDU.2020.103945>
- Danby, S., Evaldsson, A. C., Melander, H., & Aarsand, P. (2018a). Situated collaboration and problem solving in young children's digital gameplay. *British Journal of Educational Technology, 49*(5), 959–972. <https://doi.org/10.1111/bjet.12636>
- Danby, S., Evaldsson, A. C., Melander, H., & Aarsand, P. (2018b). Situated collaboration and problem solving in young children's digital gameplay. *British Journal of Educational Technology, 49*(5), 959–972. <https://doi.org/10.1111/bjet.12636>
- Davidovitch, N., & Yavich, R. (2017). The Effect of Smart Boards on the Cognition and Motivation of Students. *Higher Education Studies, 7*(1), 60–68.
<https://doi.org/10.5539/hes.v7n1p60>
- Del Barrio, V. (2016). Diagnostic and statistical manual of mental disorders. In *The Curated Reference Collection in Neuroscience and Biobehavioral Psychology*. American Psychiatric

Association. <https://doi.org/10.1016/B978-0-12-809324-5.05530-9>

Deluzio, J., & Girolametto, L. (2011). Peer interactions of preschool children with and without hearing loss. *Journal of Speech, Language, and Hearing Research, 54*(4), 1197–1210. [https://doi.org/10.1044/1092-4388\(2010/10-0099\)](https://doi.org/10.1044/1092-4388(2010/10-0099))

Denham, S. A., Bassett, H. H., & Miller, S. L. (2017). Early Childhood Teachers' Socialization of Emotion: Contextual and Individual Contributors. *Child and Youth Care Forum, 46*(6), 805–824. <https://doi.org/10.1007/s10566-017-9409-y>

Dennis, L. (1970). Play in Dewey's Theory of Education. *Young Children, 25*(4), 230–235.

Department of Education. (2015). *Guiding Principles for Use of Technology with Early Learners - Office of Educational Technology*. <https://tech.ed.gov/earlylearning/principles/>

Dorouka, P., Papadakis, S., & Kalogiannakis, M. (2020). Tablets and apps for promoting robotics, mathematics, STEM education and literacy in early childhood education. *International Journal of Mobile Learning and Organisation, 14*(2), 255–274. <https://doi.org/10.1504/IJMLO.2020.106179>

Edwards, S., & Bird, J. (2017a). Observing and assessing young children's digital play in the early years: Using the Digital Play Framework. *Journal of Early Childhood Research, 15*(2), 158–173. <https://doi.org/10.1177/1476718X15579746>

Edwards, S., & Bird, J. (2017b). Observing and assessing young children's digital play in the early years: Using the Digital Play Framework. *Journal of Early Childhood Research, 15*(2), 158–173. <https://doi.org/10.1177/1476718X15579746>

Edwards, S., Nolan, A., Henderson, M., Mantilla, A., Plowman, L., & Skouteris, H. (2018).

Young children's everyday concepts of the internet: A platform for cyber-safety education in the early years. *British Journal of Educational Technology*, 49(1), 45–55.

<https://doi.org/10.1111/bjet.12529>

Every Student Succeeds Act (p. 20 U.S.C. § 6301). (2015).

Falloon, G., & Khoo, E. (2014). Exploring young students' talk in iPad-supported collaborative learning environments. *Computers and Education*, 77, 13–28.

<https://doi.org/10.1016/j.compedu.2014.04.008>

Fantozzi, V. B. (2021). "It's Everyone's iPad": Tablet use in a play-based preschool classroom. *Journal of Early Childhood Research*, 19(2), 115–127.

<https://doi.org/10.1177/1476718X20983835>

Ferreira, M., Reis-Jorge, J., & Batalha, S. (2021). Social and Emotional Learning in Preschool Education-A Qualitative Study with Preschool Teachers. *International Journal of Emotional Education*, 13(1), 51–66.

Fox-Turnbull, W. (2019). Enhancing the learning of technology in early childhood settings. *Australasian Journal of Early Childhood*, 44(1), 76–90.

