

This is the submitted manuscript of an article published by Taylor & Francis in Early Education and Development on 27 Jun 2021, available online: <http://www.tandfonline.com/10.1080/10409289.2021.1943282>.

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Home Learning Environments for Young Children in the U.S. during COVID-19

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Early Education and Development, in press

Abstract

Research Findings: During COVID-19 many countries, including the U.S., implemented stay-at-home policies that closed most schools and childcare centers. This research focuses on the home learning environment reported by parents for U.S. children ages two through nine during the COVID-19 crisis. Parents in the U.S. ($N=162$) completed an online survey of multiple choice and short-answer questions about the home literacy and digital environment. All data in this convenience sample were collected during the beginning of the COVID-19 crisis (May 2020). Despite the limited, nonrepresentative sample, these findings provide an initial, mainly descriptive report about the home learning environment during COVID-19. Key findings are related to home literacy and digital activities during COVID-19. Children, regardless of age, engaged in more at-home digital activities during COVID-19 than before. Children in first grade and older increased digital use significantly more than younger ones. There was a significant correlation between frequency of digital usage and home literacy activities.

Practice or Policy: Virtual learning opportunities are becoming a reality for even the youngest children in the U.S. This has increased with in-school closures during COVID-19 and may continue as some children return to school. Using digital devices for participating in literacy activities may be an effective means of promoting children's literacy development.

Keywords: early literacy, literacy, COVID-19, home learning environment, home literacy environment, home digital environment

Due to the world-wide COVID-19 pandemic, many countries, including the U.S., implemented stay-at-home policies in March 2020 which required the closure of most schools and childcare centers (Masonbrink & Hurley, 2020). World-wide, “more than half a billion children have been forced to become virtual-school learners as they shelter in their homes while parents, siblings, and other family members have taken on the new role of learning facilitators, pseudoteachers, and coaches” (Cohen & Kupferschmidt, 2020, p.45). In the U.S., 93% of school-age children engaged in some form of distance learning during COVID-19 when schools were closed (U.S. Census, 2020). However, that percentage was considerably less for preschool children (Friedman-Krauss et al., 2021). This situation raises many questions, including: What activities are young children engaging in while at home? How do these activities vary with the children’s ages? Documenting the home learning environment during COVID-19 when in-school classes were suspended provides information that can guide educators and policymakers in the future.

Although there is some research about the stressors families are facing during COVID-19 (e.g., Patrick et al., 2020; Prime et al., 2020; Russell et al., 2020), there have been few empirical reports about what learning activities children are doing at home during this time (Stites, et.al., 2021; Barnett et al., 2021; Gayatri, 2020). Therefore, it is important to document what stakeholders think about distance learning (as recommended by Garbe et al. (2020) and the home learning environment that various stakeholders are experiencing (e.g., Stites, et.al., 2021). Such documentation will be helpful and important as in-person school resumes. For example, educators may use this information to plan and tailor educational programs based on the learning experiences children had during the COVID-19 pandemic. Policy-makers may use this

information to retain the effective aspects of virtual learning even when the pandemic has ended (Lockee, 2021).

Children's home learning environments prior to their beginning formal schooling as well as during the first few years of school are considered critical for children's readiness for school and subsequent academic progress (DeJong & Leseman, 2001; Korucu et al., 2020; Rodriguez & Tamis-LeMonda, 2011; Sammons et al., 2015; Serpell et al., 2005). However, we do not know how what Bronfenbrenner and Morris (2006) called the "home microsystem" (i.e., home context) during COVID-19 interacts with the "macrosystem" (i.e., societal influences) and the "chronosystem" (i.e., changes over time).

As Benner and Mistry (2020) noted, macro-level crises, such as the COVID-19 pandemic, can and do have long-lasting effects on children's development. They describe life course theory (Elder, 1998) and its relevance for understanding children's development during and following the COVID-19 pandemic. "Human development is viewed as a tapestry of intertwined developmental trajectories...with critical transition points...and linked lives..., all of which are influenced by young people's daily ecological contexts, larger social structures and the broader sociohistorical context (p.236)." Thus, it is critical to document the home learning environments of young children during the COVID-19 pandemic as their home learning experiences during COVID-19 may well predict their subsequent academic trajectories (Hirsh-Pasek et al., 2020) even after schools reopen.

Children's early literacy skills (e.g., Serpell et al., 2005) and their use of digital devices during the first few years of life change (Huber et al., 2018). Moreover, children's digital activities are related to literacy development, at least for some types of devices and some literacy skills (Neumann et al., 2017). Given the current online nature of learning during the COVID-19

pandemic, digital tools can be an important means of supporting children's literacy development (Neumann et al., 2017). Thus, both aspects of the home learning environment, literacy and digital, and age-related changes in them, need to be documented.

This paper presents mainly descriptive data and focuses on the home literacy and digital environments experienced by young children ages two through eight years in the U.S. when most schools were closed during the COVID-19 crisis. The activities are reported by their parents (typically mothers).

We focus on the early childhood years because of its importance to subsequent development (Shonkoff & Phillips, 2000; UNESCO 2020). Although the early childhood period is viewed in some ways as one time-period, the reality is that children undergo many cognitive/social/emotional changes then. Some of these changes may be maturational but others may reflect life-style changes or transition points (Holden, 2010). One such transition point is when children begin formal schooling (typically age six in the U.S.; Morrison et al., 2019; NICHD-ECCRN, 2007). Accordingly, we divide the two- through eight-year-old children who are featured in their parents' reports in this study into two groups -- those younger than six years (less than 72 months) and those six years or older (72 months and older).

