TECHNOLOGY AND INTERACTIVE MEDIA FOR YOUNG CHILDREN:

A Whole Child Approach Connecting the Vision of Fred Rogers with Research and Practice
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A Whole Child Approach Connecting the Vision of Fred Rogers with Research and Practice

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Citations

Final Report

Executive Summary

Acknowledgements
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ABSTRACT

This research report synthesizes the discussion, research, and practice around technology and media for young children since 2011—just prior to the release of the National Association for the Education of Young Children [NAEYC] and Fred Rogers Center joint position statement in March, 2012—and is aligned with Fred Rogers’ ideas about television and how that technology and media could encourage and support whole child development. The framework set forth in the NAEYC and Fred Rogers Center joint position statement (2012) and Fred Rogers’ indicators of learning readiness (Rogers & Head, 1983) served as framing devices for this study and provided a core set of terms that served as a springboard for the methodology. The synthesis employed a combination of snowball sampling, systematic database searches, reverse searches, and hand searches to identify 595 entries related to early childhood education and technology/digital media published 2011–2016. These 595 entries all met two criteria specified: 1) pertaining to early childhood contexts, and 2) containing reference to technology or digital media. From these entries, we randomly sampled 165 entries for our analyses which searched for trends related to key constructs: the child; the contexts in which the technologies or digital media were utilized; the content of the digital media; and the principles of learning readiness and social and emotional learning.

Results indicate there were fewer examples from research and practice related to infants and toddlers (0–3 years) than other age groups (3–8 years). Less than one-quarter of the entries addressed children with special rights and needs, linguistic diversity, or from homes with low socio-economic status. The majority of the research and practice indicated technology or digital media were being utilized or studied in home or school/child care contexts and that parents/guardians and teachers/child care providers were frequently identified as involved in children’s interactions with technology and digital media. Adults were more supportive of younger children’s interactions with technology and digital media than they were of older children’s interactions. For older children, support was often provided as an orientation to the task, rather than as continuous mediation of the child’s experiences. Few examples of research and practice situated technology or media use across contexts (home, school/child care, within a community, on-the-go). The majority of the entries oriented to literacy goals or objectives (n=80) with fewer examples of science (n=36), math (n=46), or non-cognitive (n=15) oriented goals.

The data provides a substantial amount of indirect evidence that children’s interactions with technology and digital media are supportive of whole child development, especially when the content itself or something in the context did any of the following: helped children deal with frustration and/or mistakes; encouraged children to take positive risks; utilized digital media to facilitate empathy and awareness; encouraged children’s sense of trust; promoted children’s sense of self-worth; engaged children’s curiosities; encouraged children to look and listen carefully; provided opportunities for children to play; and provided opportunities for children to quietly reflect—alone or near a trusted adult or peer.

Additional analyses suggest there may have been biases in the entries synthesized as a function of whether an entry was open access or behind an academic paywall. There was a greater likelihood to encounter negative or cautious messaging about young children’s interactions with technology and digital media in the open access entries. In addition, the foci of the pay-for-access entries tended to orient more around the child and specific learning outcomes, whereas the open access entries tended to orient more toward the content and use of technologies and media.

The report concludes with suggestions for future research and practice addressing the question: How does a child’s interactions with media and technology strengthen relationships? The following are among the list of actionable steps: simultaneously focus on the child, the content, and the context; look longitudinally; broaden how educators and parents identify and define technology tools for learning; plan for nimble research designs that can build theory; work to translate, demonstrate, and “show me” how to apply research; strive to be socially just with the policies surrounding technologies and media in children’s lives; and remember that every child needs a media mentor.
“Early childhood educators always should use their knowledge of child development and effective practices to carefully and intentionally select and use technology and media if and when it serves healthy development, learning, creativity, interactions with others, and relationships.”

–NAEYC & Fred Rogers Center Joint Position Statement, 2012
In 2012, less than 2 years after Apple released the iPad, the National Association for the Education of Young Children [NAEYC] and the Fred Rogers Center for Early Learning and Children’s Media at Saint Vincent College [Fred Rogers Center] released a seminal joint position statement on the use of technology and interactive media in early childhood programs. At the time of the literature review, there was little empirical research about how these new technologies and media would impact young children’s lives and classroom practices. By the time the position statement was released, over 50 million iPads were sold and had made their way into homes, schools, pediatrician’s offices, church basements, restaurants, shopping centers, libraries, and museums (Statista, 2017). Media were designed, developed, and created for young children for use on tablets, smartphones, and other mobile platforms at breakneck speed, often backed with very little or no cognitive and educational research. Dubbed “educational” media, these products were launched and marketed to caregivers, teachers, and often children themselves—the impacts of which were largely undocumented and unexplored (Guernsey, Levine, Chiong, & Severns, 2012; Schuler, Levine, & Ree, 2012). The joint position statement was intended to provide guidance to the field about the ways in which technology and interactive media might be used in developmentally appropriate and intentional ways with young children in this rapidly expanding and highly unknown landscape.

In addition, the joint position statement identified many of the general concerns held in relation to the proliferation of portable technology and media. While Fred Rogers was an early adopter of television, the predominant technology and media stream of his time, he expressed similar concerns. Fred often said that he got into children’s television and created *Mister Rogers’ Neighborhood* because so much of the programming available to the general public was inappropriate or harmful for young children. He said, “I knew that I wanted to use television the way I had used the piano and puppet play as a child: to communicate some things that I felt were important in our world” (Rogers & Head, 1983, p. 163), and to build positive relationships with children and their families to foster learning. Fred Rogers believed that “Children can learn almost anything both easily and well so long as they are ready to learn” (p. 170), but he grappled with the following essential questions for most of his career: How can my work help children become ready to learn? And how might television, as a communication medium, be utilized as a tool in my process?

In *Mister Rogers Talks with Parents* (Rogers & Head, 1983), Fred Rogers outlined the ways in which television can support or detract from the development of a child’s readiness to learn and also suggested the key role that relationships—between the child and self, caregivers and children, children and their peers, and children and their environments (including media)—influence learning readiness. He defined six principles of learning readiness that are most essential for a child to develop: a sense of self-worth; a sense of trust; curiosity; capacity to look and listen carefully; capacity to play; and times of solitude. Fred believed these fundamentals could be developed and supported through a child’s play, which he called the “serious work of childhood.”
Importantly, what Fred Rogers called learning readiness is distinguishable from school readiness or reading readiness (Almy, 1949): “It may be that the most important mastery we achieve early on is not the mastery of a particular piece of knowledge, but rather the mastery of the patience and persistence that learning requires, along with the ability to expect and accept mistakes and the feelings of disappointment they may bring” (Rogers, 2005, p. 123). These readiness skills often emerge as co-regulated and supported by an adult, and are deeply connected to academic notions of social and emotional development. Readiness and the foundations of a child’s social and emotional development occur across the early years and are usually strengthened through relationships. Sometimes, learning readiness and social or emotional development do meaningfully involve technology and media. Beyond the composition of the media content itself, though, recent attention has been placed on studying the child involved in viewing or using the media or technology and the contexts in which these interactions take place. In other words, interactions with adults and other children matter, the developmental trajectory of the child matters, and the place and purpose of the media and technology use matters. This intersection of the “three C’s” of screen time (Guernsey, 2012)—the content, the context, and the individual child—is examined in this study and, in doing so, the relationships within, among, and across these three C’s are shown to matter. We argue, as Fred Rogers did, that relationships matter most when it comes to learning readiness. Like Rogers emphasized, too, we argue that the child’s interactions with other people remain incredibly important—the screen cannot ever replace the impact and influence of a caring adult.

Nothing will ever take the place of one person actually being with another person. There can be lots of fancy things like TV and radio and telephones and the Internet, but nothing can take the place of people interacting face to face. (Rogers, as quoted in Davis, 2000, p. 29)

The content Fred Rogers presented through his television programming, in his public addresses, and his printed material was intentionally connected to theories of social and emotional wellbeing and child development. Particularly, he worked to help children deal with their frustrations and mistakes, to take positive risks, to try and persist—even when things might be challenging—and to develop empathy and self-awareness. These social and emotional skills and the indicators of learning readiness, introduced above, function in this study as one part of the inquiry and have been integrated into the coding and analytical method described below.

“Computers can be useful machines, especially when they help people communicate in caring ways with each other...”

—Fred Rogers, 1996

The main question is not so much how the new technology can help students learn. Rather, it’s what will they do with what they learn? Will they use their knowledge to build...or will they use it to destroy?

Only real human beings can help them know the difference—regardless of the medium or the technology used for communication. (Rogers, 1997, p. 13)

Research Questions

This research sought to synthesize the discussion, research, and practice around technology and media for young children since 2011—just prior to the release of the joint position statement in March, 2012—and is aligned with Fred Rogers’ ideas about television and how that technology and media could encourage and support
whole child development. The framework set forth in the NAEYC and Fred Rogers Center joint position statement (2012) served as a framing device for this study and provided a core set of terms that served as a springboard for the methodology. The joint position statement defined the terms interactive media, non-interactive media, digital literacy, and digital citizenship. The joint position statement also identified principles, guidelines, and key messages for early childhood educators and made recommendations about the ways in which technologies and digital media can be supportive of social and emotional development and learning readiness, in ways similar to Fred Rogers’ approach.

Some of the suggestions from the joint position statement include:

- Effective uses of technology and media are active, hands-on, engaging, and empowering; give the child control; provide adaptive scaffolds to ease the accomplishment of tasks; and are used as one of many options to support children’s learning.
- Interactions with technology and media should be playful and support creativity, exploration, pretend play, active play, and outdoor activities.
- Technology tools can help educators make and strengthen home-school connections.
- Technology and media can enhance early childhood practice when integrated into the environment, curriculum, and daily routines.
- Assistive technology must be available as needed to provide equitable access for children with special needs.

Considering the above, and in an effort to connect the vision of Fred Rogers to emerging research-based practice since the release of the joint position statement, the research questions for the study were as follows:

1. What kinds of technology-mediated interactions have been studied and discussed—with what age ranges and populations, for what purposes, and for what ends—since 2011 when the position statement was being finalized?

and,

2. What are the ways in which the discussion and research surrounding technology and media for young children provide evidence of the level of support for children’s social and emotional development and learning readiness? In what ways are we encouraging children to do the following: look and listen carefully; sustain their play; engage and expand their curiosities about the world and its people; demonstrate and/or document their own self-worth; establish and build trust; and experience reflective times of solitude as they engage with technology and media?
METHOD

Our objective in this synthesis was to identify the work that has been done since just prior to the release of the NAEYC/Fred Rogers Center joint position statement related topically to the key points of the position statement. To accomplish this goal, we first identified a corpus of primary source data targeting children 0–8 and/or their caregivers or teachers that also contained evidence of technology or media use as defined in the joint position statement. In this way, our data set can be used to demonstrate the ways in which the field of early childhood has advanced its knowledge of the principles put forth by the NAEYC and Fred Rogers Center joint position statement (2012) and can serve as a starting point to explore the connection among Fred Rogers’ notions of learning readiness, social and emotional development, and the existing knowledge base.

Search Method

Given the authors’ connections to early childhood, technology and media, and Fred Rogers’ vision, we were already aware of a large number of articles, reports, books, etc., but we also conducted systematic, reverse, and hand searches to expand our data sets prior to engaging in analysis. We provide additional information about our search method in the subsequent paragraphs.

Things we already knew about. Authors affiliated with the 2012 joint position statement had a collection of items they had accumulated since the statement’s publication. These items included peer-reviewed empirical studies, policy statements, research in-review or in-press, and reports from organizations conducting studies of technology that were not published in the academic domain. Also among these items were several less formal pieces ranging from news reports to blogs from early leaders in the educational technology and children’s media space. The names of these early research leaders, their research and development labs, or initiatives were already on our radar because they were part of the existing evidence base utilized in writing the joint position statement (2012). We utilized a random sample of 10% of these items we already knew about and conducted a reverse search to identify and enter studies that had cited these since original date of publication. Chip Donohue, Michael Robb, and Kyle Snow contributed PDFs of files they had collected since the release of the NAEYC/Fred Rogers Center joint position statement (2012). Each of these items were collected in Dropbox, shared via email, and entered into a Zotero citation software library.

Systematic database search. This section contains a list of search terms, limiters, and databases, and the strategies and processes for executing the systematic search. These strategies were designed to replicate, in many ways, those applied for the conduct of the National Early Literacy Panel Report (2008) and the National Reading Panel Report (2000) and are rooted in the approaches to research synthesis presented by Cooper and Hedges (1994).

Databases. To include journals spanning education, health, psychology, communication, and human–computer interaction, the systematic search strategies were replicated in each of the search engines and databases accessed (i.e., EBSCO, ERIC, ProQuest, Medline). The results of the searches were also downloaded into Zotero citation software. Duplicate entries were removed in the process. The researchers engaged in the search process from August 1, 2015, through March 2, 2016.

Publication year and language. The specifications of the Early Career Research Fellowship required that the search begin in 2011, just prior to the release of the NAEYC and Fred Rogers Center joint position statement on technology and interactive media (2012), and proceed through to the beginning of 2016. The studies, or their OnlineFirst editions, must have been published in English because the authors did not have resources to review articles published in other languages.
“The main question is not so much how the new technology can help students learn. Rather, it’s what will they do with what they learn? Will they use their knowledge to build...or will they use it to destroy? Only real human beings can help them know the difference—regardless of the medium or the technology used for communication.”

—Fred Rogers, 1997
**Peer-review.** We sought out studies and practitioner tips connecting research and theory to practice that were published in peer-reviewed journals as well as pieces that were not peer-reviewed. While the search strategies utilized in the academic databases described below yielded many results, we also utilized Google searches and a snowball sample strategy to include reports for funders (e.g., Institution of Educational Sciences, Department of Education grant reports), white papers, popular press items, and teacher blogs that corresponded to the focus of the literature review. These popular press and practitioner- or parent-oriented items provided a sample of the messaging that educators, caregivers, and other early childhood professionals are seeing and hearing about technology and media in early childhood.

**Search terms.** In order to identify the largest number of peer-reviewed articles possible connecting the domains of (1) early childhood education, (2) technology and media, and (3) social and emotional constructs, we phased out our search strategy into two parts. First, we utilized the first two key sets of search terms: age-related and technology/media-related terms. We searched for words within each set with “OR,” and then we used “AND” to identify articles that were present in both sets, indicating the abstract included evidence the article was addressing both early childhood content and technology and/or media in some way. Next, we entered each of these articles into our database.

**Age-related terms.** The scope of this synthesis is intended to focus on what we know about technology and interactive media with young children, from birth through 8 years of age. To ensure that the search yielded research that pertains to this age range, the first set of search terms served to identify the universe of indexed research pertaining to children in this age range. We executed an abstract search for this stage utilizing terms established for the 0–6 age range by the National Early Literacy Panel (2009, p. 46) with additional terms from the National Reading Panel (2000) for the kindergarten through third grade age range. These included the following: early childhood education, early experience, infant, toddlers, preschool, kindergarten, first grade, second grade, third grade, and young children.