<https://doi.org/10.1177/1836939119841457>

Furman, L. R. (2017). *The Future Ready Challenge* (E. Reed (Ed.)). International Society for Technology in Education World.

Gecu-Parmaksiz, Z., & Delialioğlu, Ö. (2020). The effect of augmented reality activities on improving preschool children's spatial skills. *Interactive Learning Environments*, 28(7),

876–889. <https://doi.org/10.1080/10494820.2018.1546747>

Ghavifekr, S. (2020). Collaborative Learning : a Key To Enhance Students ' Social Interaction.

Malaysian Online Journal of Educational Sciences, 8(October), 9–21.

<https://mojes.um.edu.my/index.php/MOJES/article/view/26394/12190>

Gottman, J., Gonso, J., & Rasmussen, B. (1975). Social Interaction, Social Competence, and Friendship in Children. *Child Development*, 46(3), 709–718.

<https://doi.org/10.2307/1128569>

Greenberg, M. T., Domitrovich, C. E., Weissberg, R. P., & Durlak, J. A. (2017). Social and emotional learning as a public health approach to education. *Future of Children*, 27(1), 13–32. <https://doi.org/10.1353/foc.2017.0001>

Haslip, M. J., & Gullo, D. F. (2018). The Changing Landscape of Early Childhood Education: Implications for Policy and Practice. *Early Childhood Education Journal*, 46(3), 249–264. <https://doi.org/10.1007/s10643-017-0865-7>

Hatzigianni, M., Gregoriadis, A., & Flear, M. (2016). Computer use at schools and associations with social-emotional outcomes - A holistic approach. Findings from the longitudinal study of Australian Children. *Computers and Education*, 95, 134–150. <https://doi.org/10.1016/j.compedu.2016.01.003>

Hatzigianni, M., Gregoriadis, A., Karagiorgou, I., & Chatzigeorgiadou, S. (2018). Using tablets in free play: The implementation of the digital play framework in Greece. *British Journal of Educational Technology*, 49(5), 928–942. <https://doi.org/10.1111/bjet.12620>

Hinkley, T., Brown, H., Carson, V., & Teychenne, M. (2018). Cross sectional associations of screen time and outdoor play with social skills in preschool children. *PLoS ONE*, 13(4), 1–

15. <https://doi.org/10.1371/journal.pone.0193700>

Jack, C., & Higgins, S. (2019). Embedding educational technologies in early years education.

Research in Learning Technology, 27, 1–34. <https://doi.org/10.25304/rlt.v27.2033>

Johnston, K., Highfield, K., & Hadley, F. (2018). Supporting young children as digital citizens:

The importance of shared understandings of technology to support integration in play-based learning. *British Journal of Educational Technology*, 49(5), 896–910.

<https://doi.org/10.1111/bjet.12664>

Jones, D. E., Greenberg, M., & Crowley, M. (2015). Early social-emotional functioning and

public health: The relationship between kindergarten social competence and future wellness. *American Journal of Public Health*, 105(11), 2283–2290.

<https://doi.org/10.2105/AJPH.2015.302630>

Kay, R., Benzimra, D., & Li, J. (2017). Exploring Factors That Influence Technology-Based

Distractions in Bring Your Own Device Classrooms. *Journal of Educational Computing Research*, 55(7), 974–995. <https://doi.org/10.1177/0735633117690004>

Kearney, M., Schuck, S., Aubusson, P., & Burke, P. F. (2018). Teachers' technology adoption

and practices: lessons learned from the IWB phenomenon. *Teacher Development*, 22(4), 481–496. <https://doi.org/10.1080/13664530.2017.1363083>

Kewalramani, S., & Havu-Nuutinen, S. (2019). Preschool teachers' beliefs and pedagogical

practices in the integration of technology: A case for engaging young children in scientific inquiry. *Eurasia Journal of Mathematics, Science and Technology Education*, 15(12), 1–13.