We begin with a short review of the importance of the literacy environment followed by an overview of digital tools and activities. Within the section on the digital environment, we discuss how parents use digital devices at home because they are role models for their children's learning and activities (Sonnenschein et al., 2016). We conclude with a section on the relation between the home literacy and digital environments, that is, how children use digital tools for literacy.

The Home Literacy Environment

Learning to read is critical for subsequent school success (Snow et al., 1998). However, research on learning to read (e.g., Serpell et al., 2005) is based on children who attended in-person school full-time, which is the normative custom in the U.S. There are no findings on what the role of the home should be or is when children are in situations where they, at best, are receiving virtual instruction. This study examines the type and frequency of literacy activities children engaged in at home when most schools were closed during the COVID-19 pandemic, and whether it differs for younger (less than 72 months) and older children (72 months and older).

There is a large body of research documenting the relationship between the home literacy environment and children's language and literacy development (e.g., Krijnen et al., 2020; Sénéchal et al., 1998, 2008; Silinskas et al., 2012). Young children need exposure to activities that foster their interest in and development of language, literacy, and related skills, such as vocabulary, print awareness, phonological awareness, awareness of the alphabetic principal, and world knowledge (e.g., National Reading Panel, 2000; Saracho, 2017; Snow et al., 1998). Although school obviously plays an important role in children's literacy development, becoming literate begins at home, prior to formal schooling (Phillips & Lonigan, 2009; Serpell et al., 2005).

Research on children's literacy development generally finds that there are several home-based factors associated with the development of children's early literacy skills. These factors include parents' beliefs about their role in their children's learning, parents' provision of literacy opportunities for their children, parents serving as literacy role models, and the quality of parent/child literacy interactions (Baker et al., 2001; Sénéchal & LeFevre, 2014; Serpell et al., 2005; Sonnenschein & Munsterman, 2002; Sonnenschein et al., 2016). Parents' beliefs about how to increase their children's interest in reading is related to the types of reading activities they

make available to their children (Sonnenschein et al., 2000). The literacy activities that young children do, are, in turn, related to the development of their literacy skills (Sénéchal & LeFevre, 2014; Serpell et al., 2005). We focus here on the frequency of children's home literacy engagement because of the importance of understanding activities during school closings related to COVID-19.

The term engagement is often used in the literature on children's learning and activities but, unfortunately, not often defined (Bond et al., 2020). It consists of behavioral, cognitive, and affective components (Guo et al., 2014). Researchers investigating literacy, however, often do not distinguish among the three components (Guthrie et al., 2012). In this paper, unless we specify to the contrary, we use engagement to refer to behavioral engagement, a child doing a task.

Home literacy activities can be categorized as focusing on the development of code skills (e.g., learning the alphabetic principle, phonological awareness skills) and language and reading comprehension. Researchers investigating the home literacy environment have considered individual literacy activities as well as have created composites of various activities depending upon their questions of interest.

The frequency with which children engage in reading activities is an important positive predictor of children's literacy development (Baker et al., 2001; Levy et al., 2006; Niklas & Schneider, 2013). Serpell et al. (2005), in their longitudinal study of U.S. children's literacy development, found that children who started first grade at the 25th percentile in literacy skills increased to the top quarter of the distribution by the end of third grade if they engaged in some form of daily literacy activity at home. Not only does the general frequency of engagement in literacy activities matter but the specific type of activity matters because different types of

activities foster different skills. For example, Sénéchal & LeFevre (2002), using a Canadian sample in a five-year longitudinal study, found that parent-child book reading when children were in kindergarten predicted their vocabulary and comprehension skills when they were in first grade. Serpell et al. (2005) found that engaging in activities like reciting nursery rhymes predicted preschool children's phonological awareness (see also Krijnen et al., 2020).

Much of the research on children's home-related literacy activities has assessed the home environments of preschool and kindergarten children (e.g., Krijnen et al., 2020; Phillips & Lonigan, 2009). Although there have been several longitudinal studies (e.g., Arafat et al., 2017; Sénéchal & LeFevre, 2014; Serpell et al., 2005) on children's literacy development, these, with a few exceptions, have not compared the home literacy activities for children of different age groups. A particular area of interest is any potential changes in home literacy activities when children have not yet started formal schooling (e.g., prior to first grade) compared to when they have. For example, Serpell et al. (2005) found that children before the start of formal schooling read storybooks with their parents whereas by third grade, they read chapter books, often by themselves.

The Home Digital Environment

Most children in the U.S. have access to digital devices at home (Pew Research Center, 2019). For example, Chen et al. (2020) discussed how 90% of children in the U.S. under the age of one year used smart tablets and devices. A recent pre-COVID-19 report found that U.S. children under the age of eight years spend, on average, an estimated two hours per day using digital devices (Rideout, 2017).

In the U.S., 88% of children have access to a television, 67% use tablets, and 60% smartphones (Auxier, et.al., 2020). This digital usage increases with children's age, both in the

U.S. and abroad. For example, in the U.S. 34% of three to four year old children use tablets while 64% of children ages five to eight do so (Auxier, et.al., 2020). Sivrikova et al. (2020) in a study of 113 Russian parents of children between birth and 8 years of age found that children's reported use of digital devices for learning increased with age (0-3 years, 4-5 years, 6-8 years). Huber et al. (2018), working with Australian families, found that watching television and using e-books were the two most common forms of digital media used by children ages eight years and younger pre-COVID-19. This is similar to children in the U.S. who frequently have access to television from a young age (Auxier, et.al., 2020). Younger children (birth-2 years) used digital devices less frequently than preschool age children (2-4 years) who used these less than school age children (5-8 years; see also Cliff et al., 2017).