**Technology/media-related terms.** A secondary set of search terms related to technology and media were applied to the “age-related” sets to narrow the pool. To do this, we searched each age-related set’s abstract for terms related to technology, devices, and the interactive media with which children interact. The majority of these terms emerged from the hardware and software identified in the joint position statement (NAEYC/Fred Rogers Center, 2012): computer, laptop, tablets, interactive whiteboards, mobile, smartphones, cameras, audio recorders, Nintendo, Xbox, PlayStation, e-book, Kindle, Nook, apps, software, media, and internet.

**Hand searches.** In addition to the systematic searches described above, we also hand searched several early childhood and technology/media journals from 2011 to 2015. We included articles that were published online ahead of print in this stage of the search process. The journals identified for hand search were *Young Children; Teaching Young Children; Teaching Exceptional Children; Child Development; Early Childhood Education Journal; Journal of Early Childhood Literacy;* and *Journal of Children and Media.*

**Sampling Method**

The searching and resource collection began August 1, 2015, and continued through to March 2, 2016. At the end of the search period, we had identified 595 sources of information—research and practice—that met the criteria for the age range and for the inclusion of technology or media.

We utilized a stratified random sampling technique with a random number generator to equitably sample sources for each publication year in our database. Table 1 shows the distribution of the entries coded per year as related to the entire sample. In the event a sampled source ended up not meeting inclusion criteria upon a closer read, another entry was randomly selected to take its place, resulting in a sample of 25–32% of the total entries in the database for any given year. The final list of coded sources is available at the end of this document.
Table 1. Comparison of Entries in Database to Sample Entries Coded by Publication Year

<table>
<thead>
<tr>
<th>Year</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
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<td>36</td>
<td>36</td>
<td>43</td>
<td>13</td>
<td>1*</td>
</tr>
</tbody>
</table>

*Danby, et al. (2017) was received September 2015 and was coded originally as 2015. Publication date was updated to reflect most accurate citation information after the coding and analysis were complete.

Coding Method

After the corpus of literature with both early childhood and technology/media conditions was identified and the sample was set, we initiated coding for every entry in its entirety for several types of data related to our research questions. In the early stages of coding, we initiated an open coding process to identify themes related to the content, context, and the child. Once 5% of the sample had been coded openly, we looked for themes and major patterns. These became levels within variables that were then utilized to code the remaining sampled entries in the research database. When existing variables or their levels did not meet our coding needs we revisited the variables and the levels we had established. We created additional variables or added additional levels to existing variables, if necessary, documenting each in a code note (Strauss & Corbin, 1990). In these instances, we iteratively double-checked our coding on entries to ensure that the additional levels created later did not impact entries that were previously considered complete, or coded.

To facilitate coding reliability and validity, the first author created a codebook for key variables that integrated the initial themes, which were conceptualized to accomplish five objectives related to our research questions, namely, to understand the following: 1) the kinds of information generated around our topic; 2) the range of characteristics/demographics of children and adults being described in the sources we identified; 3) the range of technologies and media the children, teachers, and families are using in early childhood contexts; 4) the kinds of interactions and contexts in which the sources we sampled are using the technologies and media; and 5) the extent to which the interactions appeared to provide evidence of supporting children’s social and emotional development and/or learning readiness.

Entry overview variables. In our database, we documented the bibliographic information for each entry and coded each source for entry type and instrumentation for data collection, funding status, funder, and access. We also documented, when applicable, the research questions and key variables driving the empirical work we reviewed.

Entry type. We evaluated the design of each entry based on major designs for research methods described in Green, Camilli, & Elmore (2012), while also accounting for a) a number of entries that were research/theory to practice pieces without a specific methodological design, and b) a few popular press items. In the end, we utilized the same codes employed by other early childhood professionals currently engaged in research synthesis (e.g., Hoffman, Whittingham, & Teale, in review; Teale, Whittingham, & Hoffman, 2016), which include the following: research/theory to practice, comparative, intervention, literature reviews, correlations, descriptive, formative, policy, measurement validation, meta-analysis, and an “other” category to account for those pieces that deviate from these categories.

In addition to the major design for each entry, we also documented the range of instrumentation employed to gather evidence for the empirical work that was sampled. The instrumentation variables and the corresponding levels were created in the open coding phase. We coded each entry for the full range of variables for instrumentation to allow us...
to drill down and see which research instruments were employed across the sample we coded, even if multiple or mixed methods were designated as the design. In our sample, we identified the following: survey instruments, including phone, online, and mailed formats; direct observation of children using technology or media employing field notes, video- or audio-recorded interactions, and/or observational rating scales; child or parent interview or focus groups; and content analysis of digital media.

**Funding and access.** Fred Rogers worked tirelessly to get his messages out to the public free of charge through public television. He even spoke to the U.S. Congress (1969, see [http://www.fredrogers.org/frc/news/45-years-ago-mister-rogers-addressed-congress](http://www.fredrogers.org/frc/news/45-years-ago-mister-rogers-addressed-congress)) and successfully secured financial government support for public educational television. Two variables—funding and access—relate to his work here. Funding status was determined largely by reading the recognition of funding statements commonly found on research reports. When possible, the funding sources were documented. Our access variable evaluated whether the source coded was available openly on the internet, or only behind an academic library paywall.

**The child variables.** We created a set of 10 variables for children’s age ranges (chronological age): infant (0–18 months), toddler (18–36 months), preschool (3–5 years), kindergarten (5–6 years), first grade (6–7 years), second grade (7–8 years), third grade (8–9 years), fourth–sixth grade (9–12 years), seventh–eighth grade (12–14 years), ninth–twelfth grade (14–18 years). Each age range category was coded in a binary fashion, with 0 indicating no child of that particular age range participated or was described in the entry, and 1 indicating a child of that age range did participate or was described. These variables were not mutually exclusive. If a study looked at toddlers and preschoolers, both variables would be coded as 1 to indicate the entry described children from both the toddler and the preschool age ranges as participants in the activities presented in the entry.

We were also interested in determining the number of different age groups discussed in each entry. Longitudinal and cross-sectional studies typically include children from many age groups as participants in a study. We found few longitudinal studies that followed the same child or children across two or more school years, and those we included in our analysis did not include direct observation of children (Kasari, et al., 2014; Parkes, et al., 2013; Von Salich, et al., 2011). Cross-sectional studies were defined as entries that looked at different children from multiple age groups on the same sets of variables.

In addition to child age, we also documented the presence or absence of children from low socio-economic status (SES), those from linguistically diverse backgrounds (i.e., bilingual, English Language Learners), and those with exceptional needs and rights (i.e., children with a 504 plan or Individualized Educational Plan [US]). If a study identified one or more children from low SES, that variable was coded “1–identified low SES.” When possible, we then documented the percent of the participants that came from low SES. If children’s SES was middle or high, we coded as “0–not low SES.” When the SES of children described was not clearly identified, we indicated so with the code “99–did not report.” The same coding procedure was utilized for instances of linguistic diversity and for children with exceptional needs and rights.

**The context variables.** The contexts in which young children interact with technology and media are composed of several multidimensional factors. These include the people who are in the child’s environment during his or her interactions with the technology or media and the ways in which their presence supports the child’s interactions with technology or media, the physical place in which the child engages in these experiences, and the purposes for which the child engages.

**Other people.** First, a child’s interactions with technology and media often involve other people in the child’s social world (peers, siblings, parents, caregivers, teachers, etc.). The American Academy of Pediatrics [AAP] (2016) suggests that adults co-engage and provide support for and conversation about the technologies and media present and utilized in children’s lives. At times, there are several adults collaborating with or through technologies or media about the child
or the child’s work. Our variables coded for teachers/child care providers, parents/caregivers, interventionists/therapists, other adults (e.g., researchers, librarians, adults facilitating after school activities, and pre-service teachers) in a binary fashion, indicating either the presence or absence of each of these adults in one or more of a child’s described interactions with technology and media. When no adult was described as involved in any of the child’s interactions with technology or media in the entry we entered zero values in all of the adult variable fields. As an example, Cristia and Seid (2015) surveyed French parents of children aged 5 months to 40 months about their child’s access to and use of interactive media. The authors attended specifically to the child’s gestures and asked parents to provide responses about their child’s ability to employ various gesture types. In their discussion of the methods employed in their study, Cristia and Seid do not indicate whether the parents co-engaged in the media use with their infants or toddlers. Von Salich and colleagues (2011) and Fisch and colleagues (2011) looked at children’s use of video games in homes and in schools, respectively. No adult was described in the methodology or as part of any of the analyses presented in either entry. As an additional example, Danby and colleagues (2017) indicate that the mother of two children video recorded the children’s interactions on the computer, but was not involved otherwise. In each of these instances we coded no adult. Other instances of no adult were present when the focus of the entry related to the design features of the content, or to the media itself (e.g., Cahill & McGill, 2013; Ihmeideh, 2015; Sobel, et al., 2016).

Our “grouping” variable allowed us to look at whether a child was engaged in joint use (adult–children, adult–child, or child–child) typically found in a co-viewing scenario (e.g., Takeuchi, et al., 2011), individual use, or multiple grouping methods, that would be typically present in a gradual release of responsibility model of instruction (Pearson & Gallagher, 1983). Our “support” variable allowed us to evaluate whether the other adults were providing active scaffolding or mediation for the child’s experiences. We coded support in four levels: unclear/not described, none, some (adult oriented the child to the objectives/purposes of the activity only), and significant (adult provided ongoing support and scaffolding/feedback for the majority of the child’s interactions for the majority of the time the child was utilizing

Simple Interactions uses a video-based approach to empower and uplift children’s caregivers.
“I knew that I wanted to use television the way I had used the piano and puppet to play as a child: to communicate some things I felt were important in our world.”

–Fred Rogers, 1983
technology or media). Related to this, other people interacted in conversation, at times, with children—helping them
to engage in pro-social relationship skills (Collaborative for Academic, Social, and Emotional Learning [CASEL], 2012):
communicate clearly; listen actively; cooperate; resist inappropriate social pressure; negotiate conflict constructively;
and seek and offer help when needed. When available, the descriptions of these types of interactions served as content we
coded for the social, emotional, or learning readiness constructs described below.

**Physical place.** A child may engage with technologies and media in many physical places including the home,
school, child care center, community center, or on the go. We first asked coders to identify only one mutually exclusive
place code—home, family child care, laboratory, early child care center, Head Start center, public school, private school,
library, multiple contexts, or not identified. We utilized the not identified code in instances in which the physical place
of the entry was not mentioned specifically. The not identified code was most common in the theoretical entry types
(e.g., Ko & Chou, 2014; Sherry, 2013; Wartella, 2015), or in research/theory to practice entry types with children in the
0–5 range that describe best practices for family child care, schools, homes with caregivers, or community settings (e.g.,
libraries, museums) (e.g., NAEYC/Fred Rogers Center, 2012; Shapiro, 2014; Sharapan, 2012; Slutsky, et al., 2014). The
institutionalized child care and school contexts (early child care center, Head Start center, public school, private school)
were eventually collapsed and recoded into one variable level, named child care center or school. We also created a second
variable to indicate whether one or more Head Start or early childhood care center was described in the entry. This
allowed us to draw conclusions about the extent to which research and practice relates to these particular contexts, which
are often governed by laws and rules different from those governing school contexts, for young children’s interactions
with technology and media.

**Purpose.** Third, we looked at components of the scope and purpose of the early childhood interactions with
technology and media. Here, we attended to the number of minutes children spent with technology and media as well as
the academic goals and objectives within specific domains of knowledge/disciplines that were presented in each entry.

**Number of minutes per technology- or media-based activity.** The AAP has held a stance on the use of technology and
media with young children for many years (e.g., 2010, 2011). When the NAEYC/Fred Rogers Center joint position statement
was released in 2012, the 2010 AAP statement discouraged screens in bedrooms, encouraged parents to co-view and discuss
media with their children, and suggested limiting and focusing the amount of time children spent with media. The AAP’s
2011 policy statement addressed media and the youngest children, those 2 years of age and younger, discouraging media use
by children in this age group. In addition, the AAP’s 2011 statement worked to educate parents about the potentially negative
impact of their own television watching on their relationship with their child, and on the child’s development.

In 2016, the AAP group released an updated policy statement suggesting the following, among other things:

- Children younger than 18–24 months should avoid all digital media use except for video-chatting;
- Children 18–24 months should avoid solo media use, but if they do use media it should be high-quality and used
  with an adult; and
- Children 2 to 5 years of age should be limited to 1 hour per day of high-quality programming, with co-viewing.

The U.S. Departments of Education and Health and Human Services policy statement (2016) suggests that the 1
hour per day recommendation for the 2- to 5-year-old group includes both the time spent at home and in early learning
settings, and offers the recommendation that teachers of children 6–8 years of age “should be aware of how much screen
time is being used across subject areas and at home” (p. 11), but makes no specific recommendations about the total
time the older children (6–8 years) should spend with media. Because of these matters, we coded the number of minutes
children spent with technology or media as part of the context. Our coding system allowed for six levels: unable to
determine; less than 5 minutes; 5–10 minutes; 11–20 minutes; 21–45 minutes; and 46+ minutes. We elected to record the
number of minutes only in instances in which the entry specified one event for a child or children within a specific age range with a specifically presented or easy to infer number. For example:

- Danby and colleagues (2017) described video recorded interaction of a child’s use of a computer game in his home. The authors employed conversational discourse analysis in the study and included time stamps for the excerpts in their chapter. From these, we were able to conclude that the 4-year-old boy was using the game for a bit more than 12 minutes, 43 seconds because Excerpt 4 begins at that time. Accordingly, this interaction presented in this source was coded as 11-20 minutes of use;

- Simcock, Garrity, and Barr (2011) described infants’ experience with DVD media. In their description of the study procedures the authors state, “The media demonstration was repeated twice in succession, which took approximately 1 min for both the video and the book” (p. 1610). This instance was coded as less than 5 minutes; and

- Savage and colleagues (2013) described children’s use of a literacy program presented on a computer: “[T]he investigators then presented and reviewed a suggested format for the teachers to use during a 1-hr ABRA lesson that specified 10 minutes of word-level work, 10 minutes of text-level work, 20 minutes of collaborative work, and 20 minutes of extension activities.” (p. 315). Later in the method section, Savage and colleagues pointed out that the 20 minutes of collaborative work did not have to be done with the computer. Because of this, we figured that, even if you take out the 20 minutes of collaborative work several days per week the students would be involved with computerized content for 46+ minutes per day, on average, for this intervention.

We found a need to code many of the interactions described in the sources as “unable to code” for two reasons. The first reason was when there was no single event described from which we were able to identify a time for a child’s interaction with technology or media. This applied for entries with multiple parts, often with no consistent structure for procedure (e.g., Geist (2012) and Nansen (2015) described a range of possible experiences with technology or media an infant might encounter, ranging from a few moments to several minutes; Plowman (2012) described multiple design experiments in which children’s interactions varied as functions of the media design) and for those studies in which there was no description of any child 0-8 years of age who directly interacted with the technology or media (e.g., Bassok, et al., 2016; Montelongo & Hernandez, 2013; York & Loeb, 2014). The second instance we were “unable to code” for the time a child spent with technology or media was when there were children of multiple age groups described in aggregate. In these instances, children were studied in more than one age group, but we were not able to disaggregate the information on time by the child’s age from the primary source.1

Domain of knowledge. We coded each entry in the database related to the content area objective that could be extrapolated from the description of the children’s interactions with technology or media from our sample. Our approach to coding here was not to be mutually exclusive, as early childhood teaching and learning commonly integrates an interdisciplinary approach. As an example, Aladé, Lauricella, Beaudoin-Ryan, & Wartella (2016) used an app to provide children scaffolds for learning how to measure length and height in nonstandard units. In this study, we coded the child’s use of the media to be focused on both language and math (i.e., tall and long as mathematical concepts and key vocabulary terms). The four main content areas, or domains of knowledge, which we found in our sample are science, math, literacy, and language, but we also found examples of art, music, and social studies.