<https://doi.org/10.29333/ejmste/109949>

- Kirova, A., & Jamison, N. M. (2018). Peer scaffolding techniques and approaches in preschool children's multiliteracy practices with iPads. *Journal of Early Childhood Research, 16*(3), 245–257. <https://doi.org/10.1177/1476718X18775762>
- Kormos, E., & Wisdom, K. (2021). Rural Schools and the Digital Divide. *Theory & Practice in Rural Education, 11*(1), 25–39. <https://doi.org/10.3776/tpre.2021.v11n1p25-39>
- Kossyvaki, L., & Curran, S. (2020). The role of technology-mediated music-making in enhancing engagement and social communication in children with autism and intellectual disabilities. *Journal of Intellectual Disabilities, 24*(1), 118–138. <https://doi.org/10.1177/1744629518772648>
- Lai, J. W. M., & Bower, M. (2019). How is the use of technology in education evaluated? *Computers and Education, 133*, 27–42. <https://doi.org/10.1016/j.compedu.2019.01.010>
- Laugen, N. J., Jacobsen, K. H., Rieffe, C., & Wichstrøm, L. (2017). Social skills in preschool children with unilateral and mild bilateral hearing loss. *Deafness and Education International, 19*(2), 54–62. <https://doi.org/10.1080/14643154.2017.1344366>
- Lawrence, S. M. (2018). Preschool Children and iPads: Observations of Social Interactions During Digital Play. *Early Education and Development, 29*(2), 207–228. <https://doi.org/10.1080/10409289.2017.1379303>
- Lee, J. (2016). Early Learning and Educational Technology Policy Brief. *Office of Educational Technology, US Department of Education, October*, 1–25. <https://tech.ed.gov/files/2016/10/Early-Learning-Tech-Policy-Brief.pdf>
- Leung, S. K. Y., Choi, K. W. Y., & Yuen, M. (2020). Video art as digital play for young

children. *British Journal of Educational Technology*, 51(2), 531–554.

<https://doi.org/10.1111/bjet.12877>

Lim, E. M. (2012). Patterns of kindergarten children's social interaction with peers in the computer area. *International Journal of Computer-Supported Collaborative Learning*, 7(3), 399–421. <https://doi.org/10.1007/s11412-012-9152-1>

Ljubetic, M., & Maglica, T. (2020). Social and Emotional Learning and Play in Early Years. *Bulgarian Comparative Education Society*, 18, 122–128.

Madanipour, P., & Cohrsen, C. (2020). Augmented reality as a form of digital technology in early childhood education. *Australasian Journal of Early Childhood*, 45(1), 5–13. <https://doi.org/10.1177/1836939119885311>

Mantilla, A., & Edwards, S. (2019). Digital technology use by and with young children: A systematic review for the Statement on Young Children and Digital Technologies. *Australasian Journal of Early Childhood*, 44(2), 182–195. <https://doi.org/10.1177/1836939119832744>

Maureen, I. Y., van der Meij, H., & de Jong, T. (2020). Enhancing Storytelling Activities to Support Early (Digital) Literacy Development in Early Childhood Education. *International Journal of Early Childhood*, 52(1), 55–76. <https://doi.org/10.1007/s13158-020-00263-7>

Mertala, P. (2017). Wag the dog – The nature and foundations of preschool educators' positive ICT pedagogical beliefs. *Computers in Human Behavior*, 69, 197–206. <https://doi.org/10.1016/j.chb.2016.12.037>

Mertala, P. (2019). Teachers' beliefs about technology integration in early childhood education:

A meta-ethnographical synthesis of qualitative research. *Computers in Human Behavior*, *101*, 334–349. <https://doi.org/10.1016/j.chb.2019.08.003>

Miller, J. L., Paciga, K. A., Danby, S., Beaudoin-Ryan, L., & Kaldor, T. (2017). Looking beyond swiping and tapping: Review of design and methodologies for researching young children's use of digital technologies. *Cyberpsychology*, *11*(3), 1–21. <https://doi.org/10.5817/CP2017-3-6>

