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Young Children's Tablet Use and Associations with Maternal Well-Being

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Abstract

While recent research has documented a rapid increase in the use of new technologies such as touchscreen tablets early in life, little is known about how young children use tablets, what activities they engage in, and whether family demographic and maternal well-being are associated with early use. Guided by Bronfenbrenner's bioecological theory of human development, the current study addressed these questions with a cross-sectional, online survey of mothers with children between 12 and 48 months of age. Mothers reported on their child's tablet use as well as their own personal well-being (depressive symptoms and role overload) and relational well-being (relationship satisfaction, coparenting quality, conflict frequency). Nearly 63% of all mothers owned a tablet. Approximately 46% of children with access typically use a tablet in an average day, with the majority using for 15 minutes or less. For families who owned a tablet, child's frequency of use was positively associated with child's age and mother's use and negatively associated with mother's relational well-being. Despite the American Academy of Pediatrics recommendation that screen media be avoided for children under 24 months, children in our study used tablets, albeit infrequently. Our findings suggest that it is important for researchers to consider the relationship between contextual factors within the family and child media use. Refining their focus for families with particular needs may allow child advocates and policy makers to develop more beneficial media recommendations for families with a variety of circumstances.

Keywords: Child media use, child tablet use, touchscreens, child app use

Introduction

Digital media use is common among young children, with three-quarters of children 0 to 8 years using screen media in a typical day (Rideout, 2011). Ownership of new technology, such as smartphones and tablets, has rapidly increased in families, and use of such technology by young children is on the rise (Rideout, 2013; Wartella, Rideout, Lauricella, & Connell, 2013; Zickuhr, 2013). One reason for this increase is that the past two decades mark the first time that media content has commonly been created for infants and toddlers as opposed to preschoolers and older children. Developers of such media often market their products by highlighting promises of developmental or educational benefits (Fenstermacher et al., 2010; Garrison & Christakis, 2005; Schuler, Levine, & Ree, 2012). At the same time, the American Academy of Pediatrics (AAP) has repeatedly recommended that children younger than 24 months *not* be exposed to screen-based media (AAP, 2011, 2013).

Research on the potential for learning from media at early ages has focused primarily on traditional, non-interactive video and has found little evidence for educational benefits. For instance, research comparing live versus comparable screen-based situations has found lower levels of learning from television for children under approximately 30 months for a variety of tasks (e.g., Barr & Hayne, 1999; Hayne, Herbert, & Simock, 2003; Kuhl, Tsao, & Liu, 2003; Troseth & DeLoache, 1998), a pattern referred to as the *video deficit* (Anderson & Pempek, 2005), or, more recently, the *transfer deficit* (Barr, 2013). Although traditional video appears to hold little educational value for children under 24 to 36 months (Anderson & Hanson, 2010), less is known about the effects of interactive media, such as touchscreens, on early development (Kirkorian & Pempek, 2013).

Some studies suggest that learning from video is possible under certain circumstances. For instance, socially contingent interactions with on-screen actors appear to diminish the video deficit for young children (Roseberry, Hirsh-Pasek, & Golinkoff, 2013; Troseth, Saylor, & Archer, 2006). However, contingency does not need to be social in order to aid learning from video. Interactivity provided by a computer game (i.e., pressing a key to cause an action on screen) also eliminated the video deficit for 30- and 36-month-olds (Lauricella, Pempek, Barr, & Calvert, 2010). Although computers can be difficult for young children to use, the user-friendly nature of touchscreens may afford greater opportunity for young children's learning. In fact, a recent study found that interactivity provided by a touchscreen interface enhanced word learning beyond that of non-interactive video for 24-month-olds (Kirkorian, Choi, & Pempek, in press).

Despite the plethora of interactive media for young consumers, research on how often and in what ways children use touchscreen devices is limited, with only a handful of studies addressing this topic. In a 2011 report, 52% of children 0 to 8 years old were found to have access to newer digital technologies, including smartphones, iPods, or iPads, and they used such devices for 5 minutes per day on average (Rideout, 2011). With respect to the youngest consumers, 10% of 0- to 1-year-olds and 43% of 2- to 3-year-olds were found to have ever used such devices. A more recent survey revealed that since 2011 ownership of new mobile devices has increased rapidly among families with young children (Wartella et al., 2013). Time use has also increased: Children 0 to 8 use an iPod touch, iPad, or similar device for 14 minutes per day on average and a smartphone for 10 minutes per day (Wartella et al., 2013). Another new survey confirms this increase, reporting that 72% of children 0 to 8 have ever used mobile devices, including 38% of children under 2 (Rideout, 2013). Rideout directly compared two recent surveys and also confirms an increase in time use, up from 5 minutes per day on average in 2011 to 15 minutes in 2013 across all children 0 to 8 and from 43 to 66 minutes among those who typically use daily.