The content: technology/media variables. We coded for technology and media types across three variable sets: device type, software, and media content. When considering the device type, we created a single variable that was to be coded as mutually exclusive (i.e., only one code for device type per entry). Our coding method allowed for the following

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1As example: the survey from Common Sense Media (2013): Item 17 “Thinking just about YESTERDAY, about how much TIME, if any, did [CHILD’S NAME] spend”; and, the survey from Marsh et al., 2015: Item A-Q3a “On a normal weekday, how much time does your child spend using the devices they have access to?”
device codes: TV/DVD player; iPod; tablet; computer with mouse; laptop computer; interactive whiteboard; gaming console; digital camera (stand-alone); cellular/smart phone; robot (screen free); multiple device types; and device type not specified. We also had a text variable field for elaborating on the device type.

For the software variable set, we indicated whether each entry explicitly named one or more pieces of software or application. When the entry did name one or more specific software or application, we typed the name of the software into a second text variable field to allow for future analysis of the content being utilized in practice and in research.

For the media variable, we considered two factors that emanate from a rich body of work on children’s learning from television media (e.g., Richert, Robb, & Smith, 2011; Vossen, Piotrowski, & Valkenberg, 2014). First, we asked whether the media content contained a trusted character from another media type (e.g., TV character in app, book character in app). Second, we asked if the media was from a trusted source (e.g., PBS, Sesame Street). These criteria align with the recent recommendations from the AAP (2016) and the guidelines presented by the U.S. Departments of Education and Health and Human Services (2016).

**Social, emotional, and learning readiness variables.** As a final layer of coding, we examined social, emotional, and learning readiness constructs within each of the entries we sampled. Social and emotional learning involves “fostering social and emotional competencies through explicit instruction and through student-centered learning approaches that help students engage in the learning processes and develop analytical, communication, and collaborative skills (CASEL, 2012; Friedlaender, et al., 2014)” (Weissberg, et al., 2015 p. 31). Social emotional skills may be taught, modeled, practiced, and applied across contexts in which children live, work, and play. Moreover, there is evidence to suggest that the employ of social emotional programming in early educational settings enhances children’s social and emotional competence (Bierman & Motamedi, 2015; Rimm–Kaufman & Hulleman, 2015).

Facets of social emotional programming include developing a child’s social cognition, building attachment, recognizing and dealing with emotions, and learning to self-regulate (Bierman & Motamedi, 2015). A large part of social cognition is creating a shared vocabulary to describe social norms and to identify emotions in oneself and in others. These concepts can be evident in conversational exchanges or in evaluations of the context for interaction. We looked at the external supports, like the adult’s verbal and physical prompts and the positivity of the classroom or home context, in order to help children regulate their emotions and behaviors. Opportunities for children to practice skills like basic friendship and play, emotional understanding, intentional self-control, and basic social problem solving need to be presented and engaging, experiential, and concrete in the early years. In addition, Bierman and Motamedi suggest that children receive feedback and positive consequences as they learn these skills.

In our first pass, we attempted to identify entries that contained a direct measure or assessment of any social or emotional outcome or process. Many of the measures we looked for emanated from review chapters addressing assessment of social and emotional learning [SEL] in educational contexts (e.g., Denham, 2015; Elliott, Frey, & Davies, 2015; Marzano, 2015), but others emanated in our sample: Chung, Vanderbilt, and Sores (2015) coded videotaped sessions for communication, positive affect, and aggression; DeRosier and colleagues (2012) asked teachers to rate their students’ social skills to help validate their data in their game designed to teach and assess social skills; and Marsh and colleagues (2015) coded the software for categories of play afforded by the apps (based on Hughes, 2002). We documented these and then proceeded to

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**CASEL’s Five Core Social and Emotional Learning Competencies**

1. Self-management
2. Self-awareness
3. Social awareness
4. Responsible decision making
5. Relationship skills
look for any additional indicators that the entries could serve as rationale for or against the notion that a child’s social or emotional development or learning readiness could be supported by elements of the content (i.e., the technology and media itself), or by an element within the child’s context for use (e.g., an adult or peer).

To help us, we first identified several social and emotional constructs relevant to our study. These were identified, in part, by consulting with the CEEL0 FASTfacts (Connors-Tadros, 2013) brochure and supporting research base (including the CASEL Guide for Effective Social and Emotional Learning Programs Preschool and Elementary School Edition [2012], and through review of the Handbook of Social and Emotional Learning: Research and Practice [Durlak, Domitrovich, Weissberg, & Gullotta, 2015]). The research team and the faculty associated with the Fred Rogers Center also met and discussed the list of constructs generated from the aforementioned handbooks and reference materials. The research team and its advisers (see Appendix 2) arrived by consensus at a list of constructs relevant to the scope of this research study and began to look for instances of those constructs in the entries we were coding.

We looked for more global constructs often associated with social emotional learning in the open coding stage of analysis, but, in the absence of outcome measures of these constructs, it became cumbersome to manage so many multifaceted constructs through coding. As an example, we looked globally for executive function initially because three entries identified the construct in the title and design of the studies (Flynn, 2013; Lillard et al., 2016; Merz, et al., 2016), but, given the multifaceted composition of executive function—behavioral control, recognition and control of emotions, error processing, working memory, rule following, weighing risks and rewards, determining reactions and responses (Center on the Developing Child, 2017)—and the overlap of some of the smaller components of executive function with the competencies of social emotional learning (e.g., self-awareness and self-management as described in CASEL [2012]), we elected to code for the smaller facets of the social or emotional constructs appearing in the theoretical literature. As such, some of the more global constructs in our analysis do not come through in our results, because there were few instances of all of the larger constructs as they were defined in the literature. For example, self-management, as defined by CASEL (2012), and emotional response from Harvard’s Center on the Developing Child (2017) were broken apart and ended up being integrated into four codes: dealing with frustration, dealing with mistakes, mindset, and positive risk. While coding, we evaluated each entry in our sample by asking the following guiding questions:

• Is there a component of the context or content described in the entry that could, with reason, indicate that the technology or media could be a support for a child’s social or emotional development, or the child’s readiness to learn? In other words, is there evidence to suggest that the child’s use of technology or digital media could provide some benefit to whole child development?

• Does the description of the technology or media indicate that a child’s interactions with it could, with reason, potentially harm or detract from the child’s social or emotional learning or make them less ready for school? In other words, is there evidence to suggest that the child’s use of technology or digital media could provide risks to whole child development?

Initially we tried to use a binary yes/no coding but found fairly quickly that several entries we coded presented a balanced/mixed perspective while others simply did not address the target variable in any clear way. Because of this observation, we ultimately employed four levels of coding for each variable in the set: supporting; mixed evidence; detracting from; and does not contain any evidence. Our coding allowed for multiple variable codes, but only one level per code, to exist on any part of an entry in our database, so a study could have data for two social or emotional variables, but each could only be assigned one level.

Because much of the content that we eventually coded for these variables was embedded in a wide range of places within each entry, we utilized keyword search strategies, detailed in Appendix 3, to help initially identify social,
“Imagining something may be the first step in making it happen, but it takes the real time and real efforts of real people to learn things, make things, turn thoughts into deeds or visions into inventions.”

emotional, or learning readiness constructs. These searches drew our attention to content within each entry that topically related to our interests in this variable set. We also attended carefully to all discourse samples and any dependent variables measuring social, emotional, or learning readiness outcomes as we enacted coding for this set of variables. After coding through the first 5% of the sample looking for a large range of social and emotional constructs, we determined a need to narrow what we were looking for, and so we elected to continue to code for the five most frequently coded social or emotional constructs: dealing with frustrations, dealing with mistakes, mindset, taking positive risks, and developing empathy or awareness of another’s emotional state or point of view.

Following this decision, and entering the second phase of coding and preliminary analyses of the data, we revisited the coding strategies applied and read additional material from the archive at the Fred Rogers Center. We added to the pool of social and emotional constructs by seeking out examples of interactions within our data set that could arguably support learning readiness for the child as Fred Rogers and Barry Head (1983) described. The five most frequently coded social emotional constructs and the six indicators of learning readiness together yielded the 11 social, emotional, or learning readiness variable codes. These are described below with attention to the sorts of evidence we sought through our coding process.

**Dealing with frustration.** Frustration is an emotion that arises when the path toward a goal is blocked. As a result of the block, we try to clear the obstacle and can be successful or unsuccessful in our attempts. When we are unsuccessful in removing the block, feelings of anger can emerge. When children move from frustration to anger, we see fewer instances of goal achievement and can see less confidence and motivation in the child’s ability to achieve their goals. On the other hand, if the frustration is met with calmness and strategic thinking, the child will likely be more poised to find another way to attain their goals.

When a child is frustrated there are typically overt cues that signal the child is experiencing a strong emotion. These include gestures, words, and facial expressions signaling anger, sadness, confusion, or hostility (e.g., Iverson & Thelen, 1999; Shiffrar & Pinto, 2002; Smiley & Huttenlocher, 1991; Wierzbicka, 1995). We looked for these behavioral and linguistic cues in the entries we coded and then determined whether the subsequent set of responses or actions were supportive in helping the child dealing with this emotion, or if the subsequent actions were not supportive. Examples of supportive responses included the following: prompting the child to ask for help, change goals, or take a break and try something else for a while that would generate more positive feelings to counter the feelings of frustration. Sometimes, the child also initiated these appropriate responses on their own and these were coded as well. Not supportive responses substantiated a detracting from level of coding and included doing nothing to prompt the child to move on to something else, or observations of the child doing the same thing and expecting different results.

**Dealing with mistakes.** A mistake is defined as an action or judgement that is misguided or wrong. Synonyms for this word include error, misinterpretation, miscalculation, and misinterpretation. Classifying an action or a response as a mistake requires that you have knowledge of the goal or intended purpose of the action. Mistakes occur in academic and in social contexts. Oftentimes, children first become aware of their mistakes by someone telling them about it: “Six plus one is not nine, try again.” Or, “You kicked Karim. Did you mean to?” Making a mistake often carries natural consequences: You do not score as high on your assessment, or Karim’s leg is hurt and he is upset.

Most experts suggest that children are capable of dealing with mistakes without adult intervention, but that adults being empathetic and teaching some strategies for dealing with mistakes could help children move through the emotions (sometimes frustration and sadness) that follow becoming aware of a mistake. Several episodes of *Mister Rogers’ Neighborhood* dealt with teaching children healthy ways to deal with the mistakes they might make. In episodes 1576 through 1580, Fred Rogers showed children how to correct mistakes, how to persist through mistakes by trying again, and how to encourage and help friends who might make mistakes. He conveys a clear message: we can learn from our mistakes.
In this variable, we looked first for instances in which there was a mistake documented in the entry. This primarily related to more academic than social mistakes and included errors in writing or math, or children “pressing the wrong balloon” in game play (Yelland & Gilbert, 2014, p. 8). We then looked at what followed the mistake—nothing, or perhaps a shifting of attention to another activity, or sometimes an adult pointing out the mistake and/or providing assistance, and sometimes the child trying again. When the child figured out an appropriate way to deal with the mistake, we coded the entry as supportive. Sometimes, the entry simply mentioned the mistake and offered no additional information about it. In these instances, we coded the entry as no evidence supporting or detracting from the child’s ability to deal with mistakes.

Mindset. Dweck (2006) identified that some people believe their intelligence or talent create their success while others believe their talent and intelligence can be developed through dedication and hard work. People that embrace what Dweck calls a “growth mindset” love learning and persist when they are faced with challenges. They recognize that they have a choice and persist through frustration and mistakes.

When we coded for this variable, we identified instances in which the children described in the entry clearly (a) had a choice on what to believe about themselves, and (b) were challenged by the choice. When these two conditions were met, we coded the entry as providing evidence of supporting growth mindset.

Taking positive risks. Risks, good and bad, are inevitable. A good, positive risk is an action, behavior, or activity that is precipitated by careful thought and involves deciding to move toward the edge of safety or danger. Parents, caregivers, educators, mentors, and siblings or peers are the conduit for teaching children when, whether, and where to take an emotional or intellectual risk. We know that positive risk-taking can be encouraged and supported through modeling decision making processes around risks, by talking about and modeling a willingness to fail, and by recognizing and rewarding children who take positive risks.

We specifically looked for instances of these supports in the social context or that were overtly called out in the discussion of digital content within our sample. Entries in our sample often alluded to perceived negative risks associated with technology and media; cyberbullying and exposure to violent or sexual content were frequent in our sample. These were documented as related to this variable, but the level decision was based on whether or not the adult allowed for the child to take the risk, and whether or not the child’s action was mediated by another person. When both of these conditions were met, we utilized the supporting level of the variable code. If neither condition was met when a risk was mentioned, we indicated the detracting level of the variable.

Empathy or awareness. CASEL (2012) defines social awareness as “the ability to take the perspective of and empathize with others from diverse backgrounds and cultures, to understand social and ethical norms for behavior, and to recognize family, school, and community resources and supports” (p. 9). Modeling empathetic responses, teaching point of view, using literature to teach different perspectives, listening actively to others, and being aware of your own physical and linguistic responses to others are suggested ways of building empathy and awareness in children. We identified instances of these behaviors in our entries and enacted the supporting level of the variable when one or more of them were present. When we enacted the detracting from level for this variable, there was specific discourse around harmful risks to children’s developing empathy as a consequence of their interactions with technology or media.

Sense of trust. Fred Rogers often said, “One of the first things that a child learns in a healthy family is trust” (U.S. Congress Subcommittee on Communications of the Committee on Commerce, 1969). Trust is important for all children to develop and is best learned from caring adults. Rogers and Head (1983) suggested when trust is absent, fear can take its place. Reliably and lovingly providing comfort or care to a child in distress or need, sharing in games or other activities that interest the child, and acknowledging the need for rest are ways to facilitate a child’s growing sense of trust. When we coded our data, we enacted the supporting level of the variable when the entry detailed responsiveness, shared interest, or recognition of a need for rest. We enacted the detracting from level of the variable in instances when the technology or media interfered with a need for responsiveness, or created obstacles with respect to sharing common interests.
“When the integration of technology and interactive media in early childhood programs is built upon solid developmental foundations, and early childhood professionals are aware of both the challenges and the opportunities, educators are positioned to improve program quality by intentionally leveraging the potential of technology and media for the benefit of every child.”

–NAEYC & Fred Rogers Center Joint Position Statement, 2012
Sense of self-worth. Rogers and Head (1983) identified four components essential to a child’s developing a sense of self-worth: understanding that each human is unique; understanding that we are each loveable and capable of loving; feeling that they are able to learn and knowing that learning is worthwhile; and an ability to exert self-control when it is necessary.