Miller, T. (2018). Developing numeracy skills using interactive technology in a play-based learning environment. *International Journal of STEM Education*, *5*(1), 1–11. <https://doi.org/10.1186/s40594-018-0135-2>

Mun, S. H., Abdullah, A. H., Mokhtar, M., Ali, D. F., Jumaat, N. F., Ashari, Z. M., Abu Samah, N., & Abdul Rahman, K. A. (2019). Active learning using digital smart board to enhance primary school students' learning. *International Journal of Interactive Mobile Technologies*, *13*(7), 4–16. <https://doi.org/10.3991/ijim.v13i07.10654>

NAEYC and Fred Rogers Center. (2012). *Technology and Interactive Media as Tools in Early Childhood Programs Serving Children from Birth through Age 8*. NAEYC.Org. <https://search.informit.org/doi/abs/10.3316/ielapa.728719428486158>

Neiterman, E., & Zaza, C. (2019). A Mixed Blessing? Students' and Instructors' Perspectives about Off-Task Technology Use in the Academic Classroom. *The Canadian Journal for the Scholarship of Teaching and Learning*, *10*(1), 1–16. <https://doi.org/10.5206/cjsotl-rcacea.2019.1.8002>

Nepo, K. (2017). The Use of Technology to Improve Education. *Child and Youth Care Forum*,

46(2), 207–221. <https://doi.org/10.1007/s10566-016-9386-6>

NSTC. (2018). Charting a Course for Success: America's Strategy for STEM Education.

National Science and Technology Council, December, 1–35.

<http://www.whitehouse.gov/ostp>.

Oh-Young, C., Filler, J., Kucskar, M., Buchter, J., O'Hara, K., & Gelfer, J. (2018). A

Comparison of Peer Network and Peer Video Modeling to Increase Positive Verbal Social Interactions in Young Children With Disabilities. *Journal of Special Education Technology*,

33(4), 270–283. <https://doi.org/10.1177/0162643418776631>

Operto, F. F., Pastorino, G. M. G., Marciano, J., de Simone, V., Volini, A. P., Olivieri, M.,

Buonaiuto, R., Vetri, L., Viggiano, A., & Coppola, G. (2020). Digital devices use and language skills in children between 8 and 36 month. *Brain Sciences*, 10(9), 1–13.

<https://doi.org/10.3390/brainsci10090656>

Oranç, C., & Küntay, A. C. (2019). Learning from the real and the virtual worlds: Educational

use of augmented reality in early childhood. *International Journal of Child-Computer*

Interaction, 21, 104–111. <https://doi.org/10.1016/j.ijcci.2019.06.002>

Otterborn, A., Schönborn, K., & Hultén, M. (2019). Surveying preschool teachers' use of digital

tablets: general and technology education related findings. *International Journal of*

Technology and Design Education, 29(4), 717–737. [https://doi.org/10.1007/s10798-018-](https://doi.org/10.1007/s10798-018-9469-9)

9469-9

Paciga, K. A., & Donohue, C. (2017). Technology and Interactive Media for Young Children : A

whole Child Approach Connecting the Vision of Fred Rogers with Research and Practice.

In *Latrobe, PA*.