In addition, an “app gap” was noted in the 2011 report, referring to the finding that access to and use of newer mobile technologies, such as smartphones and tablets, is less common for children in lower income households compared to those in higher income households (Rideout, 2011). Although the “app gap” continues, the divide has decreased in recent years. For instance, a recent survey of low-income, minority families found that touchscreen use is common even among the youngest users. This study reported that nearly 97% of children 6 months to 4 years of age have ever used a mobile device, and nearly three-quarters of 4-year-olds owned their own mobile device, most commonly a tablet computer (Kabali et al., 2015).

Although researchers have begun to assess amount and frequency of touchscreen use by toddlers, to our knowledge, almost no research exists on the types of activities young children engage in while using touchscreen devices. One study by Common Sense Media broadly assessed young children’s app use and activities on touchscreen devices. In this group’s 2013 report, Rideout (2013) reported that the following percent of children 0 to 8 years old had *ever* engaged in these activities on a tablet: 37% played games, 31% used apps, 28% watched videos, 24% watched TV shows or movies, and 23% read books. This group also examined the frequency with which the youngest children in their sample engaged in three categories of activities: educational games, games that are “just for fun,” and creative apps, like drawing. A relatively small number of parents of 0- to 1-year-olds reported frequent engagement (i.e., sometimes or often) in such activities; specifically, frequent use of educational games

occurred for 13% of children in this age group, games that are just for fun for 15%, and creative apps for 19% (Rideout, 2013). Engagement in these activities increased greatly for children 2 to 4 years of age, with frequent use of educational games occurring for 52% of these children, games just for fun for 43%, and creative apps for 45% (Rideout, 2013). In another recent study, Kabali and colleagues (2015) asked parents to report names of apps their children (0 to 4 years) most often used. Classifying the apps based on the developer's description, they found that parents reported content delivery apps (e.g., Netflix, YouTube), educational apps, and entertainment apps to be commonly used by children across all ages tested.

Family demographic characteristics are often found to relate to media use in children. A nationally representative study of media use by children ages 0 to 8 years old indicated that African American children used approximately 4.5 hours of media per day on average, Hispanic children used nearly 3.5 hours, and White children used just under 3 hours (Rideout, 2011). This same study found that media was used more frequently by children in families with lower income levels and lower parent education (Rideout, 2011). For children 6 months to 6 years, child's age, child's race, and parental education were common predictors across various mediums, with greater time spent using media by older children and by African American children (Anand & Krosnick, 2005). Associations between media use and parent education were mixed, with *less* education predicting greater TV use and *more* education predicting greater computer use. Child's sex and family income did not consistently predict early media use in this same study (Anand & Krosnick, 2005). Another study found that, for children 4 years and under, a greater number of adults in the home was associated with a decrease in television use over time (Lee, Bartolic, & Vandewater, 2009).

Personal characteristics of parents also play a role in whether and how they orient their children towards media. Although parents report being much more likely to direct their child to a book, toy, or other activity than to media for an educational experience, their own media practices influence their children's use: Avid media use by parents was associated with greater child media consumption, greater rate of child bedroom TV, and greater use of media as a parenting tool (Lauricella, Wartella, & Rideout, 2015; Wartella et al., 2013). Likewise, a large scale survey of parents of children in three age groups (≤ 5 years, 6-11 years, and 12-17 years) found that the average amount of time parents spent watching television was more strongly related to their children's television time than were access to television in the home, parents' television rules for children, or parental coviewing of TV, for all

three groups (Bleakley, Jordan, & Hennessy, 2013). Further, parental attitudes about the impact of media predict media use by young children, with more positive attitudes indicating greater use (Lauricella et al., 2015).

Other researchers have focused on parental well-being factors. For instance, family conflict was associated with an increase in television use over time (Lee et al., 2009). Another group of researchers, focusing on educational media in particular, found that family conflict (but not economic resources or maternal depression) was negatively related to educational media use for 2- to 5-year-olds (Vandewater & Bickham, 2004). However, another study did not find an association between children's television use and parental depression or parental well-being (Bleakley et al., 2013). This could be due to measurement of each parent variable with only one global, likert-response question in the latter study.

As these findings demonstrate, consideration of the context in which children develop can be valuable for understanding media use. However, beyond basic demographics, context factors are often ignored in studies of children and media. In particular, research in this area has not kept pace with rapidly evolving newer technologies such as mobile devices. Consideration of the media use context from an ecological perspective may help to better explain young children's use of media. One well-known ecological theory is Bronfenbrenner's bioecological theory of human development (previously ecological systems theory; Bronfenbrenner & Morris, 2006), which explains the effects of family demographics and parent characteristics on child development.