When we coded this variable we identified four indicators of a child possibly developing a sense of self-worth. The first was an honest recognition and praise for a child’s actions or effort. This recognition provides a child with an external source of esteem. Second, we looked for instances in which technology or media was used to help families appreciate the positive steps children make in their development. This creates a climate that can enhance and support a child’s self-worth. Third, we looked for instances of respect for the child. This occurs by offering choices, when appropriate, or explaining the reasons behind rules or adult decisions. Fourth, we looked for instances in which the child was gaining competence. This occurred when an adult encouraged independence, provided opportunities for success, reduced challenge and frustration and increased opportunities to practice and play, or offered diverse and creative processes through which a child might express his or her ideas or feelings. When one or more of these indicators was present in an entry, we coded the example at the supporting level of the variable.

Curiosity. Children naturally possess a strong urge to explore, to try out, and to understand. If a child’s curiosities are nurtured and flourish, they are well-poised to learn. When children are curious they feel excitement in discovery and “gain a sense that they and their world are wondrous creations and see that people are indeed capable of creating and doing wonderful things” (Rogers & Head, 1983, p. 172).

Kashdan and colleagues (2013) suggested that curiosity can be activated from the bottom-up or from the top-down. A child searching for the cause of an observed effect whose wondering is encouraged by a caregiver or educator is demonstrating bottom-up curiosity, whereas a child searching for novel and/or challenging stimuli within a context is experiencing top-down curiosity. In a bottom-up scenario, the behavior is extrinsically reinforced. In a top-down scenario, the behavior is intrinsically reinforced by the pleasures experienced through engagement in the search itself.

We identified instances in our entries in which children were placed in control of deciding to follow their interests or when their choices and abilities may have been determined by others. Conversational interactions as part of the social context frequently provided the evidence we needed to code entries for this variable, but the practical examples, ideas, suggestions, and tips that mentioned exploration were also coded for this variable. We enacted the level detracting from for this variable when a feature of the context or the content explicitly did not allow for the child to explore and engage in top-down or bottom-up curiosities described in the entry.

Capacity to look and listen carefully. Rogers and Head suggested that sustained attention fosters deliberate thought. When a child looks or listens carefully, they are often described as being observant. A child might observe the properties of objects (e.g., color, temperature, odor, sound, or texture) or they might observe patterns of cause and effect in our social context (e.g., a knock at the door is often followed by our dog barking). Looking and listening carefully can be the outcome of curiosity, but this is not always the case.

For this variable, we documented instances in which children were asked to visually or auditorily attend to something in their environment. Next, we looked for identified conditions that resulted in maximized or reduced child attention and coded those at the supporting or detracting from levels of the variable, respectively. When a condition worked better or worse for some children, or more effectively in some conditions over others, we coded at the mixed evidence level of the variable.

Capacity to play. Children engage in their own kind of thinking about the world through deliberate and sustained play. When a young child engages in play with a caregiver, the child builds trusting relationships and learns that they are loved, important, and fun to be around. In addition, the child also develops physical/motor, cognitive, and linguistic skills.

There are three strategies we associated with developing a child’s capacity to play. The first was following a child’s lead and reading their social and emotional signals. The next strategy was ensuring a safe and inviting play space.
The third was inviting or including others in play, which helps to establish relationships essential for moving into more developed or mature forms of play, such as cooperative (Parten, 1932) and rule-based play (Piaget, 1962), or the move toward ludic, or more symbolic forms of play (e.g., Hutt, 1971; Vygotsky, 1997). In our coding, we identified instances of these three strategies and coded them at the supporting level for this variable. When behaviors associated with play, such as cooperation and collaboration, varied as a function of the content or as a consequence of the context, we coded these examples at the mixed evidence level of the variable. When overt discussion of contextual or design features of the content that could harm a child (e.g., too many stimuli or distractions, observations of increased aggression) was presented in an entry, we coded the capacity to play variable at the detracting from level.

**Times of solitude.** We operationalized this variable as instances in which there was time for a child to pause, reflect, observe quietly, or to be alone but not lonely. “For young children comfortable solitude often means being near someone they love” (Rogers & Head, 1983, p. 177), thinking about and feeling important things. Therefore, being alone was not necessarily a bad thing, and Rogers acknowledged that “human beings want to be reminded that we are not alone—that people care about us, even when we are not near” (1996, p. xv).

Revisiting communications from one person to another during times of solitude can help a child develop their senses of trust and of self. Replaying familiar stories through private speech helps a child better understand the problems presented and solutions constructed in the narratives that fill the child’s life and can result in better self-regulation (Harris, 1990). Sitting in a quiet place to take a break from an emotionally tense event can be a useful activity for dealing with frustration or anger. When these behaviors were identified they were coded at the supporting level of the variable. When there were discussions or descriptions of harm or risk to the child’s development from a time of solitude, we coded the example at the level of detracting from.

Rogers suggested that for children to have opportunities to pause, reflect, and observe quietly through his or her interactions with television media, there must be pauses, appropriate pacing, and focus to allow the child moments of quiet solitude. When an entry overtly pointed out concerns about the pacing or focus of the content, we coded this variable at the detracting from level. We did not engage in any secondary analyses of content to verify or refute the classification and description of media described in the entries we coded.

**Establishing reliability among coders.** Four coders, identified in Appendix 1, worked on the data set for this study. The first, and main coder, was the first author of this report. The other three were undergraduate research assistants employed by the Fred Rogers Center, each of whom had interest in psychology and media. The first author explained the goals of the research and coding framework to the other coders, and they worked to first establish 90% or higher inter-rater reliability and consensus on three individual entries from the database. After this was established, the coders worked to independently double code an additional 10% (n=17) of the sample, with the main coder serving as the check. Across the 10% of articles that were double coded, we successfully coded 89% of all of the variable fields the same, with lower inter-rater matches in the set of variables for social, emotional, and learning readiness (of these variables 76% matched across coders). Contextually, the times of solitude variable exhibited the least reliability of the 11 social, emotional, or learning readiness variables, with 62% agreement across coders. All disagreements for all variables were settled by consensus.
ANALYSIS AND RESULTS

In this section we represent our research questions and a description of the analytic procedures we employed to identify answers to the questions. In addition, we present the results for each step or piece of analysis. These results are based on the sample (n=165) entries we described above.

Research Question 1

For our first question, we asked the following: What kinds of technology-mediated interactions have been studied and discussed—with what age ranges and populations, for what purposes, and for what end—since 2011 when the joint position statement was being finalized? The first step in this analysis was to look at the kinds of entries that were in our database. Next, we examined the children involved in the entries we coded. A third step toward answering this first research question involved looking closely at the contexts in which technology and interactive media were being utilized in early childhood. Finally, we examined the content utilized in the entries coded.

Entries coded. Figure 1 reveals that entries of the “Research/Theory to Practice” type occurred most frequently, and the proportion of entries which were funded by public or private awards identified in print in the entry. We also looked at the level of funding/support from public and private sectors for this kind of work with young children. We found that 43.6% (n=72) of the entries we coded were supported through public or private funds. Comparative entries (n=15) were most frequently funded, followed by literature review (n=13) and descriptive entries (n=12).

The most frequent (n=5) instrumentation within the funded, descriptive set (n=12) was a survey mechanism for data collection. Survey mechanisms for data collection were also employed as part of the methods in the funded comparative entries (e.g., Aladé, et al., 2016; McCarthy, et al., 2015; Suskind, et al., 2015; York & Loeb, 2014). We found that the most frequent and supportive instances of social, emotional, and learning readiness codes coming from: a) descriptive studies employing direct observations of children’s interactions with technology and media, or b) formative research utilizing one or more direct observation instrument.
The child. Figure 2 indicates that there is less inquiry about infants (0–18 months) and toddlers (18 months – 3 years) and technology or media use than other age groups. The majority of the entries in our database addressed technology or media use with children from one particular age category (see Figure 2). Four entries were longitudinally designed to examine technology or media in the lives of young children. Foci included the following: exploring the relationship between playing video games and a) aggressive behavior (Von Salich, et al., 2011) or b) psychosocial adjustment (Parkes, et al., 2013); and two technology-assisted interventions (Kasari, et al., 2014; Maddocks & Redmond, 2015). These longitudinal studies exemplify the use of intentional measures to look at social or emotional factors, but largely rely on parent-, teacher-, and self-report forms of instrumentation rather than direct observations of children using the technology or media: Kasari and colleagues (2014) do employ direct observation of children in university clinics with conversation exchange/dialogue as social measure; Maddocks & Redmond (2015) indicate observation of children and teachers in their method, but do not detail any of those data in their analyses or results; and neither of the other two longitudinal studies we coded in our sample (Von Salich, et al., 2011; Parkes, et al., 2013) employed direct observation of children using media or technology.

The studies that examined more than five age categories in Table 2 typically employed a) survey methods of data collection to describe the media use of children 0–5, 2–8, 0–8 years cross-sectionally; b) examples of practice not specific to a particular age category; or c) syntheses of other literature. We examined the count of instances in which the 11 social, emotional, and learning readiness variables described above were coded as supporting or detracting from and compared those counts to the number of age categories coded within each entry. Analyses indicate that there were more frequent instances of supportive social, emotional, or readiness interactions coded in entries focused on children from one or two age categories, while there were patterns related to the number of age categories coded found among detracting from codes within the same variable set.
Approximately 14% of the entries addressed one or more child with special rights and needs or with linguistic diversity and their use of technology or media. We noted a predominant focus on autism within the special rights and needs variable (n=7 entries). Twenty-four percent of the entries in our database addressed participants with low socio-economic status. Other than these descriptive trends, our analyses yielded no relationship among the presence of social, emotional, or readiness constructs in entries addressing a) children from low socio-economic backgrounds compared to children from other socio-economic backgrounds; b) students with one language compared to linguistically diverse children; or c) the children with diverse rights and needs compared to typically developing children.
The context. We examined the extent to which the entries in our database shed light on the issue of adult mediation of the child’s interaction with technology or media. Figure 3 shows there were even proportions of entries with description of a) the child’s parent/guardian; or b) the child’s teacher/child care provider. There are far fewer examples of specialized interventionists/therapists and other types of adults (e.g., researchers, pre-service teachers, or librarians) interacting with children as they use technology or media.

While there is a relatively even split between entries including caregivers (parents and guardians) and teachers or child care providers in the children’s use of technology or media, there is less balance in the level of support the adults gave for the children’s interactions with technology or media. Our grouping and support variables were utilized to examine the extent to which the other people in the contexts we coded jointly engaged with children and provided support to them as they interacted with technology or media. Here, we found higher frequencies of joint engagement for entries with toddlers and preschoolers than for entries with older children, aged 5 through 8 years.

We also looked at adult mediation patterns as a function of the children’s age. From these data, we concluded that the adults were often described as being present, but without presence, when children interacted with technology and media. Approximately twenty two percent of the entries coded indicated a single child with a single device. These one child with one device interactions occurred primarily in school and laboratory contexts. Even so, some of these entries reported parents, teachers, or other adults as present when children are using technology and media. An adult’s presence, however, did not always imply active, co-engagement. When adults were present, they often supported a child’s use by setting up the device or familiarizing the child with the activity.

In these instances, children were often provided with brief directions from the teacher, caregiver, or researcher present in the context. These adults orient the children to the activities, and may have engaged in discussion of the child’s experiences with technology or media afterward, but the adults do not always support the child’s interactions with active and continuous mediation (e.g., Aladé, et al., 2016; Ciampa, 2015; DeRosier, et al., 2012; Gibson, et al., 2011; Hawkins, et
“Perhaps it is the blending and balancing of interactive technology and interactions with others that offers the most promise for effective and appropriate uses of technology in the early years – closely connecting Fred Rogers’ approach with our emerging understanding of appropriate and intentional use of digital media to support early learning.”

– Chip Donohue, 2015
In general, we found adults were more supportive of the younger children’s interactions than they were with older children’s. This pattern was consistent across home and school contexts (see Figure 4).

![Figure 4. Number of Entries per Type of Adult Mediation](image)

We had also coded the physical location as part of the context in which the child’s interactions occurred. Recall that this variable was coded as mutually exclusive in that each entry could have only one location code. Some entries did describe multiple locations for the children’s interactions with technology or media and were coded as such. Examples of multiple context entries included teachers utilizing media to make home-school connections (e.g., Lozano & Ponciano, 2016), using technology to send behavioral nudges from laboratory to parents involved in home reading intervention (Suskind, et al., 2015), or a multiple case study document in which home and school use were both explored (Marsh, et al., 2015), among others. Figure 5 displays these data.
Twelve of the studies coded as child care center or school or with multiple contexts were specific to Head Start or center-based care (i.e., not attached to a primary or elementary school) providing services to 0–5 or 6 years (e.g., Blagojevic, et al., 2012; DigEdu, 2014; Geist, 2012; Lozano & Ponciano, 2016; Luckenbill, 2012; Marsh, et. al., 2015; Roskos, Burstein, & You, 2012). Within the child care center or school category, the majority (56.9%) of the entries contained the descriptive or research/theory to practice entry codes (from Figure 5). Within the descriptive category, the majority of these studies utilized survey methods of data collection in the home contexts (e.g., AVG, 2015; Piotrowski, Jordan, Bleakley, & Hennessy, 2015; Kabali, et al., 2015; Nikken & Schols, 2015) or direct observational methods (e.g., Danby, et al., 2017; Flewitt, Kucirkova, & Messer, 2014; Livingstone, et al., 2014; Merchant, 2015) of data collection in the child care or school contexts. The majority of the research/theory to practice codes emanated from the child care center or school category.

To address the “for what ends” part of the first research question, we examined the number and corresponding percent of studies by the domain knowledge variable that are presented in Figure 6. From these data, it appears that there is less attention related to the use of technology and media as a tool to support development of children’s non-cognitive, scientific and mathematical understandings. In addition to the domains above, there were also limited examples of art, music, and social studies domains of learning, but these were often tied to one of the four main domains in an interdisciplinary manner. For example, visual components were utilized as part of a graphic organizer in a literacy journal in Hutchison and Woodward’s entry (2014). Additional examples of the interdisciplinarity of domains were also presented in Picard’s study (2014) which compared children’s drawings of houses on a tablet versus paper integrated art and geometry and spatial reasoning (i.e., math), and in Ko and Chou (2014) which presented a theoretical basis for the premise that visual arts and music explorations with technology are supportive of child development.

*A small number of Head Start and/or Early Childhood Education programs and settings are represented within these codes.
The combination of language and literacy represents the most frequent pairing of two domains within a single study. The most frequent combination of three domains is science, language, and literacy. In many studies we were unable to infer any specific content objective from the description of the child’s interactions with technology or media, or from the included description of the technology or media itself. The number and percent of studies with codes present in one, multiple, or no specific domain are presented in Table 3.

Table 3. Context: Studies with Children’s Technology or Media Use Related to One, Multiple, or No Specific Domain Knowledge

<table>
<thead>
<tr>
<th>Category</th>
<th>Number of Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Specific Domain Identifiable</td>
<td>51</td>
</tr>
<tr>
<td>1 Domain</td>
<td>42</td>
</tr>
<tr>
<td>2 Domains</td>
<td>30</td>
</tr>
<tr>
<td>3 Domains</td>
<td>20</td>
</tr>
<tr>
<td>4 Domains</td>
<td>22</td>
</tr>
</tbody>
</table>

When we examined the time children spent with technology or media as a function of the context, we identified a range of times that varied by child age and by physical space, presented in Table 4. The more frequently occurring times are high or within 2016 AAP recommendations. Higher times, 46+ minutes, came from a range of contexts, with three different physical place codes—homes, child care centers or schools, and multiple contexts—all having instances of children spending 46+ minutes of time with technology or media. Some examples of high times include the following:
• Homebound learning that utilized a learning management system to coordinate work from school to home for the duration of the child’s school day (Currie-Rubin & Smith, 2014);

• Students in a school-based robotics program worked in small groups with two students utilizing the computer to read the directions while another two students found pieces and completed the build over 50-minute class sessions (Ferreira, Dominguez, & Micheli, 2013); and

• Two examples of children’s experiences with tangible technology (i.e., no-screen necessary robotics) (Bers, Flannery, Kazakoff, & Sullivan, 2014; Sullivan & Bers, 2015).