- Papadakis, S., Kalogiannakis, M., & Zaranis, N. (2017). Designing and creating an educational app rubric for preschool teachers. *Education and Information Technologies*, 22(6), 3147–3165. <https://doi.org/10.1007/s10639-017-9579-0>
- Parten, M. (1932). Social participation Among pre-school children. *The Journal of Abnormal and Social Psychology*, 27(3), 243–269.
- Pew Research Center. (2021). *Demographics of Internet and Home Broadband Usage in the United States* / Pew Research Center. Internet/Broadband Fact Sheet. <https://www.pewresearch.org/internet/fact-sheet/internet-broadband/#internet-use-over-time>
- Pinto, A. I., Grande, C., Coelho, V., Castro, S., Granlund, M., & Björck-Åkesson, E. (2019). Beyond diagnosis: the relevance of social interactions for participation in inclusive preschool settings. *Developmental Neurorehabilitation*, 22(6), 390–399. <https://doi.org/10.1080/17518423.2018.1526225>
- Pokhrel, S., & Chhetri, R. (2021). A Literature Review on Impact of COVID-19 Pandemic on Teaching and Learning. *Higher Education for the Future*, 8(1), 133–141. <https://doi.org/10.1177/2347631120983481>
- Rabinowitch, T. C., & Knafo-Noam, A. (2015). Synchronous rhythmic interaction enhances children's perceived similarity and Closeness towards each other. *PLoS ONE*, 10(4), 1–10. <https://doi.org/10.1371/journal.pone.0120878>
- Rönkkö, M., Yliveronen, V., & Kangas, K. (2021). Investigative activity in pre-primary technology education-The Power Creatures project. *International Journal of Technology*

and Design Education, 26(1), 29–44.

Safar, A. H., Al-Jafar, A. A., & Al-Yousefi, Z. H. (2017). The effectiveness of using augmented reality apps in teaching the english alphabet to kindergarten children: A case study in the state of Kuwait. *Eurasia Journal of Mathematics, Science and Technology Education*, 13(2), 417–440. <https://doi.org/10.12973/eurasia.2017.00624a>

Sakyi, K. S., Surkan, P. J., Fombonne, E., Chollet, A., & Melchior, M. (2015). Childhood friendships and psychological difficulties in young adulthood: An 18-year follow-up study. *European Child and Adolescent Psychiatry*, 24(7), 815–826. <https://doi.org/10.1007/s00787-014-0626-8>

Sarker, M. N., Wu, M., Cao, Q., Alam, G. M. M., & Li, D. (2019). Leveraging Digital Technology for Better Learning and Education: A Systematic Literature Review. *International Journal of Information and Education Technology*, 9(7), 453–461. <https://doi.org/10.18178/ijiet.2019.9.7.1246>

Schonert-Reichl, K. A. (2017). Social and emotional learning and teachers. *Future of Children*, 27(1), 137–155. <https://doi.org/10.1353/foc.2017.0007>

Sjöman, M., Granlund, M., Axelsson, A. K., Almqvist, L., & Danielsson, H. (2021). Social interaction and gender as factors affecting the trajectories of children's engagement and hyperactive behaviour in preschool. *British Journal of Educational Psychology*, 91(2), 617–637. <https://doi.org/10.1111/bjep.12383>

Slot, P. L., Mulder, H., Verhagen, J., & Leseman, P. P. M. (2017). Preschoolers' cognitive and emotional self-regulation in pretend play: Relations with executive functions and quality of

- play. *Infant and Child Development*, 26(6), 1–21. <https://doi.org/10.1002/icd.2038>
- Stotz, M. (2018). Using Augmented Reality to Teach Subitizing with Preschool Students. *Journal of Interactive Learning Research*, 29(4), 545–577.
- Sundqvist, A., Koch, F. S., Birberg Thornberg, U., Barr, R., & Heimann, M. (2021). Growing Up in a Digital World – Digital Media and the Association With the Child’s Language Development at Two Years of Age. *Frontiers in Psychology*, 12, 1–44. <https://doi.org/10.3389/fpsyg.2021.569920>
- Sundqvist, P., & Nilsson, T. (2018). Technology education in preschool: providing opportunities for children to use artifacts and to create. *International Journal of Technology and Design Education*, 28(1), 29–51. <https://doi.org/10.1007/s10798-016-9375-y>
- Syrjämäki, M., Pihlaja, P., & Sajaniemi, N. K. (2019). Enhancing Peer Interaction in Early Childhood Special Education: Chains of Children’s Initiatives, Adults’ Responses and Their Consequences in Play. *Early Childhood Education Journal*, 47(5), 559–570. <https://doi.org/10.1007/s10643-019-00952-6>
- Tarr, B., Slater, M., & Cohen, E. (2018). Synchrony and social connection in immersive Virtual Reality. *Scientific Reports*, 8(1), 1–8. <https://doi.org/10.1038/s41598-018-21765-4>
- The National Agency for Education. (2018). Curriculum for the Preschool Lpfö 98. *Skolverket*, 1–20. www.fritxes.se
- Tunçgenç, B., & Cohen, E. (2018). Interpersonal movement synchrony facilitates pro-social behavior in children’s peer-play. *Developmental Science*, 21(1), 1–9. <https://doi.org/10.1111/desc.12505>