Much of the research on children's use of digital devices has focused on their use at school or, alternatively, for recreational purposes (Johnson, 2015). There is a lack of research focusing on home usage during distance learning situations such as COVID-19, where it is the primary source of learning for many children. This study addresses that gap by examining home digital use during COVID-19, when it is the primary source of learning for many children. Of particular interest is whether and how digital usage differs for younger (less than 72 months) and older children (72 months and older)?

Parents' Digital Usage

Social learning such as observing one's parents and the activities they engage in is an important means by which children learn (Sonnenschein et al., 2016). Research by Wartella and her colleagues (e.g., Connell et al., 2015; Lauricella et al., 2015) found that the frequency with which children use digital tools, the types of digital devices, and the purpose of their usage are associated with parents' use of technology and attitudes about it. Such findings are consistent

with findings indicating that parents who serve as role models of engagement in literacy activities have children who more frequently participate in literacy-related activities (Sonnenschein et al., 2016). However, whereas our knowledge of parents' literacy activities and their role in their children's literacy acquisition is robust, it is far less so for digital activities.

Relation Between Literacy Activities and Digital Use

It is important to document children's digital activities because research shows it is related to literacy development, at least for some types of devices and some literacy skills. For example, Neumann (2016) worked with a group of Australian children ages two to four years and found that using tablets at home for reading and writing was associated with their print skills, print knowledge, and sound knowledge.

More generally, research exploring the relation between children's use of digital devices and the development of their literacy skills has inconsistent findings. These inconsistencies reflect the differences in the type of device and the specific skill to be fostered (see Chen et al., 2020; Neumann et al., 2017; Takacs et al., 2015, for further review). Children may be more likely to be distracted by extraneous stimulation when reading e-text without adult supervision and guidance. Other differences are in the nature of the e-text and the cognitive processes required of the children (Takacs et al., 2015). That is, some forms of technology do not clarify the text but take the child's attention away from key, important features (Takacs et al., 2015). If children are able to interact in reciprocal and contingent social interactions with others, the effects are positive (Parish-Morris et al., 2013; Roseberry et al., 2014). However, more research is needed to address which devices can promote which specific skills.

Despite the increasing amount of research on children's digital use and its relation to literacy development, we need additional research focusing on such usage during school closures due to COVID-19 when distance learning is the primary source of learning for many children.

Bond et al. (2020), in a recent analysis of research with college students, found a positive relation between college students' engagement in tasks (primarily behavioral, followed by affective, then cognitive) and use of digital devices. We extend that work to younger children by considering how much children like using digital devices for literacy activities (affective engagement) and whether it relates to the frequency of their literacy activities (behavioral engagement) during this time-period. More broadly, we consider the social/affective context of digital use and its relation to the frequency of doing literacy activities. Social/affective context includes using digital devices with others and liking to do various literacy activities using digital devices.

The Present Study

This study explores two aspects of the home learning environment during school closings during COVID-19: home literacy and home digital, and the relation between them. Data were collected during May 2020.

- (1) The frequency of children's home literacy activities during COVID-19.
 - a. Do parents view the frequency of their children's home literacy activities as having changed during COVID-19? Given the limited availability of out-of-home activities for children during COVID-19, we hypothesize that parents will report an increase in these activities.
 - b. Does the pattern of home literacy activities differ for younger (less than 72 months) versus older children (72 months and older)? Given age-related

differences in children's literacy skills, we hypothesize that there will be differences in activities.

- (2) The frequency of home digital activities during COVID-19 and the relation of such frequencies to pattern of use, parental beliefs, and child age.
 - a. Do parents view the frequency of their children's home digital activities as having changed during COVID-19? As with home literacy activities, we hypothesize that parents will view home digital activities as having increased.
 - b. What are parents' and children's home digital usage? Does the pattern of home digital activities use differ for younger versus older children?
 - c. What are parents' views about children's digital activities?
 - d. What is the relation between parents' beliefs and practices and children's digital usage?
- (3) The relation between children's use of digital devices and the frequency of their literacy activities?
 - a. Does children's use of digital devices predict the frequency of literacy activities?

We hypothesize that digital usage will predict the frequency of literacy activities.

Does the relation differ for younger and older children?

Method

Participants

We used a convenience sample to recruit participants --parents of children ages two through eight (early childhood as defined by UNESCO) and who had access to the internet (Tashakkori & Teddlie, 1998). Participants in this study were recruited in the U.S. as part of a larger study that also included participants from Bulgaria, Israel, and Spain. Because each

country has its own education system, educational responses to COVID-19 and digital culture, the examination of each country individually was deemed to be more valid than aggregating results across countries. We used online listservs populated by parents of young children to recruit our sample. We did so, in part, because we were not able to recruit through other means in May 2020 as COVID-19 restrictions were still in place. More importantly, however, parents using online listservs are more likely to have been engaging with digital devices (and having their children do so) than parents less connected. Because of that, analyses of differences in digital practices before and after COVID are likely to be underestimates of the general population of parents with children ages two through eight. More generally, given our restricted sample, these results may not necessarily generalize to a more representative sample (Andre, 2021). Nevertheless, we believe the information we collected, even with a nonrepresentative sample, is important. We discuss this further in the limitations section of the Discussion.

One hundred sixty-two parents (98% mothers, $M_{\text{age}} = 38.03$, $SD = 6.87$) in the U.S. completed at least 85% of an online survey of the home learning environment. Although most parents answered most or all the questions, not all of these parents answered each question. Accordingly, the n across questions varies. Parents' education levels ranged from high school (1.2%), to associate degree, (11.2%), to BA/BS (29.2%) to graduate degree (58.3%). These averages are higher than average educational level of U.S. parents where only 43% of parents have a BA/BS or higher (National Center for Education Statistics, 2021). However, the preponderance of highly educated parents in our sample is comparable to what others using such surveys in the U.S. find (e.g., Dworkin et al., 2016; Keeter & McGeeney, 2015; Whitaker et al., 2017). Nevertheless, our sample is not representative of U.S. parents, where first time mothers average an age of 23.1 years and fathers 25.5 years (Centers for Disease Control, 2017). Our

sample is more educated and older than the general U.S. population of mothers (Livingston & Cohn, 2010). English was the most common language spoken at home (92%).