In its latest iteration, Bronfenbrenner's theory focused on the Process-Person-Context-Time model (PPCT) in which he emphasized the interactive nature of relations between these four components (Bronfenbrenner & Morris, 2006). *Process* refers to specific interactions, or primary processes, between the individual and the environment that are predominantly responsible for development such as reading, problem solving, parent-child interactions, and group or solitary play (Bronfenbrenner, 1993; Bronfenbrenner & Morris, 2006). Although proximal processes occupy a central role in Bronfenbrenner's theory, their influence on development is said to vary as a result of the remaining three components: person, context, and time (Bronfenbrenner & Morris, 2006). *Person* refers to dispositions, bioecological resources (e.g., knowledge, ability), and demand characteristics which influence the "direction and power" of proximal processes (Bronfenbrenner & Morris, 2006), including demographic factors often considered in studies of media use. *Context* refers to the four "nested structures" of the environment for which Bronfenbrenner is widely known, including microsystems, mesosystems, exosystems, and macrosystems (Bronfenbrenner, 1993). Most relevant here, the innermost set of structures, referred to as microsystems, include

patterns of “activities, social roles, and interpersonal relations” within the individual’s immediate environment (e.g., home, school; Bronfenbrenner, 1993, p. 39). The final factor of the PPCT model, *time*, is divided into three levels: microtime (continuity/discontinuity in proximal processes), mesotime (repetition of proximal processes throughout an individual’s development), and macrotime (inter- and intra-generational changes at the societal level; Bronfenbrenner & Morris, 2006).

Many of the key context factors that may be relevant to young children’s tablet use can be classified according to Bronfenbrenner’s PPCT model. In his early writings, Bronfenbrenner refers to television as an example of an exosystem factor (e.g., Bronfenbrenner, 1979). Under the later PPCT model, activities such as watching television or using a touchscreen tablet are better classified as proximal processes in that they constitute a regularly occurring interaction between the developing child and a symbolic medium. Child demographic variables often considered in the media context, such as child’s age, appear at the person level of the PPCT model. Other factors relating to the family more broadly, such as parent’s age, education, income, and number of children in the home, appear at the context level as a microsystem (i.e., the family microsystem). Likewise, maternal well-being, as a characteristic of the mother (e.g., level of depressive symptoms), is a contextual, microsystem factor. Relational well-being (e.g., quality of support mother receives from partner) is a characteristic of the mother’s interactions with her romantic partner, including support on parenting issues. Because the relationship between parents is occurring in their child’s immediate context and many times likely involves the child (e.g., issues of coparenting), this factor also appears at the microsystem level. As specified by the PPCT model, person and context factors influence primary processes. Thus, each of these factors is viewed as a potential influence on the process of screen media use.

From this perspective, in the current study, we sought to expand upon research on the description of early tablet use by considering family demographics and parent characteristics that might be important for determining frequency of use of new media by young children. By isolating key context factors, the current study attempts to provide a more refined view of early technology use by very young children. In particular, we used a cross-sectional sample to investigate how often and in what ways children use touchscreen tablets and whether context factors such as maternal personal and relationship well-being are related to early child tablet use.

Based on the literature reviewed above, we proposed the following hypotheses. First, based on previous research by Common Sense Media (Rideout 2011, 2013), we hypothesized that approximately half of families would have access to tablets. In line with recent reports from Wartella et al. (2013) and Rideout (2013), our second

hypothesis was that children who used tablets would spend 15 minutes per day or less using them, on average. Also based on work by Rideout (2013), our third hypothesis was that use of educational apps (e.g., matching apps, math/counting apps) and creative apps (e.g., drawing/coloring apps) would occur more frequently than playing games. Our fourth hypothesis, based on Bronfenbrenner's PPCT model as well as on findings that family conflict affected educational media use in young children (e.g., Lee et al., 2009; Vandewater & Bickham, 2004), was that mothers who were experiencing more stressful personal circumstances (e.g., feeling down and overloaded) and family situations (e.g., lower quality and more conflictual couple and coparenting relationships) would allow more frequent tablet use. Finally, based on previous research on family demographics and media use, our fifth hypothesis was that greater child age (Rideout, 2011, 2013), greater frequency of maternal tablet use (Lauricella et al., 2015; Bleakley et al., 2013), and lower levels of maternal education (Rideout, 2011) would be associated with greater frequency of tablet use by the child. On the other hand, we also hypothesized that mother's age and income would not be associated with tablet use when considering only those children who use tablets.

Method

Participants

Participants included 358 mothers of children 12 to 48 months old. Average maternal age was 30.16 years ($SD = 4.47$) and child age was 2.21 years ($SD = 0.89$). On average, mothers had 1.79 children ($SD = 0.95$). If mothers had more than one child, they reported on the youngest child; 32% of target children had at least one older sibling. The majority of the sample was White (85.8%), with an additional 4.2% Hispanic, 3.9% African American, 3.1% Asian or Pacific Islander, 2.8% other, and 0.3% American Indian. Mothers were well educated, on average; for highest educational level achieved, 72% had a college degree. Mean income level was \$64,039 ($SD = \$42,702$). The sample represented geographically diverse regions within the United States. According to maternal report, 28% resided in the West, 24% in the Midwest, 20% in the Northeast, and 26% in the South, and 2% outside of the U.S. Further, 20% of participants described the area where they lived as rural, 64% as suburban, and 16% as urban.