- Uyanik Balat, G., Arslan Ciftci, H., Unsal, O., Kilic, Z., & Degirmenci, S. (2019). Analyzing The Relationships between Preschool Children's Play Skills and Their Social Competence and Emotion Regulation Skills/Analiza odnosa između vještina igre i društvenih sposobnosti i vještine reguliranja emocija u predškolske djece. *Croatian Journal of Education - Hrvatski Časopis Za Odgoj i Obrazovanje*, 20(3), 243–257. <https://doi.org/10.15516/cje.v20i0.3037>
- Veiga, G., de Leng, W., Cachucho, R., Ketelaar, L., Kok, J. N., Knobbe, A., Neto, C., & Rieffe, C. (2017). Social Competence at the Playground: Preschoolers During Recess. *Infant and Child Development*, 26(1), 1–15. <https://doi.org/10.1002/icd.1957>
- Verenikina, I., Kervin, L., Rivera, M. C., & Lidbetter, A. (2016). Digital play: Exploring young children's perspectives on applications designed for preschoolers. *Global Studies of Childhood*, 6(4), 388–399. <https://doi.org/10.1177/2043610616676036>
- Walker, G., & Venker Weidenbenner, J. (2019). Social and Emotional Learning in the age of virtual play: technology, empathy, and learning. *Journal of Research in Innovative Teaching & Learning*, 12(2), 116–132. <https://doi.org/10.1108/jrit-03-2019-0046>
- Wang, X., Laffey, J., Xing, W., Ma, Y., & Stichter, J. (2016). Exploring embodied social presence of youth with Autism in 3D collaborative virtual learning environment: A case study. *Computers in Human Behavior*, 55, 310–321. <https://doi.org/10.1016/j.chb.2015.09.006>
- Yilmaz, R. M., Kucuk, S., & Goktas, Y. (2017). Are augmented reality picture books magic or real for preschool children aged five to six? *British Journal of Educational Technology*, 48(3), 824–841. <https://doi.org/10.1111/bjet.12452>

- Yip, J., & Hiniker, A. (2019). *Intentional Technology Use in Early Childhood Education*. 78, 1–22. <https://doi.org/10.1145/3359180>
- Yliverronen, V., Marjanen, P., & Seitamaa-Hakkarainen, P. (2018). Peer Collaboration of Six-Year Olds When Undertaking a Design Task. *Design and Technology Education*, 23(2), 1–23.
- Yuan, S. N. V., & Ip, H. H. S. (2018). Using virtual reality to train emotional and social skills in children with autism spectrum disorder. *London Journal of Primary Care*, 10(4), 110–112. <https://doi.org/10.1080/17571472.2018.1483000>
- Zabatiero, J., Straker, L., Mantilla, A., Edwards, S., & Danby, S. (2018). Young children and digital technology: Australian early childhood education and care sector adults' perspectives. *Australasian Journal of Early Childhood*, 43(2), 14–22. <https://doi.org/10.23965/AJEC.43.2.02>
- Zack, E., & Barr, R. (2016). The role of interactional quality in learning from touch screens during infancy: Context matters. *Frontiers in Psychology*, 7, 1–12. <https://doi.org/10.3389/fpsyg.2016.01264>