There are many entries per age category in which we were not able to extrapolate a single number for a particular child’s time spent interacting with technology or media. Recall from our coding methodology that age variables were not mutually exclusive, so instances that looked, for example, at screen time for all children 0–8 were marked as unable to code for each of the age categories presented in Table 9 below, because children were studied in each of those age groups, but we were not able to disaggregate the information on time by the child’s age from the primary source.

Table 4. Context: Frequency of Entries Specifying Time for Use Within a Single Use/Session

<table>
<thead>
<tr>
<th></th>
<th>Infant</th>
<th>Toddler</th>
<th>Preschool</th>
<th>Kindergarten</th>
<th>1st Grade</th>
<th>2nd Grade</th>
<th>3rd Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5 mins</td>
<td>4</td>
<td>6</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>5-10 mins</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>11-20 mins</td>
<td>2</td>
<td>2</td>
<td>11</td>
<td>8</td>
<td>7</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>21-45 mins</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>46+ mins</td>
<td>1</td>
<td>2</td>
<td>8</td>
<td>10</td>
<td>9</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>Unable to Code*</td>
<td>28</td>
<td>34</td>
<td>54</td>
<td>58</td>
<td>50</td>
<td>52</td>
<td>46</td>
</tr>
</tbody>
</table>

*Unable to identify minutes of time for use for a single described event/session for particular age group, or unable to disaggregate data on minutes of use by age group.

The content. When a single technological device was named in the studies discussed here, tablets or desktop computers were most commonly utilized (see Figure 7). Parallel to this, we identified an additional 30.9% of the studies examining children’s use of multiple device types. Multiple device types were most common in descriptive studies, employing cross-section and survey instrumentation to examine a child’s access to and use of a range of technologies, rather than as description of a child’s use of a range of technologies. In other words, there is a preponderance of research we describe as device agnostic. These studies broadly look to see the range of devices children have access to and use with regularity versus a look to see what experiences children have with the device specific to the focus of inquiry that could theoretically impact children’s background knowledge of a specific task environment. Our analyses yield no significant relationship between any specific device type code and the presence or absence of a social, emotional, or readiness construct in the entry.

One or more specific software or application was named in 53% (n=88) of the entries we coded. Thirty-five percent (n=58) of the studies coded indicated use of a specific, but unnamed, software or application. Approximately
“Human beings want to be reminded that we are not alone—
that people care about us, even when we are not near.”

—Fred Rogers, 1996
34.5% of the entries included characters or storylines that were likely to have been affiliated with media brands or printed media popular in early childhood (e.g., Sesame Street, Disney, Eric Carle, Curious George). There is evidence to suggest that the design of the content played a key role in the social dimensions of interactions (e.g., Cohen, et al., 2012; Palmér, 2015; Wartella, 2016), but a thorough analysis of this possibility was not conducted at this time.

**Figure 7. Content: Device Types**

![Bar chart showing device types](chart)

**Research Question 2**

For our second research question, we asked: What are the ways in which the discussion and research surrounding technology and media for young children provide evidence of the level of support for children’s social and emotional development and learning readiness? In what ways are we encouraging children to do the following: look and listen carefully; sustain their play; engage and expand their curiosities about the world and its people; demonstrate and/or document their own self-worth; establish and build trust; and experience reflective times of solitude as they engage with technology and media?

Before we begin detailing the results of each social, emotional, or learning readiness variable in our sample, we present the following data related to the overall data set. There were 15 studies in our sample that we identified as having direct measure of one or more social, emotional, or learning readiness variable. Despite these few instances of direct measures of non-cognitive constructs, we observed that the majority of the entries we coded (n=121) did contain at least one direct or indirect instance of support for one or more of the 11 social, emotional, or learning readiness variables. Many of the entries (n=27) were coded as suggesting that technology and media could be supportive of a child’s development in these domains across more than half of the 11 variables in the set. Of these entries with dense and positive coding for social, emotional, or learning readiness, the most frequent occurring entry type was descriptive (n=11). The descriptive studies in this set typically employed interview (e.g., Gaskins, 2012; Johnson, et al., 2015; MacCallum & Bell, 2015; McCarthy, Li, & Tiu, 2012) and/or direct observation field notes (e.g., Rowe, Miller & Pacheco, 2014; McCarthy, et al., 2012) as data collection instruments. The second most frequently occurring entry type (n=3) was formative research (Highfield, 2013; Slovak, Gilad-Bachrach, & Fitzpatrick, 2015; Wohlwend, 2013), typically utilizing various types of data collection.
instruments. Survey instrumentation was rarely (n=2) indicated as the sole form of instrumentation in this group of entries with dense and positive coding for social, emotional, or learning readiness variables.

On the other hand, we observed fewer examples of entries coded as indicating evidence that the child’s use of the technology or media described could detract from their social or emotional development, or their learning readiness (n=33). Of these, there were no examples coded as such across more than half of the 11 variables in the set. Moreover, the majority of the entries (n=28) in this set were coded as detracting from one or two of the 11 social, emotional, or readiness variables. We see descriptive (n=12) and research/theory to practice (n=8) entry types most frequently occurring in this set of entries, but there are also more substantial numbers of comparative (n=4) and correlational (n=5) entry types here. Among these entries, we see more frequent employ of survey instrumentation (n=7).

**Dealing with frustration.** We coded 50 examples of dealing with frustration in our sample. In these examples, the child’s experience of frustration frequently occurred by accident or was the result of poor design; load time and unsatisfactory design of the content were frequently attributed to being at least part of the cause for young children’s experience of frustration. For example:

- Paciga (2015) noted that children with less developed digital literacy skills more frequently opted to abandon story listening activities requiring them to click through interactives on the computer story. She theorized that children abandoned the story listening activities when they experienced frustration in navigating the digital task environment.
- Livingstone and colleagues (2014) noted a child’s frustration with some apps: “She was melodramatically frustrated with loading times, and when it went wrong” (p. 21).
- Yelland and Gilbert (2014) documented that the child’s ability to hear the sound only once, and the clumsiness of the action on a tracing game rendered an app not useful in their study’s context.
- Nikolopoulou (2014) drew attention to early childhood teachers’ perception that children get frustrated when they do not produce drawings as well on a digital interface as they do when they draw with traditional materials. Teachers in this study opted to not use the digital tools, thus externally regulating the frustration–initiating scenario in the child’s reality. The author here points out that the teacher could have better supported and guided students’ digital drawing experiences.
- Plowman (2012) advises designers of interactive content that “sometimes creating interactivity can get in the way of the educational potential and can actually be an impediment to a child’s learning if they don’t understand what they need to do or don’t have the fine motor skills to do it” (p. 18).
- Cohen and colleagues (2012) suggest that “the risk of frustration and boredom is high unless game challenge is sustained through leveling” (p. 5).

In addition to these content–related contributors to frustration, we also identified several context–related factors that suggested the technology or media provided children opportunities for dealing with frustration that may have been supported by an adult, peer, or the content itself:

- Govus (2012) detailed kindergarten students addressing their frustration with peers. One peer stated that her wiki content had been deleted and asked a peer to not delete anything else: “Out of nowhere Nicole emerged and slowly and calmly she said, ‘That is my page! Don’t do anything to it. Make sure you do not touch my photos too’ while the other boy was left staring at her she continued by adding, ‘You know sometimes my things vanish from my wiki…I hope you won’t do anything.’” (p. 225).
- Wohlwend & Kargin (2013) identified a young boy telling a peer about his frustration when he was not able to make friends in an online virtual world. The peer then shared her strategy.
Kucirkova and colleagues (2014) noted that “occasional frustrations happened and conflicts arose when a child jumped into an activity already started by another child” (p. 181) but noted that these instances were rare and were often settled among children by negotiating whose turn would be next, as well as the length of their turns with the iPad.

Hawkins and colleagues (2014) identify strategies that the child might use when dealing with strong emotions (e.g., deep breathing, win-win solutions, and the use of “I” statements). These strategies are integrated into the content of this social–emotional learning game. A parent communication tool embedded within the game sends parents updates on the strategies the children are learning though the game. For example, “Your daughter is making choices that recognize the power of deep breathing as a tool to manage frustration” (p. 15).

Sometimes, adults manipulated the content to help reduce the potential for the child to experience frustration: Flynn (2013) utilized the “practice” menu option in her study of exergames to reduce the possibility of “children becoming frustrated at the game if they could not succeed at it” and to “play without the risk of failing the song” (p. 65), thus removing the opportunity for children to encounter desirable difficulty in exchange for a more streamlined research design. In other instances, entries suggested that adults frequently give children tablets to “calm them down” (e.g., Medical Xpress, 2016; Radesky, Schumacher, & Zuckerman, 2015) presumably following a feeling of frustration.

**Dealing with mistakes.** We coded 42 examples providing evidence of a child learning to deal with his or her mistakes. Thirty–one of these instances were considered to be supportive of a child’s learning to deal with mistakes. A portion of these discussed experimentation and no–stakes play as the vehicle by which this learning could occur (e.g., Ko & Chou, 2014; Geist, 2012; Govus, 2012; Highfield, 2013), and other entries discussed the programming in the content/software to be facilitative of the child’s recognition of errors (e.g., Baker, 2014; Johnson, et al., 2015; More & Tavers, 2013; Scheutz, 2016; Young & Stover, 2013), arguably one piece of dealing with mistakes. Other entries shared examples of the ways in which a child’s peers or other adults in the context provided support for the child’s dealing with mistakes (e.g., Yelland & Gilbert, 2014; Young & Rasinski, 2013; Zaman, et al., 2016). The structure of the activities themselves help the child learn to deal with mistakes, too, by encouraging debugging in code written by children during robotics explorations (Bers, et al., 2014; Highfield, 2013; Sullivan & Bers, 2015), allowing for children to utilize storytelling apps that “have the advantage of immediate playback and endless opportunities for ‘do–overs’ if children want to revise” (Wohlwend, 2013, p. 75), and reducing the number of steps in the design of the activity to minimize the number of mistakes possible before successfully solving the learning puzzle (Huber, et al., 2016).

**Mindset.** We coded 10 instances of the mindset code in our sample. All of these examples suggested that technology and media could facilitate a child’s growth mindset. There were zero examples suggesting that technology or media detracted from a child’s capacity to develop a growth mindset. Yelland and Gilbert (2014) found children to be “persistent” when using tablets: “…[T]hey displayed intense concentration and focus on the task at hand. Children who often had difficulty sustaining concentration on a specific task, appeared to have no difficulty when engaged with the tablet” (p. 13). Much of this likely has to do with the design of the content and the context in which children utilized the technology or media. We coded many instances of content or context supporting mindset:

- Ciampa (2015) employed e–books from a range of text levels and allowed children choice in their book selection. Students self–selected books that may have been challenging or above their independent reading levels.
- Steckel, Shinas, and Van Vaerenewyck (2015) shared a teacher’s explanation of how children gained keyboarding and spelling skills quickly because of the motivating purpose of exchanging ideas and stories on a classroom blog.
- Young and Stover (2013) and Young and Rasinski (2013) shared examples of digital tools to facilitate text creation and composition. In the former example, children were encouraged to utilize a digital tool to help them become more self–aware of the kinds of edits and revisions that could be completed to improve the quality of the child’s
writing. In the latter example, the authors utilized student-produced movies and emphasized that the goal was not perfect spelling and immaculate grammar, but rather the telling of a good story in a new medium. At the end of the unit, Young and Rasinski prompted reflection with the children to crystallize the children’s learning and growth.

- Baker (2014) captured a child reflecting, “[W]hen you try, you realize you know how to do something” (p. 9), illustrating a child's recognition that he or she had a choice to try or not.

**Taking positive risks.** We coded 26 examples of children potentially taking positive risks when using technology or media. Of these, there are examples of caregiver or professional education efforts addressing the value of the child taking risks (e.g., Edwards, 2015; EU Kids Online, 2014; Wohlwend, 2013) as well as examples of the child directly being encouraged to take a positive risk (e.g., Gaskins, 2012; Ferreira, et al., 2012; Young & Stover, 2013; Xin & Sutman, 2011), sometimes described with positive reward that grew out of the adult’s encouragement and support for the child through a challenge: “[T]he children were beginning to take risks as their confidence with classroom technology grew” (Baker, 2014, p. 9).

The examples coded as not supportive of taking positive risks typically presented the negative risks associated with online interactions and identified restrictive parental action, as the result of the perceived risk of the child’s experience with online social exchanges. Alternatively, active parental mediation, through co-engagement and discourse about the risks of online activity, was often presented as a strategy to minimize the negative risks for children (e.g., Livingstone, et al., 2014; Marsh, et al., 2015; EU Kids Online, 2014). Other studies discussed how the content of the software or media itself could facilitate the child’s positive risk-taking (e.g., DeRosier, et al., 2012; Johnson, et al., 2015; McPake, Plowman & Stephen, 2013).
**Empathy and/or awareness.** We coded 43 instances of empathy or awareness in our sample. Of these, 32 provided positive, supportive discussion around the possibility for technology or media supporting a child’s development of empathy and/or awareness. Nine sources that were coded for empathy or awareness provided a mixed perspective on the extent to which the child’s interaction could be supportive of developing awareness or empathy. Two of these sources provided negative discourse about the possibility of technology and media supporting a child’s development of empathy or awareness (e.g., Radesky, et al., 2014; Walters, 2015).

Oftentimes, the content children consumed or created in sources coded for this variable contained one or more pro-social goals that promoted the child’s development of empathy and/or awareness. For example:

- Wood and Jocius (2014) described two second- and third-grade boys’ use of storytelling apps to explore the topic of bullying.
- DeRosier, Craig, and Sanches (2012) described moments within a game where children are asked to make decisions that demonstrate their awareness of another’s perspective or emotional state.
- Xin and Sutman (2011) utilized digital social stories to support children with autism as they develop social skills, such as empathy or awareness.
- Roskos and colleagues (2012) noted that children exhibited more facial expressions, some of which were interpreted as sympathetic to an onscreen character, with iPods compared to the child’s interactions with larger screens.

Other times, however, the caregiver or teacher utilized technology tools such as video and photo documentation as tools to facilitate self-reflection. For example:

- Luckenbill (2012) concluded that practitioners who engaged in this sort of practice were more likely to become responsive caregivers. Our thinking here is that when empathy and responsiveness are modeled, children are more likely to become empathetic and responsive themselves.
- Rumenapp, Whittingham, and Hoffman (2015) encouraged children to reflect on their own thinking during story time after viewing recordings of discussions, finding that video reflections can prompt children to articulate the origins of their ideas.