Procedure

Data for this study were drawn from a survey of women's media use and well-being. Participants were recruited through fliers in community buildings, emails, and announcements on a parenting website. The fliers directed potential participants to a website where they were invited to complete a survey. To qualify, participants had to be women 18 years of age or older. Qualified individuals who chose to complete the survey first completed

informed consent and then reported demographic information and frequency of media use. They also rated their personal well-being (e.g., depression, role overload) and relational well-being (e.g., relationship satisfaction, coparenting quality, relational conflict). Those participants who had a child from 12 months of age, up to and including 48 months of age, also responded to items regarding their child's tablet use. Of these mothers, those who were married or currently living with a partner were included in the current study ($N = 358$). We included only those who had a relational partner, as some of our variables of interest were relational in nature (e.g., relationship satisfaction, coparenting, etc.). Those with more than one child in the target age range were asked to respond in reference to their youngest child. Upon completion of data collection, data were analyzed using the statistical software SPSS. This research was conducted following ethical principles and was approved by the University Institutional Review Board.

Tablet Use Measures

Frequency of Use. Mothers reported on their own and their child's frequency of tablet use (i.e., using an iPad, Kindle, or other tablet) on a typical day on a 10-point scale: 0 (Never), 1 (1 to 15 minutes), 2 (16 to 30 minutes), 3 (31 minutes to 1 hour), and so on to 9 (7 or more hours). These two items were created specifically for this study.

Child App Use. Using the question from the Common Sense Media survey by Rideout (2011), mothers rated how many apps they have downloaded specifically for their child on a 5-point scale from 1 (Fewer than 5) to 5 (More than 30). They then rated the frequency with which their child engages in 13 tablet activities on a typical day using a 6-point scale from 0 (Never) to 5 (Very Frequently). We created these 13 tablet activity items specifically for the current study from a careful review of the literature (e.g., Rideout, 2013) and by examining the types of activities children can engage in while using a tablet. Rideout (2011, 2013) measured the frequency of three broad categories of app use, including educational games, games just for fun, and creative apps. Our items fit into these categories as follows. For *educational apps*, we included (1) matching apps, (2) math/counting apps, (3) reading interactive books, (4) letters/writing/word apps, and (5) history/geography apps. Note that Rideout (2011, 2013) did not originally include items assessing history/geography apps, but we felt that this type of an app best fit under the broad umbrella of educational apps. For *games just for fun*, we included one item: (6) playing games (e.g., Angry Birds, Fruit Ninja, etc.). For *creative apps*, we included (7) drawing/coloring/painting apps and (8) music apps (not including listening to music). We also included five items assessing *other activities* that children might engage in

while using a tablet, including (9) watching TV shows/cartoons, (10) watching movies, (11) listening to music, (12) using the internet, and (13) playing with the camera.

Mothers' Personal Well-Being Variables

Depressive Symptoms. Mothers completed the Center for Epidemiological Studies-Depression Scale (CES-D; Radloff, 1977). They rated how often they experienced 20 symptoms during the past week on a 4-point scale from 0 (Rarely or none of the time—less than 1 day) to 3 (Most or all of the time—5 to 7 days). Example items include “I felt depressed” and “I had crying spells.” Items were summed to produce an overall score; higher scores represent more symptoms ($\alpha = .92$).

Role Overload. Mothers rated how overcommitted and stressed they feel as a result of having too many tasks and too little time on a 5-point scale from 1 (Strongly disagree) to 5 (Strongly agree; Reilly, 1982). Example items include “I can’t seem to get caught up” and “There are too many demands on my time.” Items were summed to produce an overall score; higher scores indicated higher overload ($\alpha = .92$).

Mothers' Relational Well-Being Variables

Relationship Satisfaction. Mothers responded to The Quality of Marriage Index (QMI; Norton, 1983). Wording was changed to “partner” and “relationship.” The first five items (e.g., “We have a good relationship”) ask participants to rate their agreement on a 7-point scale from 1 (Very strongly disagree) to 7 (Very strongly agree). The sixth item asked them to rate their overall relationship happiness on a 10-point scale from 1 (Unhappy) to 10 (Perfectly happy). Items were standardized and averaged, with higher scores indicating more satisfaction ($\alpha = .97$).

Coparenting Quality. Mothers responded about the quality of their coparenting relationship with their partner on the short-form of the Coparenting Relationship Scale (CRS; Feinberg, Brown, & Kan, 2012). This 14-item scale assesses various dimensions of coparenting quality, such as support and undermining. Mothers rated the degree to which each statement describes their parenting relationship with their partner on a 7-point scale from 0 (Not true of us) to 6 (Very true of us). Example items include “My partner and I have the same goals for our child” and “My partner undermines my parenting.” An overall coparenting score was determined by reverse scoring negative items and averaging items; higher scores indicate higher quality coparenting ($\alpha = .89$).