One hundred fifty-four of the 162 parents provided their child's date of birth. Children ranged in age from 2 through 9 years ($N=154$; $M_{\text{Age}} = 5.69$, $SD = 1.88$). Note that two parents of nine-year old children submitted surveys and we kept them in the sample. Of the 162 cases, 153 (92.7%) had complete data (only 7.3% were missing any values). There were no cases of unit non-response. Across all variables in the study, only 2.3% of the responses were missing. Little's (1987) test for missing completely at random (MCAR) was nonsignificant, $\chi^2(110) = 108.5$, $p = .523$. The missing data patterns were therefore considered to be MCAR, and the potential for missingness to bias the results was considered minimal. No imputation methods were deemed necessary, and all analyses were conducted using pairwise deletion.

As we discussed in a prior section of this paper, we divided the children into two age groups – those younger than 72 months ($N=66$; $M_{\text{Age}} = 3.83$, $SD = 1.10$) and those older than that ($N=88$; $M_{\text{Age}} = 7.08$, $SD = .87$). Sixty-six (43%) of the children were younger than 72 months; 88 children (57%) were 72 months or older. Eight percent of the children ($N=12$) in the full sample were two years old (between two and two years, 11 months), seven percent ($N=10$) were three years old, 14% ($N=21$) were four years old, 15% were five ($N=23$), 18% were six ($N=28$), 18% age were seven ($N=27$), 20% were eight ($N=31$), and one percent ($N=2$) were nine.

About half of the children (51.6%) in the study were boys. Sixty percent were the oldest children in the family. Families generally reported having one (23.1%), two (48.8%) or three (17.5%) children. The remaining parents reported having more than three children.

Measures

This study was part of a larger, international study using identical or almost identical questionnaires distributed in the predominant language of the country. The only modifications made were to make the questions culturally relevant to the population. For example, WhatsApp, a common messaging application outside the U.S., was changed to text message for the U.S. survey. These changes did not change the meaning of the questions and therefore were not a threat to validity. Each research team determined which questions to analyze based on their research questions.

The Home Learning questionnaire was developed by Aram and Levin (2014) and Meoded Karabanov and Aram (2020) and adapted by the authors of this paper for use related to COVID-19 when the majority of children were unable to attend in-person school and many parents were working from home . The original questionnaire included 52 questions about general parenting behaviors and relationships between parents or partners (Sagi & Aram, 2019) that were not analyzed for this study.

In the current study, we used the two measures about the home learning environment during COVID-19--the home literacy environment and the home digital environment in May 2020. The home literacy measure included 23 questions of which 21 were analyzed here. The two questions removed were not relevant to the U.S. population. Removing them did not impact validity. The digital measure included 24 questions about digital activities, mostly related to literacy (e.g., using digital devices for book reading, letter games, writing, etc.). In addition, there were six demographic questions (e.g., marital status, number of children in the family, educational level of parents, etc.). Although everyone in our sample was asked to answer all the questions (from the parenting survey as well as home literacy and digital activities), we describe below only the home literacy and digital activity results.

Home Literacy Activities. We used 21 of the original 23 questions about the frequency of children’s engagement in specific literacy activities such as reading and its components and writing. We omitted two of the 23 items on the original questionnaire because they did not focus on literacy. We also added one additional question about changes in home literacy activities during COVID-19 (described below). Thus, the final home literacy questionnaire had a total of 22 questions.

The 21 questions specific to literacy, such as the frequency with which the parent “writes notes with your child” and “plays with magnet letters (see Table 1 and 2 for questions), were included. We also slightly modified the wording of questions at times to make them more consistent with what we thought of as U.S. English usage and experiences. For example, “what’s app” was revised to “text message”. Responses to items could range from 1 (never) to 5 (very much). A breakdown of questions with their means is provided in Table 2. The various literacy activities included different genres of activities (e.g., singing songs, solving riddles, playing games, reading books, writing), code-related skills activities (using workbooks for reading and writing, copying letters) and comprehension skills activities (reading storybooks, making up a play based on a book) and everyday activities (sending text message, writing notes (such as grocery list). A composite score was created by adding responses to the 21 questions. Internal consistency, measured using Cronbach’s alpha, was high at 0.86.

As we mentioned above, in addition to the 21 questions described above, we added a question focusing on the frequency of literacy behaviors at home during COVID-19: “Since COVID-19 began, has the number of literacy-activities you have done with your child changed?” Response options were increased, decreased, stayed the same.

Home Digital Activities. Twenty-three questions, all of those from the original questionnaire by Meoded Karabanov & Aram (2020), were included here. There was one question about the type and number of digital devices available in the home, two questions about parents' use of digital tools for work and nonwork situations, four questions about parents' views about children's digital usage, and 16 questions about children's digital usage (frequency, preferences, etc.). Tables 1 and 2 contain sample questions/responses. As with the Home Literacy Questionnaire, we added a question to the instrument focusing on digital activities at home during COVID-19, "Since COVID-19 began, has your child's use of digital devices changed?" Response options were increased, decreased, stay the same. Thus, the total number of questions about home digital activities was 24.

Examples of questions about parents' digital use included, "What digital devices do you have at home, and the numbers of each device ?" (included as one question; choices were mobile phone, tablet/iPad, computer, television). Parents were given choices from none to four or more. Another example was "What is your level of use of digital activities in your free time?" Response options ranged from 1(very low) to 5 (very high, see Tables 1 and 2 for additional examples).