**Sense of trust.** We coded 65 entries as containing evidence for supporting or detracting from the child’s development of a sense of trust. Of these, 49 entries suggest that technology and/or digital media can be supportive or beneficial to the child’s developing a sense of trust. We saw instances of children co-engaging with others in joint activities with one person (adult or child) acting as more expert than the other, or as a trusted source/companion. For example:

- Danby and colleagues (2017) shared the experiences of two young boys, the older of whom teaches his younger brother how to make a particular sound effect work in a computer software game.
- Many studies utilized e-books in parent-child dyads to mimic the trust and maternal bond documented in mother-child studies (e.g., Bus & van Ijzendoorn, 1995) (e.g., Krcmar & Cingel, 2014; Hoffman & Paciga 2014; Parish–Morris, et al., 2015; Strouse, Doherty, & Troseth, 2013; Suskind, et al., 2015).
- Gaskins (2012) interviewed young children about their thoughts on robots and one child shared, “[My robot] keeps my secrets. I can tell him anything and he gives me advice (boy, 10, France)” (p. 7).
- Wohlwend and Kargin (2013) documented and analyzed collaborative play in online worlds in which peers sat in close proximity to one another, shared materials, and provided visual and verbal scaffolds to model effective game playing strategies.
We saw instances of technology and media connecting children’s school or care lives to their at-home lives, providing content and context for, as Fred Rogers suggested, “Strengthen[ing] the parent,” to, in turn, “strengthen the child” (Rogers, 1994, p. 156). Some of these provided support for caregivers’ developing understandings of their child’s development, and others provided activities for caregivers and children to do together. For example:

- York & Loeb (2014) utilized a text messaging intervention to provide preschool parents “fact, tip, and growth” texts to facilitate consistency and efficacy in parents’ interactions with their child just prior to the child’s transition into kindergarten. These text messages arguably facilitated discussion around topics that were of shared interest between child and caregiver.

- Edwards-Gaura, Whitaker, and Self-Brown (2014) utilized a social media group to help parents whose children were classified as at-risk for child maltreatment learn to use developmentally appropriate rules and consequences for children. These rules and consequences could provide the children with consistent, predictable expectations for behavior.

- Rowe and colleagues (2014) sent digital cameras home with children so they could create e-books in school about their personal belongings and their home lives; they also provided children opportunities to share these text creations with their peers and their families.

- Suskind and colleagues (2015) worked with parents to set goals for the number of minutes they read with their children each evening and sent them text reminders of their progress toward their goals. Setting aside time to prioritize a relationship with a child helps establish trust.

**Sense of self-worth.** We coded 54 entries for sense of self-worth. One study (Von Salich, et al., 2011) employed a direct measure of this construct—children were asked to evaluate their own academic self-competence and global self-worth. Von Salich and colleagues found that a child’s perceived self-competence was not a significant factor in explaining the finding that openly aggressive youngsters tended to select more violent video games over time. Of the other studies coded for self-worth, the majority suggested children’s sense of self-worth grew in positive ways through their experiences with technology or media. The entries we coded suggest that children exhibit self-efficacy and optimism when they create and communicate through technology:

- Baker (2014) studied children in her own classroom action research project in which she infused more technology into her classroom she noted, “Greater legibility of typed pieces encouraged children to publically display their efforts, which provided more frequent opportunities for positive feedback” (p. 10).

- The teachers in Edwards’ (2015), Rowe and colleagues’ (2014), and Wohlwend’s (2013) studies actively worked to integrate children’s home cultures and/or languages into their formal study at schools or child care centers. In their professional development efforts with teachers they worked with teachers to help them realize that accepting children’s commercialized media interests enables social connections among children and avoids sending the message that “what is loving and comfortable doesn’t belong here” (Wohlwend, 2013, p. 3).

- McPake and colleagues (2013) documented children’s learning about the purposes of communication through digital technologies. Here, a brother and sister learned that they were valuable communicative partners with family members living in another country. The same argument could be made for the children communicating, often in dialogue, in a number of the other entries we coded (e.g., Coiro, 2015; Danby, et al., 2017; Flewitt, et al., 2014; Micklos, 2012; Palmér, 2015; Roseberry, Hirsh-Pasek, & Golinkoff, 2014; Rowe, et al., 2014; Wood & Jocius, 2014; Young & Rasinski, 2013). Other times, children were invited to show and share actual products of their work for which they received immediate peer and teacher recognition (Bers, et al., 2014; Sullivan & Bers, 2015).
“All of us, at some time or other, need help. Whether we’re giving or receiving help, each one of us has something valuable to bring to this world. That’s one of the things that connects us as neighbors—in our own way, each one of us is a giver and a receiver.”

– Fred Rogers
In addition, we noted a shift in caregivers’ and educators’ perceptions of children’s academic achievement when using technologies or media as a tool to engage them in the learning, especially in instances in which the adult did not expect the child to be able to understand the academic content or to complete the academic task. An adult’s recognition of a child’s ability to engage in difficult content can reflect on the child’s sense of self-worth: “They think I can do this. I am good enough.” York and Loeb (2014) and Fuller, Lizárraga, and Gray (2015) tell of interventions encouraging parents via text message. York and Loeb focus specifically on parents engaging their children to find out what skills their children already had and to support their literacy learning. The result of this intervention yielded demonstrable impact on children’s overall literacy, which likely made the children and parents feel more positive about engaging in some of the academics in school. Fuller and colleagues cast a wider net to look at the ways in which social networking and digital messaging impact the lives of Latino families and children, pointing out that texting is a convenient way to receive ideas for educational “activities...yield[ing] positive responses from their young children, inducing growing demand for additional ideas and stronger feelings of efficacy as a parent” (p. 48). Also, MacCallum and Bell (2015) documented a child’s use of digital tools to build an e-book which was shared with the child’s parents. The parents read the e-book and discussed it with the child and prompted some revision and expansion of the text. When the child completed adding to and revising the text, the parents were “particularly pleased...” (p. 35). McCarthy and colleagues (2012) described a parent as “impressed that [her] son is using operations, geometry, spatial sense, measurement, data collections and analysis, algebraic thinking” (p. 4). Moreover, the parent indicated that she would include these concepts from the experiences with math apps as part of the intervention in home learning experiences. Whether or not the child directly received this information from the parents remains unknown, but often when parents see good in children, the children seem to gain a more secure sense of self-worth. The parents “felt empowered to teach their children with the support provided by the intervention program, and subsequently became more aware of their children’s abilities, interests and difficulties” (p. 3).

We found entries suggesting caution was needed as we weigh the benefits and risks of technology and media as related to supporting children’s self-worth. These codes were less frequent than the instances already discussed as supporting the child’s sense of self-worth. Some caution emanated from the concern over the adult’s use of media pulling away from joint engagement (e.g., AVG, 2015; Radesky, et al., 2014). Nathanson (2015) suggested that lower caregiver-child attachment could be correlated to higher uses of media, while others suggested that the child’s disposition or emotional state is at the root of increased media use (e.g., Kabali, et al., 2015; Medical Xpress, 2016). Yet others suggested that media bridges a cultural gap related to parents’ feelings of unfamiliarity or lack of qualification to support children (e.g., Maddocks & Redmond, 2015; Njoroge & Elenbaas, 2013; Vaala, et al., 2013). These situations raise concerns about the child’s experience of more solitary time with technology and media and a lower sense of self-worth, of the sort documented in the survey by AVG (2015).

Other instances coded as potentially detracting from a child’s sense of self-worth indicated that the child’s skill/ability or the design of the media could influence the child’s sense of self-worth. In Wohlwend and Kargin’s (2013) study, the researchers documented one child’s struggle to engage in social interactions in an online environment. The child concludes, “Hey, you’re like getting so many friends! I’m not” (p. 94). Children engaged in guessing for the correct answers—a behavior commonly observed when children interacted with math apps classified as strong framing/strong classification—got less feedback on their learning from teachers than children using apps with other design profiles (Palmér, 2015), and use of extrinsic rewards as design features were rated as less desirable than simply having engaging content (e.g., Ihmeideh, 2015; Marsh, et al., 2015; Sobel, et al., 2016).

**Curiosity.** We observed 70 instances of the code for curiosity, the majority of which provided evidence to suggest technology or media can support or promote children’s curiosity, ability to pursue study based on their interests, or to facilitate wondering. The entries coded for this variable document children’s curiosity about the technology and media itself (e.g., Cohen, et al., 2012; Holloway, Green, & Stevenson, 2015) and as a tool for exploring other areas of a child’s personal interest (e.g., Bradshaw–Truesdale, 2013; Gaskins, 2012; Steckel, et al., 2015;
In several of the examples here, the technology gives children and early child care professionals tools to document, explore, discover, and reflect.

Also, we noted the adult describing the need to allow children to be curious about the technology or media (e.g., Bird, 2013; Luckenbill, 2012; Rowe, et al., 2014). For example, “You have to let them play with it first or they will use it in an inappropriate manner. They’re curious and they are going to try and go places where they can’t go” (Cameron, 2015, p. 75). In others, adults involved in the child’s interactions with technology or media recognized how following a child’s interests can promote academic and/or social emotional growth (e.g., Coiro, 2015; Danby, et al., 2017; Edwards, 2015; Merz, et al., 2016; Nikolayev, 2016; Suskind, et al., 2015).

Features of the context or the content could impact the child’s ability to pursue his or her curiosities. Several robotics studies (e.g., Bers, et al., 2014; Highfield, 2013; Sullivan & Bers, 2015) allowed time for children to test and revise their hypotheses. The result of this was increased time with the technology. Self-selected topics and project-based learning (e.g., Falloon, 2015; Ferreira, et al., 2012; Salyer, 2015; Young & Rasinski, 2013) allowed for children to personalize their learning experiences and to engage in socially collaborative work that was mediated by technology and/or media. When these contextual conditions were met, entries often indicated children carried over their investigations from school contexts into home (e.g., Bradshaw-Truesdale, 2013; Falloon, 2015; Govus, 2012).

The entries addressing the design of the content as it relates to the child’s learning clearly suggest that design impacts a child’s utility of the media to engage their curiosities: “Curiosity about other apps increases as patience with the current app decreases. If the interface of an app is not intuitive or does not readily afford access, children will engage in trial and error efforts, and then quickly move on” (Cohen, et al., 2012, p. 7). In addition, parents were less likely to use apps that were “too complicated” for the child (Nikken & Schols, 2015) and were more likely to restrict their child’s use of such media, rather than to co-engage with them and provide additional supports.

**Capacity to look and listen carefully.** We observed 94 instances of the code for children or adults in early childhood contexts using technology or media to facilitate the child’s looking or listening carefully. From the mean comparison studies in this code set, it is clear that children learn processes more effectively from animated and narrated content than from still images (e.g., Strouse, et al., 2013), that children can imitate (e.g., Simcock, et al., 2011), learn, and transfer skills from new interactive and non-interactive media technologies (e.g., Aladé, et al., 2016; Huber, et al., 2016), and, in many cases, young children still require adult mediation for optimal learning (e.g., Parish-Morris, et al., 2015; Nikolayev, 2016).

Among the other entries coded for this variable, we note that many overlapped with the curiosity code. We see what we call “shallow” and “deep” examples of looking and listening carefully. Shallow examples may include an academic objective or purpose, typically determined by someone other than the child. In other words, shallow examples were not typically child-directed, but they did involve the child engaging in an activity in which he or she was asked to attend to a visual or audio source to meet some learning objective (e.g., use the e-book dictionary or other interactive feature to listen to the word’s meaning, see Paciga, 2015; Shamir & Baruch, 2012; Wright, Fugett, & Caputa, 2013).

There were only a few examples of deep looking and listening in our set, compared to the multitude of shallow examples of looking and listening we coded. Within the deep examples, the looking and listening was child-initiated and involved the sustained attention of the child when he or she had other competing content or factors within the context to which he or she might attend. For example, Edwards (2015) documented a child’s interest in Spiderman and utilized technology tools to engage the child’s curiosity about spiders by engaging in internet research about spiders and by composing a synthesis of his learning through a digital puppet performance. Govus (2012) asked her kindergarten children to use blogs with photos, videos, and written text to document their learning—an invitation to which the children responded with enthusiasm and productivity. The kindergarten students designed YouTube videos to tell about drawings and uploaded data related to a study of plants to their individual wiki pages within the classroom blog tool.
Bers and colleagues (2014; Sullivan & Bers, 2015) and Highfield (2013) included exploratory time during which children could come to understand what robots could and would do when given child-created code. Bers and colleagues observed significant improvement over a six-lesson unit and suggested, “The improved scores might be attributed to the fact that children had more enthusiasm for these personally-selected projects that would soon be part of a show-and-tell celebration as well as more time to experiment at their own pace than in the lessons” (p. 154).

**Capacity to Play.** We observed 62 instances of play in our sample. Forty-three of these described technology or media as being supportive of the child’s developing capacity to play or to sustain play. Multiple studies documented similarities between play scenarios online and offline (e.g., Bird, 2013; Edwards & Bird, 2015; Holloway, Green, & Livingstone, 2013; Marsh, et al., 2015). The examples coded for this variable included many types of play: creative (e.g., Coggin, Wohlwend, Bucholz, & Husbye, 2014; Kucirkova, et al., 2014; Rowe, et al., 2015; Wohlwend, 2013), exploratory (e.g., Flewitt, et al., 2014), pretend (e.g., Wohlwend & Kargin, 2013), and active play (e.g., Bradshaw-Truesdale, 2013; Chung, et al., 2015; Staiano & Calvert, 2011). Other than two examples stating the need to balance a child’s digital experiences with outdoor play (NAEYC/Fred Rogers Center, 2012; Stewart, 2011), there were no examples of outdoor play activities in our sample. Moreover, the integral role of the social dimension of the context rang out in this code; when there was active, joint engagement, children’s play was affected:

- Edwards (2015) documented that children’s play was sustained and extended when teachers engaged children’s interests in digital media content and/or technology-enabled platforms in their center-based pretend and creative play.
- Chung and colleagues (2015) observed increased positive affect in autistic children when co-playing active, augmented-reality video games, compared to the affect observed while co-playing less active, sedentary video games.
- McCarthy and colleagues (2012) documented that parents engaged in co-playing apps with their children, extending their play.

In addition to the social context, we identified the child’s use of the technology or media as a tool or prop in their play as commonly coded as supportive of facilitating children’s capacity to play (e.g., Bird, 2013; Marsh, et al., 2015; Wohlwend, 2013). McPake and colleagues (2013) noted children utilizing cameras in unrestricted exploration, and as a tool to help embellish existing narratives and to help create their own. In addition, the authors noted that children utilized video viewing and listening to music in times of solitude to become more acquainted with the narratives and themes presented in the media content, and then as the subject of performative play by way of reenacting familiar narratives, stories, and songs.