Conflict Frequency. Participants reported the frequency of relationship conflict in 8 areas taken from the RELATE assessment battery by indicating how often each item is a problem in their relationship (e.g., financial

matters, communication, rearing children, etc.) on a 5-point scale from 1 (Never) to 5 (Very often; Busby, Holman, & Taniguchi, 2001). Items were averaged; higher scores represent more conflict ($\alpha = .74$).

Overall Well-Being Measures

When all of the well-being predictor variables (e.g., depression, role overload, relationship satisfaction, etc.) were entered into the model simultaneously, collinearity statistics indicated low tolerance. For example, we found tolerance values of .37, .39, and .46 for coparenting, relationship satisfaction, and conflict, respectively, indicating that 54% to 63% of the variance in these variables was shared with the other variables in the model and was therefore redundant. We also found evidence of suppression effects: When each predictor variable was entered into the model alone it was significant, but when all predictors were entered into the model simultaneously, none of the predictors were significant due to overlapping variance. Therefore, overall personal and relational well-being variables were created to reduce multicollinearity in our regression model. When including the overall personal and relational well-being variables, tolerance values were improved to .62 for personal well-being and .70 for relational well-being. Personal well-being represented the average of standardized and reverse scored depression and role overload ($r = .416, p < .001$), and relational well-being represented the average of standardized relationship satisfaction, coparenting quality, and reverse scored conflict frequency ($\alpha = .88$). Note that before standardizing the scores, log transformations were calculated for depression, relationship satisfaction, and coparenting quality in order to reduce skewness; these transformations successfully reduced the skewness values on these scales from 1.35 to -0.48, -1.20 to 0.46, and -1.50 to 0.48, respectively. For both personal and relational overall well-being measures, higher scores indicate greater well-being.

Results

Tablet Ownership and Use

The number of mothers who reported owning an iPad, Kindle, or other tablet device was 225 (62.85%). This finding generally supports Hypothesis 1, which predicted that approximately half of families would have access to tablets. However, this percentage was slightly higher than expected. Of those who owned a tablet, mother and child tablet use were correlated ($r = .29, p < .001$). Income for those who owned a tablet was nearly \$15,000 greater than for those who did not own a tablet, $F(1, 357) = 10.168, p = .002$. This was also true when we excluded 7 outliers for income which were greater than 3 SDs above the mean income (5 owned tablets, 2 did not), $F(1, 350) = 12.750, p < .001$.

The majority of all mothers reported that their young child did not use a tablet in a typical day (69.55%; 54.22% in families who own a tablet). As predicted in Hypothesis 2, most of those who used tablets did so for 1-15 minutes (see Table 1 for frequencies). Chi-square tests were used to assess differences in frequency of time use for older and younger children. Children 25 to 48 months spent more time on tablets than 12- to 24-month-olds, $\chi^2(4) = 15.37, p = .004$, a pattern that also held when examining only those who owned tablets, $\chi^2(4) = 16.94, p = .002$.

Both number and type of apps downloaded for the child were assessed. Only mothers who reported that their child used a tablet device in a typical day ($N = 107$) were included in these analyses. This was done because including large numbers of children who do not use tablets would likely provide an inaccurate result by skewing results towards zero. In terms of number of apps downloaded specifically for the child's use, 26.17% reported downloading fewer than 5; 28.97% reported 5-10; 34.58% reported 10-20; 6.54% reported 20-30; and 3.74% reported more than 30. The chi-square test of differences between young and older children on this factor was not significant ($p = .159$).

Again only for children who typically used tablets, frequencies with which they used various types of apps were calculated to test Hypothesis 3 (see Table 2). In support of Hypothesis 3, we found that children engaged in use of educational and creative apps (with the exception of music apps) more frequently than games for fun. Overall, the percent of mothers who indicated that their children used the following apps *frequently* or *very frequently* included 32.7% for drawing/coloring apps, 29.0% for letter/writing/word, 24.3% for math/counting, 23.4% for matching, 19.7% for reading books, 15.9% for playing games, 9.3% for music apps (not including listening to music), and 1.9% for history/geography apps.

To further explore children's app use, the frequency of the five other tablet activities are reported in Table 3. Watching TV shows/cartoons was the most common, with 17.8% reporting that their child did this *frequently* or *very frequently*. Note that although this was the most common of the other activities, when compared to the eight app categories described previously, it was only more frequent than reading books, music apps, and history/geography apps. Further, the percent of mothers who responded that their children engaged in the following activities on a tablet *frequently* or *very frequently* included 14.0% for listening to music, 11.2% for playing with the camera, 8.4% for watching movies, and 1.9% for using the internet .