There also were 11 questions which focused on the frequency of children's digital activities and with whom they used them, and how much they enjoyed/liked using digital tools for literacy activities, what we have called the social/affective context. Examples of questions related to digital use were, "To what extent do you and your child work on digital devices together (mobile phone, tablet, computer)?" and "To what extent does your child use digital devices at home with siblings?". Response options for these and other similar items ranged from 1 (never) to 5 (frequently) Two sample questions about how much the child likes to use digital

devices for literacy activities are, “To what degree does your child show interest in writing on a digital device?”, and “To what degree does your child show interest in reading digital books?” Response options ranged from 1 (does not show interest) to 5 (very much; see Tables 1 and 2 for more examples). Responses to these 11 questions were examined using a composite score of responses to these questions. The Cronbach’s alpha for the composite of these 11 activities was 0.86.

A sub-composite of items focusing on liking to use digital tools for literacy activities was calculated using only the responses to the six items about the child liking using digital tools for literacy (see prior paragraph for sample questions). The Cronbach’s alpha for the “likes using digital tools for literacy activities” was 0.72.

Procedure

The questions were administered in a Qualtrics survey and disseminated on various social media sites populated by U.S. respondents such as Facebook parenting sites and preschool listservs. Parents received a link to access the survey. To proceed, parents had to indicate that they were the parent of a child in the target age range by indicating the child’s birthday. The survey was distributed and completed during May 2020. Parents were told the survey was about parents’ behaviors and activities at home with their young children during COVID-19.

We piloted the questionnaire with five parents to ensure they understood the questions in the way we intended and that the survey did not take too long. No one appeared to have any difficulty and the survey took about 10 minutes to complete.

Analyses

We used IBM Statistical Package for the Social Sciences (SPSS) version 26 for all analyses. In addition to presenting descriptive analyses, we conducted inferential statistics.

Differences between groups were tested with χ^2 and *t*-tests. Associations between groups were tested with zero order correlations and OLS regressions.

Results

The Home Literacy Environment

We asked parents, “Since COVID-19 began, has the number of literacy-related activities you have done with your child changed?” Consistent with our hypothesis, 86.3% of the parents reported that their children had increased the use of home literacy activities during COVID-19. There were no significant differences in how parents of older children (89.3%) versus those of younger ones (81.7%) responded to this question about increases in home literacy activities ($p > .10$).

There were no significant differences in the frequency of engagement in home literacy activities, using the composite score of activities, between younger and older children ($p > .10$). However, there were statistically significant differences between these two groups on certain individual activities (see Table 2). As is apparent from Table 2, these age-related differences appeared in keeping with the literacy skills one would expect each age group to be developing. For example, the younger children more frequently played games to learn letters whereas the older children more frequently took turns reading with an adult.

Table 3 depicts the activities most frequently engaged in by younger and older children. Reading story books and informational books were among the most common for both age groups. In contrast, younger children’s most frequently occurring activities focused on basic code skills such as learning letters. Older children used workbooks (the nature of the usage was not specified) and took turns reading with parents.

The Home Digital Environment

Parents' and Children's Home Digital Usage

The children in this study were growing up in homes where digital usage was prevalent. Parents generally reported having several mobile phones, computers, and iPads at home. Two thirds of parents (67%) reported spending a lot of time (very high) using digital devices for work ($M = 3.86$ out of 5, $SD = 1.43$). Parents were less likely to report a high usage of digital devices during their free or nonwork time, although usage was still high (43.6% selected very high; $M = 3.47$, $SD = 0.83$).

Younger children reportedly spent two to four hours a day using digital devices ($M = 3.99$, $SD = 1.32$); older children spent three to four hours a day ($M = 4.50$, $SD = 1.34$, $t(150) = 2.37$, $p = .019$, Cohen's $d = 0.38$.) This is slightly higher than the pre-COVID-19 findings of Chen and Adler (2019) who found that U.S. children under the age of two averaged about three hours of screen time each day while those between the ages of three and five averaged about two and a half hours. The type of device also differed. Chen and Adler (2019) found television to be the most common type of screen used. The parents in this study reported that although children used a variety of digital devices, the most commonly used were tablets and iPads. Eighty-one percent of parents reported that their children found using digital tools enjoyable or very enjoyable. Thirty-four percent of younger children liked using tablets/iPads whereas 48% of the older children did, $\chi^2(df=1, N = 141) = 25.8$, $p = .001$.

There also were statistically significant differences in the frequency with which older children and younger ones participated in digital activities. Using the composite of the 11-item home digital activities, the social/affective context, older children had higher scores ($M = 3.31$, $SD = .59$) than younger ones ($M = 2.88$, $SD = .74$), $t(140) = 3.90$, $p = .001$, Cohen's $d = 0.64$. Similarly, using the sub-composite of liking to use digital devices for literacy activities, older

children received higher scores ($M = 3.17$, $SD = 0.78$) than younger ones ($M = 2.71$, $SD = 0.96$), $t(150) = 3.17$, $p = .002$, Cohen's $d = 0.53$.) In short, the older children had a higher amount of digital use for literacy activities than younger ones.

Parents' Views about Children's Digital Usage

Parents of children in both age groups reported being highly involved in selecting digital content for their children (69.9%, $M = 4.08$, $SD = 0.99$) and believed the optimal amount of time that children should spend using digital tools at home was one to two hours per day (78%). Although parents reported that they used digital devices frequently, their opinions were more variable for how important it was for their children to do so. Only 22% thought it was important or very important for their young children to use digital devices at home and only 13% highly encouraged their young children to use digital devices. Interestingly, only 26% thought that using digital devices positively contributed to their children's development. Differences between what parents said about younger and older children was not statistically significant, $p > .10$.