Other studies noted developmental differences in children’s play with technology and media (e.g., Marsh, et al., 2015; Plowman, Zaman, et al., 2016) and examined the capacity for the content itself to support or sustain children’s play and creativity:

- Yelland and Gilbert (2014) noted the developmental trend that 2-year-olds do not share their play materials and play in parallel, but they observed “that when a child was playing with the tablet there were some occasions when another child would come over to see what was going on, and they would interact, both verbally and non-verbally. This was unique to tablet play” (p. 8). In addition, Yelland and Gilbert noted that with 4-year-olds:

  There was lots of exploratory play as children discovered which Apps they liked playing, often revisiting these Apps again in following sessions, consolidating their learning and understanding. This is not dissimilar to children revisiting a theme in imaginative play or building towers with blocks, with each visit they acquire new learning and/or deeper understanding (p. 13).
• Marsh and colleagues (2015) detailed the types of play and creative thinking children would experience while using the playtime apps and augmented reality [AR] apps included in their study. The authors applied Hughes’ (2002) Taxonomy of Play Types and Robson’s (2014) Analyzing Children’s Creative Thinking (ACCT) framework. They found that children would engage in all but two of the types of play Hughes’ taxonomy identified present in the apps children used in homes and schools, and that common apps purchased grouped around creative play, exploratory play, and/or object play (Hughes, 2002).

• McCarthy and colleagues (2012) described the narrative content in the apps as “playful and engaging” and identified that “collaborative play fostered by use of the intervention led to additional opportunities for developing children’s socio-emotional skills, such as listening and communication, respecting others, and cooperation and sharing” (p. 1).

Engaging children in active mediation, discussion, and learning around why an adult might restrict access to a particular media was a frequently recommended practice to help children learn about balancing digital and non-digital play (e.g., Holloway, et al., 2014; Marsh, et al., 2015; Livingstone, et al., 2014).

**Times of solitude.** We identified 22 examples warranting the times of solitude variable. Approximately one-quarter of these instances were coded as supporting the idea that technology and media could co-exist with and benefit children’s engagement in the types of reflective activity Rogers and Head (1983) described. Puente (2012) indicated that a child’s time alone with e-books positively influenced children’s reading volume. Coggin and colleagues (2014) and Young and Rasinski (2013) provided preschool children offline planning time for digital content creation. This time proved beneficial as rehearsal for actually creating digital content.

Other examples of supportive coding emanates from children’s perspectives about one specific type of technology, namely, robotics. In the first example the author described the connectedness humans feel to technology, “While many adults think about technology as separate from humanness, kids tend to think of it as fundamentally human. It comforts us; it keeps us company; it helps us learn and grow; and, in some cases, it can fulfill certain emotional needs…” (Gaskins, 2012, p. 2). A second example of supportive coding for the times of solitude variable emanated from a second grade child: “They really just let you on your own. They didn’t give you instructions on how to program it…you can do cool stuff on your own” (Bradshaw-Truesdale, 2013, p. 20).

A more substantial proportion of these items were coded at the detracting from and mixed evidence levels than we observed in the other social, emotional, or learning readiness variables. We attributed the detracting from and mixed evidence to three points, in particular, described below.

First, the set of entries in which adults restricted or mediated children’s use of and access to media with perceived risks—including online bullying and inappropriate content—indicated fewer perceived risks for children during their times of solitude (e.g., EU Kids Online, 2014; Fuller, et al., 2015; Hoffman & Paciga, 2014; Livingstone, et al., 2014; Nikken & Schols, 2015). These parental actions in home contexts indicated mixed evidence in that the parents restricted a child’s use of media, including during the child’s times of solitude. So while children being engaged with media could be harmful, the parents’ actions restricting or mediating served as a buffer for the children’s risk.

Second, several entries addressed the social and physical contexts of children’s technology and media use head-on. AVG (2015) concluded that both parents and children report intrusion of devices and media into down time: that parents’ attention to devices harmed a child’s social interactions with their parents. Common Sense Media (2013) and Crux Research (2015) both suggest that as children approach 7–8 years of age, more screen time is spent in bedrooms, alone and away from parents. In these ways we identified that the complexities of the features of the social and physical contexts in which media were accessed and used were also related to the perception of whether or not media could be part of a child’s times of solitude.
“We all have different gifts, so we will have different ways of saying to the world who we are.”

–Fred Rogers, 2005
Third, the design of the media itself was also related to the frequency with which we employed the mixed evidence or detracting from code for the times of solitude variable. Although we did not engage in a deep or thorough content analysis of all the technologies or media presented in the studies we coded, we noted that older children were identified more frequently as having interactions with what we anecdotally identify as loud or fast-paced media (e.g., Kabali, et al., 2015). Moreover, parents actively sought out media that was designed for children to figure out quickly, such as apps that provided children opportunities to play and be entertained on their own (Cohen, et al., 2012). Marsh and colleagues (2015) noted:

> It was clear from the case studies that the most frequent role for parents was that of supervision, with co-use being deployed for introducing children to new apps and supporting their engagement when the child wanted that. However, for much of the time, children appeared to prefer independent use and actively resisted parental intervention” (p. 29).

We weren’t certain whether this preference was attributable to the design of the media itself or to some other factor present in the children’s interactions with technology or media.

As we examined the instances of the times of solitude variable, we noted that there were more instances of freely available entries in this set. This led us to enact one additional analysis.

### Additional Analysis

A final, but unplanned, query further explored the relationship among the social, emotional, and learning readiness variables as a function of whether the public had freely available access to the primary source. This analysis emanates from an observation made while analyzing the data coded for the social, emotional, and learning readiness variables. Of the entries described above as being coded for multiple instances of detracting from a child's social or emotional development or learning readiness for more than one of the 11 variables in the set, we found that 57% of the entries were also coded as free access. As context for this analysis, consider that approximately 37% of the entries coded were freely available, or open access. The other 63% of the entries coded were only available to those in the business of academic scholarship—behind academic library paywalls. This means there is a greater likelihood that educators and caregivers reviewing only open access sources would see a higher proportion of negative or cautious headlines and articles. These negative, cautious instances would be more likely to address the negative

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Figure 8. Word Cloud Analysis of Entry Titles by Access

<table>
<thead>
<tr>
<th>Titles: All (n=165)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Titles: Paywall (n=104)</td>
</tr>
<tr>
<td>Titles: Free Access (n=61)</td>
</tr>
</tbody>
</table>
effects of technology and its impact on social and emotional learning. As such, educators and caregivers reviewing
only open access sources may draw the conclusion that there are few, if any, benefits for young children using
technology or media.

Because the words we hear and read and the actions we observe in others contribute to the creation of biases, we
also looked at the words utilized in the titles of the entries we coded. Words were incredibly important to Fred Rogers
because they represented the vehicle by which his messages were sent to parents, children, and the general public. The
figures (Figure 8 and Figure 9) and table (Table 5) below represent an analysis of words (i.e., those displayed in the rows
of Table 5 that are shaded in gray) present in titles of entries coded in the database. We sorted the titles of the entries into
two groups based on access (i.e., openly/freely available or behind a paywall), and utilized a word cloud analysis and word
frequency analysis to help identify differences in messaging across the two groups.

From the word cloud analysis (Figure 8) it was clear that technology and children were prominent in all three
sets of data. Learning, social, and use were words that appeared to be more visually significant in different frequencies in
the free set compared to the paywall set. Because of this apparent difference, we analyzed whether these key words, and
others related to the design of the study, were present or absent in the titles of each entry in the database as a function
of access. Truncated word searches were used to allow for different affixes of the same base to be counted (e.g., “‘us-’”
represented “‘use,’” “‘using,’” “‘used,’” etc. and “‘educa-’” represents “‘education,’” “‘educate,’” “‘educational,’”
etc.). We counted the number of entries in which each word appeared and created a frequency count for each word for
each of the three sets (i.e., all, free/open, and paywall). We divided the frequency count for each set by the total number of
entries in the set (i.e., the n-values in column 1 of Table 5) to arrive at relative percentages across the groups of data, so
that the value in each cell of Table 5 represents the proportion of entries in any set that contained a particular key word.
In Figure 9, below, we placed the values shaded red, with the most pronounced differences, on a bar graph. No statistical
significance testing was run.

Table 5. Percent of Entries Containing Keywords by Access

<table>
<thead>
<tr>
<th></th>
<th>Child-</th>
<th>Parent</th>
<th>Teacher</th>
<th>Technology</th>
<th>Digital</th>
<th>Media</th>
</tr>
</thead>
<tbody>
<tr>
<td>Titles: All (n=165)</td>
<td>30.91</td>
<td>9.09</td>
<td>4.85</td>
<td>16.97</td>
<td>10.91</td>
<td>13.94</td>
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<tr>
<td>Titles: Free Access (n=61)</td>
<td>31.15</td>
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<td>22.95</td>
<td>14.75</td>
<td>14.75</td>
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<tr>
<td>Titles: Paywall (n=104)</td>
<td>67.31</td>
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<td>3.85</td>
<td>7.98</td>
<td>8.65</td>
<td>13.46</td>
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<td>Social</td>
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<td>Emotion</td>
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<td>Trust</td>
<td>9.7</td>
<td>1.21</td>
<td>0</td>
<td>9.7</td>
<td>0.61</td>
<td>1.82</td>
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<tr>
<td>Titles: All (n=165)</td>
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<tr>
<td>Titles: Free Access (n=61)</td>
<td>13.11</td>
<td>3.28</td>
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<td>13.11</td>
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<td>7.69</td>
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<td>7.96</td>
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<td>2.88</td>
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<tr>
<td>Us-</td>
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<td>Support</td>
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<td>Learn</td>
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<td>Develop</td>
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<td>Educa-</td>
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<tr>
<td>Self</td>
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<tr>
<td>Titles: All (n=165)</td>
<td>26.67</td>
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<td>Titles: Free Access (n=61)</td>
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<td>20.19</td>
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<td>10.58</td>
<td>1.92</td>
</tr>
</tbody>
</table>
The data presented in Table 5 and visualized in Figure 9 indicate that there is more emphasis put on the child in the titles in the pay-for-access entries, while there is more emphasis on the content (i.e., the technology or digital media named in the entry) in the free access items. When we look at the verbs in the titles of the entries—use, learn, educate—use is emphasized more in the free group and learning/education is focused on more in the pay-for-access group. A closer look at the social key word identified in the free access items revealed that half of the hits for social came from “social network” (Edwards-Guara, et al., 2014; Grimes & Fields, 2012; Livingstone, et al., 2011) and the other half came from pieces pertaining to social development (Slovak, et al., 2015; Parkes, et al., 2013; Richert, et al., 2011).
FINAL THOUGHTS

The field of early childhood research and practice has examined much about the role of technologies and digital media in young children’s lives since 2012 when NAEYC and the Fred Rogers Center released their joint position statement. It is safe to assert that we know much about how technology and tools are being implemented in a range of contexts, but that we still have much to learn about the impact of these technologies on whole child development. There are several key findings from these analyses that should be highlighted. These key findings will help drive our future work of exploring the ways in which Fred Rogers’ vision connects to research and practice.

Looking Back: Summary of Key Findings

• During the past 5 years, researchers, academics, teachers, developers, and the popular media have produced a body of literature addressing the use of technology and media in contexts with young children (0–8 years). As a field, we have been curious about the ways in which these new technologies and media have and will continue to impact young children and their worlds. We identified 595 pieces of literature to review. Within the sample we coded (n=165, or 27.5% of the entire sample), we saw a range of source types inclusive of a range of purposes. The majority of the entries reviewed were unfunded. The largest portions of funded sources included comparative analyses, literature reviews, or descriptive entries. The most frequent mechanism for data collection within the funded, descriptive set was an online or phone survey.

• The literature described technology and media use for all ages of young children (0–8 years). In our sample, there was no significant difference in the number of entries coded for any age group over another, although the number of entries describing infant or toddler use of technology and media is moderately less than the number of entries at other ages within the early childhood range. This was not surprising, but it was important given the position statements and policy recommendations of the American Academy of Pediatrics (2010; 2011; 2016) around the use of technology and media before the age of 18 months. We found little specific discussion of or attention to special demographics. The frequency with which we coded for research participants with low socio-economic status, English language learners, or diverse needs and rights was minimal throughout the sample, with the exception of the sources employing mean comparisons of particular groups of students or predictive analyses of behaviors or cognitive outcomes based on child or parent demographics.

• Adults were also often described as being present, but without presence, when children interacted with technology and media. Teachers and parents were most frequently described as adults present when children were using technology and media, with approximately 84% of the sources we coded involving a parent figure or a teacher. Another 16% of the sources we coded involved no adult interaction. When adults were present, we identified that they generally did provide at least some kind of support for the children’s use, often by way of getting the child set up with the device and oriented to the purpose of the activity and then leaving the child to use the technology or media without additional support or interaction. The level of support for the child’s experiences with technology or media varied as a function of the child’s age and the context, or setting, described in the sources. A smaller portion of the entries provided examples of an adult’s active and continuous co-engagement with the child around technology or media.

• There is tremendous diversity in the kinds of technologies and media being utilized with young children (0–8 years). Much of the inquiry in early childhood and technology and media focuses on access and therefore focuses very much on what the children have and how frequently they use what they have access to. We coded
survey after survey providing inventories of all of the hardware and the various software applications and media content children consumed. We noted very few examples of more basic, screen-free types of technologies that are commonly employed in exploration of how things work, such as light projectors, microscopes, robots, tangible technologies, or single function digital cameras.

- **Children are using technologies and media in a range of contexts.** The majority of the literature we coded implied technology or media use was occurring either in homes or in schools/child care centers. Libraries (Campbell, Haines, Koe, & Saltz, 2015), church basements (Guynn, 2016), or family child care settings (Blagojevic, et al., 2012; Luckenbill, 2012) represented some other potentials for contexts of use, but these were in very small numbers. The number of entries of a child’s use of technology and media across contexts was also small; we do not know much about the cumulative use of technology and media a child might encounter from home, child care/school, and other places in the community.

- **The sample we coded demonstrates that opportunities for social and emotional development and growth in learning readiness are possible, but they may not be intentionally identified or discussed when children use technology and media to interact with themselves, others, and their worlds.** In other words, the majority of the sources we coded did not have clearly defined outcomes focused on measuring social, emotional, or learning readiness constructs. Despite this, we were able to read into the descriptions of the child, context, and content to make many theoretically rooted inferences about the ways in which the “three C’s — the child, the context, and the content” (Guernsey, 2012) could interact to provide support for children’s social emotional development or learning readiness in more than 70% of the entries we coded.

- **The field’s attention to academic outcomes through children’s use of technology and media is evident, but the notion of utilizing technology and media as a strategic support for learning readiness, or to support children’s social or emotional development while they interact with technologies and media, is not prominent in the**
data we coded. We found that the entries in our database that did address more social, emotional, or readiness constructs attended more frequently to multiple facets of interaction: the child, the context, and the content.

- We observed a trend that some of the media utilized in the entries we coded may convey themes related to social and emotional learning, or may provide more frequent opportunities for social interactions, as a function of the design of the software or media. There is theoretical rationale supporting the notion that children’s use of content with these features could potentially impact children socially or emotionally. There is need to further review media content, software, and apps for learning to identify the ways in which themes or narratives are written especially with the objective to support children’s social and emotional development. We also need to account for more systematic methods of documenting and analyzing the social interactions that are present when children use applications or software with a range of design features integrated (e.g., multi-touch, multi-user features, scaffolds for guiding adult-child interactions).

- Playing, creating, imagining, wondering, and reflecting undergirded the majority of the children’s actions identified as including technology or media and providing evidence of supporting children’s social and emotional development or learning readiness. Fred Rogers identified these same actions and activities as particularly fruitful for building learning readiness and modeled these kinds of actions and activities in his television programming, public speaking, and published printed materials (e.g., Rogers, Head, & Adams, 1986).