Relation between Maternal Factors and Child's Tablet Use

In families who owned tablets, child tablet use was correlated with worse personal well-being (role overload and a trend toward depression) and worse relational well-being (relationship satisfaction, coparenting, and conflict) in mothers (see Table 4 for correlations and descriptives). To test Hypotheses 4 and 5, stepwise multiple regression was used to examine associations between our variables and frequency of tablet use by children in families who owned a tablet. In the first step, mother's age, child's age, number of children in the home, mother's frequency of tablet use, income, and mother's education were entered. In the second step, overall maternal personal and relational well-being were entered. Entering personal and relational well-being accounted for an additional significant amount of the variance in child tablet use ($\Delta R^2 = .042, p = .004$). The overall model was significant, $F(8, 216) = 7.705, p < .001, R^2 = .222$. In partial support of Hypotheses 4 and 5, child tablet use was positively associated with child's age ($B = .470, p < .001$) and mother's tablet use ($B = .197, p < .001$) and negatively associated with relational well-being ($B = -.213, p = .047$; see Table 5). Also as expected, mother's age and income were not associated with child tablet use. However, counter to our hypotheses, mother's education and personal well-being were not significantly associated with child tablet use in the context of all other predictors.

Discussion

In line with findings that tablet use has increased in recent years (Rideout, 2013; Wartella et al., 2013), nearly two-thirds of families in our sample owned a tablet. Even with increased ownership we found an "app gap" similar to previous research (Rideout, 2011): Tablet owners had higher incomes than non-owners. Although only about 30% of mothers reported that their child uses a touchscreen device in a typical day, this number increased to nearly half when considering only those families who owned a tablet. Of those who own, children were most likely to use tablets for 1-15 minutes per day (44%), as hypothesized. An additional 27% used tablets for 15-30 minutes. Considering that children 8 and under use screen media for around 2 hours per day (Rideout, 2013), for some children this is a substantial portion of their media use. It is yet unclear whether use of technology such as tablets displaces non-media activities or other media use. In our sample, children 12-24 months used tablets less frequently than those 25-48 months, with 66% of younger children never using compared to only 45% of older children. Although this may be promising in light of the AAP recommendation of no screen time for children under 2 years of age (AAP, 2011, 2013), it may also mean that the youngest consumers are spending screen time with non-interactive video rather than interactive touchscreen content. The latter may be particularly undesirable, as initial reports

indicate that interactive media may hold greater potential for learning at this age than do non-interactive media (Kirkorian et al., in press).

Motivated by Bronfenbrenner's discussion of context factors in his PPCT model (Bronfenbrenner, 1993), we predicted that those mothers experiencing more stressful personal and family situations would allow their children to utilize tablets more frequently. This hypothesis was partially supported. Poorer personal and relational well-being both significantly correlated with greater child tablet use. Once child age, mothers' tablet use, and other factors were accounted for, relational well-being was significantly associated with tablet use while personal well-being dropped out. This may indicate that poorer relational well-being decreases the coordination between parents in setting or implementing media limits, or it may be that poorer quality romantic relationships draw parents' attention away from the child more generally, leading to less parent-child interaction and more child media use. Further, it may be that the effect of mothers' personal well-being on child tablet use is accounted for by mothers' relational well-being because these were similar constructs. Taken together, these findings provide support for the potential influence of microsystem factors (i.e., contextual factors within the family in which the child is involved) on child screen media use. Thus, Bronfenbrenner's PPCT model can inform the understanding of young children's media use and should be considered in future research on this topic.

Finally, we explored the frequency with which various touchscreen activities were performed by young children. Many of the activities assessed were never done by a quarter to a half of all children who use tablets. The most frequent activities (those in which approximately 20% of parents or more reported that their children engaged "frequently" or "very frequently") included playing with art, language, math/counting, and matching apps as well as reading interactive books. Some of these activities, such as reading books, are also typical for young children in a non-digital form.

Many apps for young children are marketed as educational (e.g., Schuler et al., 2012), and parents of children 6 to 36 months of age frequently report allowing touchscreen use by their children in order to promote learning (Dodson, McClain, & Pempek, 2015). However, research on developmental outcomes of touchscreen use is in its infancy. Future research should consider whether the transition to a digital format affects outcomes for activities known to benefit development in their traditional forms. For instance, researchers have begun to consider the effects of parents' reading of digitally-enhanced storybooks on young children. Although some studies find benefits of digital features over traditional books (e.g., Takacs, Swart, & Bus, 2015), others find negative effects on

comprehension and parent reading style (e.g., Parish-Morris, Mahajan, Hirsh-Pasek, Golinkoff, & Collins, 2013). As the latter research highlights, transferring a traditionally beneficial learning activity to a touchscreen does not guarantee positive outcomes for child development.