Relations between Parents' Beliefs, Practices, and Children's Digital Usage

There were several statistically significant relations between parents' digital beliefs and practices and children's use of digital tools. Parents who encouraged children to use digital tools had children who more frequently engaged in digital activities, $r(150) = .19$, $p = .02$. Relatedly, parents who reported that a higher optimal amount of children's digital usage was desirable, had children who more frequently used digital devices, $r(153) = .26$, $p = .001$.

Parents were role models of digital activity for their children. Parents who used digital devices more frequently in their free time reported that their children had higher amounts of digital activity, $r(153) = .23$, $p = .004$.

Changes in Children's Digital Usage during COVID-19

As predicted, almost all parents (91.8%) reported that their children's digital activities increased during COVID-19. Parents of older children (97.6%) were significantly more likely than those of younger children (86.8%) to say their children's digital usage increased during COVID-19, $t(150) = 2.51, p = .01$, Cohen's $d = .20$.

Relation Between Literacy Activities and Digital Use

We first computed a series of zero order correlations between the three digital measures (full composite, the two subcomposites) and the literacy composite. We did this for the full sample and then separately for the older and younger children. For the full sample, correlations ranged from .236 to .428, $p < .004$. For the older cohort, correlations ranged from .137 (ns) to .365, $p = .001$. For the younger cohort, correlations ranged from .264 ($p < .10$) to .523 ($p = .001$).

We further explored the correlations by conducting several OLS regression analyses of the association between the full digital composite (social/affective context), and the one for how much the child likes to use digital tools for literacy activities, and engagement in home literacy activities (composite). The first two factors were predictors and the third was an outcome variable. We conducted these analyses separately for each age group and for each of the predictors. Thus, there was a total of four OLS regressions, two for each age group.

For older children, analyses with the full digital activities composite and the sub-composite for liking to use digital tools for literacy activities significantly and positively predicted the frequency of engagement in literacy activities during COVID-19. With the full digital composite, the older children's scores predicted the frequency of home literacy activities, $R^2 = .09, \beta = .31, F(1,80) = 8.33, p = .005$. Similarly, how much the child expressed an interest in using digital activities for literacy activities predicted the frequency of engagement in home literacy activities, $R^2 = .14, \beta = .37, F(1,80) = 12.79, p = .001$.

The same pattern occurred with the younger children. With the full digital composite, children's scores predicted the frequency of home literacy activities, $R^2 = .21$, $\beta = .46$, $F(1,61) = 16.55$, $p < .001$. Similarly, children's interest in using digital tools for literacy activities positively predicted the frequency of engagement in home literacy activities, $R^2 = .20$, $\beta = .45$, $F(1,65) = 16.47$, $p < .001$.

Our final OLS regression analyses tested the relation between parents' reports of how much they thought their children enjoyed using digital devices at home and the frequency with which the children engaged in home literacy activities during COVID-19. Parents' reports significantly and positively predicted the frequency with which children engaged in home literacy activities, $R^2 = .03$, $\beta = .16$, $F(1,152) = 4.02$, $p = .047$.

Discussion

Documenting children's home learning experiences during COVID-19 when most schools were closed is critical because so many children engaged in some form of distance learning (U.S. Census 2020) during this time, and because these experiences may well predict children's subsequent academic trajectories (Benner & Mistry (2020); Hirsh-Pasek et al., 2020). This study, which used a nonrandom convenience sample, addressed the learning opportunities in young children's homes during the height of the COVID-19 pandemic in the U.S.. We focused on the home literacy and digital environments because of their importance to children's educational development.

The Home Literacy Environment

In general, both age groups of children, regardless of whether they had started formal schooling, engaged in frequent home literacy activities during COVID-19. Both age groups engaged in frequent storybook and information book reading, something that has been found by

others who study these age groups (e.g., Serpell et al., 2005). Nevertheless, there also were age-related differences in the type of experiences children had. As is appropriate, the younger children were more likely than older ones to engage in basic code-related activities such as learning letters and letter sounds. Older children engaged in activities thought to develop more advanced literacy skills. In other words, children were engaging in the types of activities known to foster literacy skills consistent with their age.

The Home Digital Environment

These children were growing up in digital-rich environments (Chen et al., 2020; Neumann et al., 2017). Children had access to several digital devices, although they most commonly used tablets and iPads. They spent several hours a day using digital devices, with the older children doing so significantly more than the younger ones. Consistent with what has been found with literacy development (Sonnenschein et al., 2016), children who saw their parents use digital devices at home during their free time and whose parents encouraged the use of such devices were more likely to use digital tools.

The differences in amount of digital device use during COVID-19 was evident in parents' estimates of their children's digital usage and the digital composites we created. Unfortunately, we cannot definitively account for the age-related difference in the amount of digital device use. Was it related to school-based requirements, was it that the older children could work more independently on such devices, or both? Future research is needed to address these issues.

The American Academy of Pediatrics (2016) advises against screen time, except for video-chatting, for children under 2 years of age and one to two hours a day, at most, for children between 2 and 5 years old. With the onset of COVID-19, digital usage has clearly increased; however, it is too early to assess the long-term effects of such usage. What we do know is that

U.S. children are spending more time in front of screens for school and entertainment. And, based on our results, we conclude that the older children are spending more time than younger ones using digital devices, even though younger children are spending much time this way. Unfortunately, given limitations in our questionnaire, we cannot definitely determine the cause of the age-related differences.