- There is a need to consider the important role of messaging and access as part of the discussion surrounding the topic of children, technology, and media and the ramifications on whole child development. Our analysis demonstrated that there is a difference in emphasis between what is presented and available in free and open access content and that which is presented and available behind academic paywalls. This reminds us that as Fred Rogers did, we (academics) tend to put the child and child development first, and we then consider whether and which use of technology or media tools or interventions would be appropriate.

Looking Ahead

As Fred Rogers knew, children become much more ready to learn when adult-child relationships are established. These relationships also enable the media experiences to contribute positively to a child’s social and emotional development. Through the NAEYC and Fred Rogers Center joint position statement (2012), many strategies of joint engagement and media mentorship are recommended, such as co-viewing of media; asking children questions about a game they are playing; or making connections to content viewed in a program to the child’s environment.

Technology and media are present in so many aspects of life that it is nearly impossible to imagine a one-size-fit-all approach of limits and restrictions that could meet the diverse needs of children and families. Earlier attempts that focused limitations on screen time do not address the nuanced nature of current technology and media interactions.

Following from Fred’s belief in “simple and deep,” we at the Fred Rogers Center and the Technology in Early Childhood Center [TEC] at Erikson Institute are looking for simpler and clearer messages to engage and empower parents, caregivers, and educators as media mentors who help young children safely use media and technology and navigate the digital age. Every child, family, and context is unique, and any guidance should reflect and support individual decisions. In a recent conversation we had with Michael Rich, Director of the Center on Media and Child Health at Harvard Medical Center, and a Fred Rogers Center advisor, he suggested that, “Our focus should be on living well with media rather than opposing or restricting it.”

Here are some actionable steps we can take to help us learn more about relationships and how to support children, educators, caregivers, and communities as they learn to “live well with media” and technology:
“One of the greatest dignities of humankind is that each successive generation is invested in the welfare of each new generation.”

–Fred Rogers, 2003
• **Simultaneously focus on the child, the content, and the context.** Children live, play, and work in complex systems influenced by biological, social, economic, and political factors. Carefully documenting and detailing myriad elements of each of the three C’s (i.e., the child, the content, and the context [Guernsey, 2012]) in any research, basic or applied, will help us better understand the ways in which the child’s relationships with themselves, others, and their worlds might be strengthened with the use of technology or media.

• **Look longitudinally.** There is some utility in cross-sectional studies and studies of children in one particular age range, but technology and media are likely to have a cumulative effect on children, similar to the ways in which children learn language and literacy emergently; those children who have early and ongoing, scaffolded, and developmentally appropriate experiences with technology and media are more likely to have stronger relationships with themselves, others, and their worlds that are inherently saturated with technologies and media of all sorts. Empirical data can be generated to support this claim if we design studies thoughtfully.

• **Broaden how educators and parents identify and define technology tools for learning.** Provide young children with more diverse device choices while they are deciding how to investigate their worlds, and help them learn to match the right tool with the task. As suggested in the joint position statement (NAEYC/Fred Rogers Center, 2012), children may also use older, analog technologies including overhead projectors, flashlights, magnifying glasses, digital microscopes, and cameras in addition to tablets, computers, and televisions. In addition to this broadening of how we define tools, we ought to attend more broadly to the purposes for utilizing these tools, one of which is to communicate our thoughts and ideas with others. We would like to see more examples of the creative and communicative functions for technology use in future examples of research and practice.

• **Plan for nimble research designs that can build theory.** Intentionally seek to study and better understand the intersectionality of the social and emotional facets of a child’s interactions with technology and media. The debate about a child being alone and staring at a screen, versus using a screen together with an adult or peers, is big and needs to be better understood through applied research. This could be better accomplished if we engage in formative, or design-based, research to allow us to consider critical elements of use while engaging in the quest for fundamental understanding (e.g., Design-Based Research Collective, 2003; Reinking & Bradley, 2008; Reinking, 2010). Given the rapid rate at which technological advances come through and into children’s lives, it is critical that we adapt as we create and implement to theoretically understand the ways in which an intervention has potential to help achieve a particular goal. This research should frequently employ direct modes of observation to collect data on the following: 1) user experiences; 2) the activity or task; 3) the child’s engagement with the device; 4) contextual information; and 5) demographics of the participants. Within these, we should attend to documenting the following:
  o How long it takes to complete tasks, the amount of learning needed prior to use, and the ways in which that instruction is delivered;
  o The function and purpose of the activity and the extent to which those goals were met, considering that the child’s purpose may not always be the same as the adult’s purpose;
  o Gaze, touch, gesture and discourse;
  o The position of the device relative to the child, the number of social partners, as well as the frequency and types of verbal and nonverbal interactions the child has during his or her interactions with technology and media;
  o The longer-term impact of these experiences on the child’s emotional attachment, social awareness, and relationship skills; and
  o The diverse personas that comprise the world, not just middle class children who happen to live near an academic institution—this includes linguistically, economically, and culturally diverse children from
all walks of life. As part of the demographics, we ought to focus our work on understanding the role of technology and media on children’s relationships, and so the early childhood settings and research participants must reflect the real diversity of the world and must include: refugee children, children of migrant workers, children with two working parents, children in hospital settings all day every day, orphaned children and those in foster care, and children in every other imaginable context.

- **Adapt the Simple Interactions Tool to experiences with technology and digital media.** The Simple Interactions Tool (Li, 2014) can be applied to formally examine the following: the connection between the people engaged in interactions with the child; the reciprocity of the control of the interaction; the ways in which participation is encouraged; and the progression of challenge and the function of support for the child as they work toward goals across domains of their development that frequently involve other people and a range of technologies or media.

- **Bring together experts in child development, content development, and other adults that use technology and media with children as part of the formative research process.** We want to work to build interactive media that encourages interactions with others—not just media that delivers academic content.

- **Work to translate, demonstrate, and “show me” how to apply research.** Infuse dollars into pre-service and in-service teacher preparation and professional development, administrator preparation programs, and continuing education initiatives to help incentivize teachers and policy makers to be bold and courageous in their work with young children that includes technology and media. Utilize funding to infuse community-based opportunities for parents to engage in learning more about the inextricable role technologies and media play in their children’s current and future lives so that children’s interactions with technology and experiences with media are supported in developmentally appropriate and culturally relevant ways. Advocate for funding for research that explores the ways in which children’s social and emotional worlds are influenced by relationships with technology and media.

- **Continue work to curate libraries of exemplars in which educators, child care professionals, and parents can see excellent and developmentally appropriate use of technology and media in contexts that might positively impact a child’s development.** These should continue to focus on homes and schools and child care settings, and they should be expanded to also consider after school organizations, community centers, collections, museums, church basements, laundromats, buses, shopping centers, and places in-between. This broadening of context will help provide a more accurate sense of the ways in which technology and media impact a child’s relationships throughout their everyday lives. Consider, as Fred Rogers did, the ways in which technologies or media do the following:
  - Allow children to learn more about and playfully explore topics of interest;
  - Assist children as they actively create and share their interests, wonderings, and creations with others;
  - Provide opportunities for the adults or the agents within the media to model prosocial interactions and connections across communities.

- **Strive to be socially just with the policies surrounding technologies and media in children’s lives.** Equitable access to technology, including broadband connectivity and mobile devices, are issues of social justice in the digital age when media literacy, technology skills, and using technology tools for communicating, collaborating, and learning are identified as essential 21st century skills. Examine restrictive policies around technologies and media in early education and care settings based on evidence from research and practice to allow for careful and intentional examination of the use of technology and media as tools for playing, learning, and doing the work of early childhood.

- **Every child needs a media mentor.** Work with stakeholders in media and policy to help create initiatives to educate children and the range of people in children’s lives—including educators, caregivers, librarians, interventionists, and medical professionals—about healthy ways to live with technology and media. Fred Rogers
advocated for positive messaging that meets caregivers where they are, in ways that honor and build from the caregivers’ strengths and pre-existing knowledge base.

- Advocate for better understanding of the role of an adult in a child’s interactions with technology and media. While we do and ought to value and encourage technology and media interactions that are supported by an adult, we also recognize the complexity of life and the reality presented especially in the larger-scale survey entries we analyzed and have ourselves conducted (e.g., Erikson Institute, 2016; Blackwell, Wartella, Lauricella, & Robb, 2015). Children spend significant portions of their daily lives with technology and media that is often not supported by adults for a wide range of reasons. Some of the descriptions detail the value of what Fred Rogers called “times of solitude.” Joint interaction or co-viewing are not always possible, and, in some cases, are not preferable. Balance and understanding is essential.

- Remember Fred Rogers’ response to the question, “How much television is okay for my child to watch?” He said, “There are some children whose life experience is so restricted that television is enormously enhancing...there are others who might be using television as a detachment from life...figuring out how much television is appropriate for a child is a little like making sure that our children have balanced diets...that also includes time with parents, time with other children, time for active play, time for quiet play, and, of course, enough time for sleep” (Rogers & Head, 1983, p. 176).

Fred Rogers said, “It’s through relationships that we grow best—and learn best” (as quoted by Sharapan, 2012). We think this straightforward statement might offer the most essential clue to understanding how children gain the most learning benefit from their interactions with media and technology. Building on this, the essential question might be: How does a child’s interaction with media and technology strengthen relationships? We think it might be helpful to think about a child’s relationships in three ways:

1. **The child’s relationship to self:** We might ask how the experience helps a child to understand and express him- or herself and to develop both competence and confidence.

2. **The child’s relationship to others:** How does the experience help a child to connect, collaborate, and share ideas with peers, family, and others?

3. **The child’s relationship to the larger world, community, and environment:** For example, how might the experience help a child appreciate the natural world or gain understanding and empathy for the lives of people and other creatures near and far?

This focus on relationships in all of their diverse forms aligns with the message of Fred Rogers, who spoke about media, technology, and children in a far less media-saturated time: “No matter how helpful they are as tools (and, of course, they can be very helpful tools), computers don’t begin to compare in significance to the teacher--child relationship which is human and mutual. A computer can help you to learn to spell H-U-G, but it can never know the risk or the joy of actually giving or receiving one” (Rogers, 1994, p. 89).
“Where would any of us be without teachers – without people who have passion for their art or their science or their craft and love it right in front of us? What would any of us do without teachers passing on to us what they know is essential in life?”

– Fred Rogers, 2005
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References not Part of the Coded Sample


Complete List of Primary Source Entries in Coded Sample


Segal-Drori, O., Korat, O., & Klein, P.S. (2013). What can better support low SES children’s emergent reading? Reading e-Books and printed books with and without adult mediation. In A. Shamir & O. Korat (Eds.), Technology as a Support for Literacy Achievements for Children at Risk (pp. 59–71). Dordrecht: Springer Netherlands. DOI: 10.1007/978-94-007-5119-4_6


Appendix 1: The Research Team

Dr. Katie Paciga was selected as the first Early Career Research Fellow for the Fred Rogers Center and the TEC Center at Erikson Institute to lead the review of the literature, analysis of research, and identification of emerging practices. Katie earned her Ph.D. in Curriculum and Instruction with a focus area in Literacy, Language, and Culture from the University of Illinois at Chicago in 2011. Her dissertation, *Preschoolers’ Listening Comprehension of Digital Storybooks* (2011), and publications following thereafter (Paciga, Lisy & Teale, 2013; Hoffman & Paciga, 2014; Paciga, 2015; Paciga & Hoffman, 2015; Paciga & Quest, 2017) have examined the relationships among the child, the content of the interactive media being used, and the context in which the use occurs. Dr. Paciga holds a position as Associate Professor of Education at Columbia College Chicago. Her teaching and research interests focus on the social, emotional, cultural, and cognitive bases for language and literacy development, with a focus on the ways in which educational policies, human interaction, individual interests, printed media (i.e., children’s literature), and interactive media (i.e., web- and app-based games and tools) contribute to language and literacy teaching and learning.

Chip Donohue, Ph.D., is Dean of Distance Learning and Continuing Education and Director of the TEC Center at Erikson Institute in Chicago. He is a Senior Fellow and Member of the Advisory Board of the Fred Rogers Center for Early Learning and Children’s Media at Saint Vincent College, where he co-chaired the working group that revised the 2012 NAEYC & Fred Rogers Center Joint Position Statement on *Technology and Interactive Media as Tools in Early Childhood Programs Serving Children from Birth through Age 8*. Chip is the editor of two books, *Technology and Digital Media in the Early Years: Tools for Teaching and Learning* (2015) and *Family Engagement in the Digital Age: Early Childhood Educators as Media Mentors* (2017), co-published by Routledge/NAEYC. In 2012 he received the Bammy Award and Educators Voice Award as *Innovator of the Year* from the Academy of Education Arts & Sciences. In 2015, he was honored as a children’s media *Emerging Pioneer* at the KAPI (Kids At Play International) Awards.

Maura Snyder, Margaret Miller, and Hailey Umbaugh, students of the Fred Rogers Center for Early Learning and Children’s Media at Saint Vincent College, served as research assistants by coding data. They provided checks and balances, leading to more reliability and consistency in the coding methodology and data analysis. Maura read and provided feedback on drafts of the final report and key messages.
Appendix 2: Acknowledgement of Intellectual Contributions

The authors of this report would like to recognize and thank those who contributed significantly to the development and execution of this project:

- Faculty and staff from the Fred Rogers Center for Early Learning and Children’s Media at Saint Vincent College provided important and valuable contributions to this study:
  - Jeremy Boyle co-presented the background of the study in the late phases of the project and contributed to penning some parts to the report as well.
  - Tanya Baronti co-presented the background of the study in the early phases of the project.
  - Rick Fernandes, Junlei Li, Dana Puglisi Winters, Karen Struble Myers, and Emily Uhrin provided background knowledge to help shape the project and its outcomes, as well as context for and documentation of Fred Rogers’ work and words.
  - Senior Fellows Roberta Schomberg and Chip Donohue chaired the working group and worked to arrive at the final updated joint position statement (NAEYC/Fred Rogers Center, 2012).

- Tamara Kaldor, Associate Director of the TEC Center at Erikson Institute, helped identify sources and reviewed drafts of data analysis.

- Kyle Snow, formerly the Director of the Center for Applied Research at the National Association for the Education of Young Children, provided formative feedback in the early stages of the research, specifically identifying emerging work that was already known.

- Michael Robb, Director of Research at Common Sense Media, helped shape the scope and direction in the early stages of the project.

- Jennifer Garrett Lisy read and provided feedback on drafts of the full report specific to the research methodologies employed in the report.

- Jennifer Miller, Susan Danby, Tamara Kaldor, and Leanne Beaudoin-Ryan collaborated to utilize a sample of the data from this study as the basis for a manuscript, “Looking Beyond Swiping and Tapping: Review of and Recommendations for Methodologies for Researching Young Children’s Use of Digital Technologies,” which is currently in review for a special forthcoming issue of Cyberpsychology: Children’s Uses of Digital Media.
Appendix 3: Keyword Search Strategies Utilized for Social and Emotional Constructs

Below is a list of keyword searches conducted within entries to identify the possible presence of social, emotional, or learning readiness constructs. Coders utilized Control + F to execute each keyword search within the body of every entry coded.

- alone
- close
- curious*
- empath*
- error
- explor*
- frustrat*
- goal
- listen
- look
- mistake
- persist*
- plan
- play
- reflect*
- risk
- self-awar*
- self-efficacy
- social
- trust
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