This study has several limitations that should be considered. One limitation is that mothers were asked to provide a global estimate of their child's overall tablet use. Research comparing video observation of child TV viewing with various types of parent report indicates that overall estimates are less accurate than other methods, such as viewing diaries (Anderson, Field, Collins, Lorch, & Nathan, 1985). While future studies should utilize a media use diary method to capture frequency and time use if possible, this may not always be feasible due to limited time or resources. Some studies indicate that commonly used global measures (as used in the current study) are not as inaccurate as once assumed because differences between measures balance out when considering results at the sample level as opposed to the individual level. For example, average estimates (across a sample) for various media use measurement techniques, including electronic monitoring, global estimates, and media diaries, were found to be fairly similar (Vandewater & Lee, 2009). Another limitation of this study is that research on television has demonstrated the importance of content, particularly with respect to educational and violent programming (e.g., Anderson, Huston, Schmitt, Linebarger, & Wright, 2001). Although we did consider apps and activities that may be educational, we did not assess the educational quality of specific apps. Future studies may be done to address this question by using a content analysis approach and comparing content seen in apps with desirable educational objectives for young children. Similarly, although we addressed contextual factors in this paper, we did not assess the specific conditions under which tablet use occurs (e.g., whether it is happening while with a parent or while alone), which may be important for developmental outcomes. Future studies might use a diary approach to track the type of touchscreen content young children are exposed to, length of exposure, and conditions under which media use occurs. Finally, our sample was restricted in terms of several demographic features. For example, single mothers were excluded to allow us to focus on relational well-being in the current study. Further, although we did see a range in family income, indicating some socioeconomic diversity, our results may not generalize to children of different racial backgrounds or those whose parents have fewer years of education as our sample was primarily White and educated. Prior research on older children indicates that those who are White and whose parents have achieved higher levels of education tend to spend less time with media (Rideout, 2011). Thus, it is important that future studies examine our results in more diverse samples.

Although the current study provides a starting point for considering child and family factors related to use of new technologies, future research should consider content of media use by young children and should include participants more representative of the US population. Likewise, we recommend that future research continue to integrate components of Bronfenbrenner's PPCT model into examinations of children's media use. Bronfenbrenner describes methodological designs that can accomplish this goal (see Bronfenbrenner & Morris, 1998). For instance, although the cross-sectional nature of the data in the current study precludes the measure of time as Bronfenbrenner described, future research could be done longitudinally to assess this factor. Future work could also examine broader, cultural issues (macrosystem) as they relate to the acceptance and frequency of child media and tablet use. At the very least, the current study demonstrates that the immediate contexts surrounding the child (microsystems, such as the quality of the inter-parental relationship) are associated with child screen media use and should be considered in future research.

Despite the AAP's earlier recommendations to avoid screen media exposure for children under 2 (AAP 2011, 2013), even the youngest children in our sample used touchscreen devices. Additionally, tablet use was more frequent with child's age and with poorer maternal relational well-being. Along with recent findings demonstrating that parent factors predict young children's overall screen time (Lauricella et al., 2015), our results suggest that overarching media use recommendations for young children could be inadequate given differences in family circumstances. A recent article in the AAP News magazine offers more realistic research-based recommendations for parents regarding children's media use than the previous recommendation of discouraging all screen media use (Brown, Shifrin, & Hill, 2015). For instance, this article suggests setting limits, modeling appropriate media use, and attending to media content while also emphasizing the importance of parent-child interaction and unstructured playtime (Brown et al., 2015). Despite these positive suggestions for strengthening recommendations for parents, more research is warranted to further address context factors like those assessed in the current study. Research like this may allow for further refinement of recommendations so that they are more beneficial to families.

Although more empirical evidence is needed in order to isolate and validate factors relevant to young children's touchscreen use, we speculate that providing information on family characteristics and media use to parents and healthcare providers could be useful. For instance, it may be valuable for parents to learn about the connections found in our study between parental characteristics and child tablet use because such information could help parents make more conscientious decisions about family media use. Likewise, healthcare professionals might

use such information to target messages to families most in need of guidance. For example, recommendations might be targeted to parents experiencing relational problems as part of existing interventions, such as couples counseling. Further research incorporating contextual family factors into assessments of children's technology use is clearly needed. Armed with results from work like this, researchers and policy makers may be able to develop media use recommendations that better serve families with a variety of needs.

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Table 1

Frequencies and percentages of Tablet Use by Age Group and Overall

	12 to 24 months		25 to 48 months		All children	
	N	%	N	%	N	%
Entire sample ($N = 358$)						
Never	127	77.4	122	63.5	249	69.9
1-15 min	21	12.8	24	12.5	45	12.6
16-30 min	10	6.1	20	10.4	30	8.4
31-60 min	5	3.0	13	6.8	18	5.1
> 60 min	1	0.6	13	6.8	14	3.9
Total	164	100.0	192	100.0	356	100.0
Those who own tablets ($N = 225$)						
Never	66	66.0	56	44.8	122	54.2
1-15 min	20	20.0	24	19.2	44	19.6
16-30 min	8	8.0	19	15.2	27	12.0
31-60 min	5	5.0	13	10.4	18	8.0
> 60 min	1	1.0	13	10.4	14	6.2
Total	100	100.0	125	100.0	225	100.0

Note. Data was condensed for categories over 60 minutes due to low number of responses. Percents reported are valid percents; for results for the entire sample, data was missing for one participant in the 12-24 month group (0.6% of the sample) and one participant in the 25-48 month group (0.5% of the sample).