Relation Between Digital Use and Literacy Activities

Children's digital usage was positively related to the frequency with which they engaged in home literacy activities. We assessed digital use in several ways: through parents' reports and the digital composites we created. We found a positive relation between parents' ratings of how much they thought their children liked using digital devices and the frequency of their home literacy activities. And children's scores on our digital composite, which consisted of the extent to which children wanted to do digital activities with others and the degree to which children wanted to use digital devices for literacy activities, was positively related (again) to the frequency of engagement in home literacy activities. These converging findings give us confidence in the relation between digital use and children's literacy engagement. These findings are particularly interesting given that our composite of digital usage was unique. That is, we assessed digital usage as an activity to be shared with others and children's interest in using digital devices for literacy tasks, something that we do not believe has been done by others using this age group.

We know the importance of the quality of children's reading interactions (e.g., Baker et al., 2001; Sonnenschein & Munsterman, 2002) for their literacy development. Children who engage in positive reading interactions with others choose to read more frequently, which in turn, predicts the growth of literacy skills (Serpell et al., 2005). In other words, the positive reading

interactions “seed” further reading and development. This study extends such findings to show that the frequency of children’s use of digital tools with others and their interest in using digital tools for literacy tasks also is related to the frequency with which they participate in literacy activities. Given the increasing prevalence of digital devices in the U.S., such findings are particularly important and have implications for educational issues. According to our results, children liked using digital devices and using them for literacy activities (see also Aram & Bar-Am, 2016). We predict that such positive interactions with digital devices may “seed” future use of digital devices for literacy activities and possibly literacy development.

Strengths, Limitations, Implications, and Future Directions

This is one of the first papers to document the home learning environment of young children in the U.S. during the COVID-19 pandemic when most schools were closed. Given the ongoing consequences of the pandemic in the U.S., and the continuing need to implement virtual schooling for many children, these patterns are critical to document. Children in this U.S. sample between the ages of 2 and 9 more frequently engaged in literacy activities and used digital devices to do so. Although there were no age differences for reported frequency of engagement in literacy activities, there were for digital ones. Older children did this more than younger children. These results are consistent with the restricted range of activities and options that were available to children during this period. Many other sources of entertainment and learning were not available to children and their families during this time period: schools, movies, malls, and recreational centers were typically closed then. Many of the schools in the U.S. turned to virtual learning, particularly for school-age children, which would have required the use of digital tools.

Whether schooling is virtual or not, our findings are important for understanding digital use and literacy engagement and their relationship. That is, children who wanted to use digital tools with others and who wanted to use digital tools for literacy activities, participated in literacy activities more frequently. Given how much children like to use digital devices and interact with others, this may be an important means of encouraging them to participate more frequently in various literacy activities. Future research should continue to specify the parameters of when digital device use is positively associated with children's literacy development.

There are four limitations to the design of this study. One, our sample consisted of mainly highly educated parents. It was not a random sample representative of the U.S. population; it was a convenience sample. Convenience samples are among the most commonly used in developmental science (Jager et al., 2017). However, the nature of the sample limits generalizability of the findings and causal explanations (Dearing & Zachrisson, 2019; Etikan et al., 2015; Sedgwick, 2013). The findings may not necessarily apply to less educated parents or low-income families. Although about 80% of families in the U.S. have access to the internet at home, children from low-income backgrounds are less likely to have digital tools and internet access than their more affluent peers (Pew Research Center, 2019). Relatedly, not only do families need access to digital devices and the internet, they need to have the time to assist their children. This, too, may vary by family income. Despite this significant limitation, the results of this study based on our sample are important for increasing our understanding of activities during COVID-19. These results provide information about the types of activities taking place in homes during a period of unprecedented closures. This study provides initial data that may be used as a

starting point to conduct longitudinal studies and to explore how the home literacy environment and digital usage changed during the course of the pandemic.

Another limitation is that although we asked parents about their and their children's participation in digital activities and the relation between digital use and literacy activities, we did not observe the interactions. Therefore, we cannot conclude whether or how using digital devices is related to growth in literacy skills. Related to the prior point, our findings are based on parents' reports of their children's activities and not children's actual activities. Although we have no reason to question the accuracy of parents' reports, it is possible that parents were not always aware of their children's activities.

Three, this was a questionnaire used by a consortium of investigators from different countries. We were limited in our ability to modify the questions. Unfortunately, we did not ask whether the children were in school, and if so, were required by their school to engage in distance learning. Most school systems in the U.S. during the time these data were collected did require their students to engage in distance learning. As we noted in the Introduction, 93% of children in the U.S. engaged in distance learning (U.S. Census, 2020). On the other hand, 25% fewer four-year-olds were enrolled in any form of preschool during this time period than prior to the COVID-19 pandemic (Barnett & Jung, 2021). Thus, we cannot determine why children engaged in literacy or digital activities at home. Was it due to requests from schools or parents' desires to keep their children up to date in skill development or some other reason? Although it would have been nice to know why the children did their activities, we believe that why this occurred is less important than knowing what was occurring at home.

We also did not ask about families' race/ethnicity or income. Such information should be included in future research to allow investigators to explore demographic group-based

differences. Unfortunately, it is difficult to get economically, culturally, and linguistically diverse respondents, at least in the U.S., to complete on-line surveys of the type used in this study (e.g., Stites, et.al., 2021).

Four, although the two through eight year old range is considered early childhood, it is a very large age span, and there can be large developmental differences. We were primarily interested in differences pre- and post-the start of first grade (formal schooling in the U.S.). It would have been desirable if we could have further divided the sample. However, the sample was small, particularly the number of children ages two or three years.

In spite of the limitations to this study, we think these findings make an important contribution to understanding the home learning environments of children in the U.S. during a time they were confined to their homes because of COVID-19.

Implications and Future Directions

Although our sample was nonrepresentative, these results provide an important, initial step to understanding the home learning environment when in-person school availability is limited. These findings provide a window into the types of literacy activities (both digital and more traditional) being completed in the home by these families. The parents in this study reported their children liked using digital devices with others and using them for various literacy activities. Teachers can collect such information from the families in their classes to learn: What is the nature of children's digital use at home, with whom and for what? What is the impact of such usage on children's literacy development? Based on answers to these questions, teachers can suggest further at-home activities for children or supplement missing topics in children's classwork.

Many of the U.S. school systems during COVID-19 school closures made digital tools available to children who did not have ready access. Based on the findings with the present sample of children who enjoyed using digital devices with others and for literacy activities, policy makers should continue making digital tools available to families who need them . Moreover, using distance learning as an aspect of instruction may well continue into the future (Locklee, 2020).

Future research needs to consider whether these findings apply to a more diverse sample of families. Although about 80% of families in the U.S. have access to digital devices (Pew Research Center, 2019), such access is more limited among less affluent families.

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children.

Table 1.

*Sample Survey Items***Home Literacy Questions**

- Since COVID-19 began, has the number of literacy-related activities you have done with your child changed? (Increased, Decreased, Stayed the Same)

Below are items that describe activities that occur between parents and children in the home.

- Please note the frequency with which you engage in each activity with your child since the outbreak of the Coronavirus: (5-point scale with 5 being the highest)
 - Read children's storybooks with the child
 - Encourage the child to copy letter/words
 - Solve riddles about objects/people/nature (e.g. what is green on the outside and red on the inside? A watermelon)
 - Sing songs with the child

Digital Use Questions

- Since COVID-19 began, has your child's use of digital devices changed? (Increased, Decreased, Stayed the Same)
- What device(s) does your child prefer to use?
- How much time per day, on average, does your child spend using digital devices (e.g. television, computer, tablet, and mobile phone)? (Hours – 7-point scale with 7 being the highest)
- In your opinion, to what degree does using digital devices contribute to the development of young children? (6-point scale with 6 being the highest)
- To what extent do you and your child work on digital devices at home together (mobile phone, tablet and computer)? (5-point scale with 5 being the highest)
- To what extent does your child show interest in writing on a digital device? (5-point scale with 5 being the highest)
- To what extent does your child play letter games/sound games/rhyme games with his digital devices? (5-point scale with 5 being the highest)
- To what degree does your child show interest in reading digital books? (5-point scale with 5 being the highest)

Table 2.

Mean Literacy and Digital Use by Age During Covid-19 (N = 154), Select Findings

	Full group Mean (SD)	< 72 months Mean (SD)	≥72 months Mean (SD)
Home Literacy Activities Composite	3.17(0.64)	3.08 (0.54)	3.22 (0.70)
Play games with the child where the child learns letters	3.23 (1.25)	3.60 (1.00)	3.08 (1.30)*
Write notes with the child	2.50 (1.06)	2.00 (1.00)	2.63 (0.98)*
Encourages the child to write his or her name and names of family members	3.42 (1.30)	2.88 (1.28)	3.59 (1.25)*
Play sound games (like rhymes)	3.43 (1.16)	3.72 (0.96)	3.35 (1.22)*
Work in reading and writing workbooks	3.52 (1.34)	2.77 (1.36)	3.79 (1.24)*
Play with magnet letters	1.89 (1.14)	2.37 (1.22)	1.72 (1.07)*
Read children's storybooks with the child	4.35 (0.79)	4.51 (0.70)	4.27 (0.83)*
Encourage the child to copy letters and words	3.28 (1.28)	2.93 (1.16)	3.37 (1.30)*
Read with the child taking turns	3.23 (1.44)	2.16 (1.23)	3.60 (1.31)*
Sing songs	3.14 (1.21)	3.67 (1.09)	2.89 (1.21)*
Home Digital Use Composite	3.13 (0.69)	2.88 (0.74)	3.31 (0.59)*
To what extent do you think your child enjoys using the digital devices at home? ¹	5.27 (0.87)	5.28 (0.84)	5.26 (0.91)
How much time, on average, does your child spend using digital devices, per day? (hours) ²	4.27 (1.33)	3.99 (1.32)	4.50 (1.34)*
What is your level of involvement in selecting digital content that your child uses?	4.08 (0.99)	4.15 (1.13)	4.01 (0.89)

<i>Social-Affective Context Digital Activities Composite³</i>	3.28 (0.70)	3.05 (0.75)	3.44 (0.62)*
<i>Likes Doing Digital Activities Composite³</i>	2.99 (0.90)	2.71 (0.96)	3.17 (0.78)

* $p < 0.05$

Note. Unless otherwise indicated, all home literacy and digital activities were measured on a 5-point scale with a range of 1 to 5 with 5 the highest rating.

¹ This item was measured on a 6-point scale with 6 being the highest.

² This item was measured on a 7-point scale with 7 being the highest.

³ The social-affective context includes doing digital activities with specified others and how interested child was in using digital tools for literacy activities. The likes doing digital activities was based on how interested the child was to use digital tools for literacy activities.

Table 3.

Four Most Frequently Reported Home Literacy Activities

	Mean (SD)
Older Children	
Read children's storybooks with the child*	4.22 (0.83)
Work in reading and writing workbooks	3.91 (1.21)
Read with the child taking turns	3.76 (1.26)
Read information books*	3.71 (1.11)
Younger Children	
Read children's storybooks with the child*	4.50 (0.73)
Play sound games (like rhymes)	3.64 (0.97)
Play games with the child where the child learns letters	3.52 (1.03)
Read information books*	3.48 (1.15)

Note. Scores ranged from 1-5 with 5 high.

*The same activity appeared for older and younger