Table 2

Frequency (%) and Mean of App Use for Children Who Use a Tablet ($N = 107$)

	Never	Very Rarely	Rarely	Occasionally	Frequently	Very Frequently	Combined Frequent ^a
Drawing/Coloring/Painting							
Younger	24.3	8.1	13.5	37.8	16.2	0.0	16.2
Older ^b	5.7	5.7	10.0	35.7	34.3	7.1	41.4
All^b	12.1	6.5	11.2	36.4	28.0	4.7	32.7
Letters/Writing/Word							
Younger	45.9	10.8	8.1	18.9	13.5	2.7	16.2
Older	28.6	5.7	5.7	24.3	30.0	5.7	35.7
All	34.6	7.5	6.5	22.4	24.3	4.7	29.0
Math/Counting							
Younger	59.5	5.4	8.1	10.8	16.2	0.0	16.2
Older ^b	24.3	8.6	10.0	28.6	21.4	7.1	28.5
All^b	36.4	7.5	9.3	22.4	19.6	4.7	24.3
Matching							
Younger	40.5	10.8	16.2	18.9	13.5	0.0	13.5
Older	17.1	11.4	2.9	38.6	25.7	2.9	28.6
All	25.2	11.2	7.5	31.8	21.5	1.9	23.4
Music (other than listening to music)							
Younger	45.9	8.1	5.4	32.4	8.1	0.0	8.1
Older	40.0	10.0	10.0	30.0	10.0	0.0	10.0
All	42.1	9.3	8.4	30.8	9.3	0.0	9.3

Note: Younger children are those age 12-24 months ($n = 37$); Older children are those 25-48 months ($n = 70$). History/Geography was also assessed but was not included here because 84.1% of parents, overall, reported that their child did not use such apps.

^aCombined Frequently and Very Frequently. ^bData missing for one participant.

Table 3

Frequency (%) of Touchscreen Activity Use for Children Who Use a Tablet ($N = 107$)

	Never	Very Rarely	Rarely	Occasionally	Frequently	Very Frequently	Combined Frequent ^a
Reading interactive books							
Younger	37.8	8.1	5.4	37.8	10.8	0.0	10.8
Older	24.3	14.3	7.1	30.0	17.1	7.1	24.2
All	29.0	12.1	6.5	32.7	15.0	4.7	19.7
Watching TV shows/cartoons							
Younger ^b	43.2	8.1	13.5	27.0	5.4	0.0	5.4
Older	14.3	11.4	21.4	28.6	17.1	7.1	24.2
All^b	24.3	10.3	18.7	28.0	13.1	4.7	17.8
Playing games (e.g., Angry Birds, Fruit Ninja)							
Younger	59.5	8.1	8.1	16.2	5.4	0.0	5.4
Older	27.1	14.3	8.6	28.6	18.6	2.9	21.5
All^b	38.3	12.1	8.4	24.3	14.0	1.9	15.9
Listening to music							
Younger	32.4	8.1	10.8	32.4	16.2	0.0	16.2
Older	35.7	17.1	11.4	22.9	12.9	0.0	12.9
All	34.6	14.0	11.2	26.2	14.0	0.0	14.0
Playing with the camera							
Younger ^b	51.4	5.4	13.5	21.6	2.7	2.7	5.4
Older	30.0	8.6	10.0	37.1	14.3	0.0	14.3
All^b	37.4	7.5	11.2	31.8	10.3	0.9	11.2
Watching movies							
Younger ^b	64.9	10.8	8.1	10.8	2.7	0.0	2.7
Older ^b	44.3	12.9	14.3	15.7	7.1	4.3	11.4
All^c	51.4	12.1	12.1	14.0	5.6	2.8	8.4

Note. Younger children are 12-24 months ($n = 37$); older children are 25-48 months ($n = 70$). Using Internet was assessed but is not included here because 85.0% of parents, overall, reported that their child did not do this activity.

^aCombined Frequently and Very Frequently. ^bData missing for one participant. ^cData missing for two participants.

Table 4

Means (SD) and Correlation Coefficients for Mothers who Owned a Tablet ($N = 225$)

	M	SD	1	2	3	4	5	6	7
1. Mother's age	30.36	4.50	---						
2. Child's age	2.24	0.90	.12	---					
3. Number of children	1.76	1.05	.10	.19**	---				
4. Income	69,503.67	45,128.65	.44**	.09	-.04	---			
5. Education	6.24	1.16	.32**	-.05	-.11	.33**	---		
6. Mother's tablet use	2.33	1.81	.15*	.02	.01	.03	.02	---	
7. Child's tablet use	0.95	1.33	.09	.31**	.04	-.01	-.02	.29**	---
8. Personal well-being	0.00	0.84	-.03	-.01	.02	-.07	-.07	-.06	-.18**
9. Relational well-being	0.00	0.89	-.11	.05	.06	-.12	-.06	-.05	-.18**

Note: Mother and child ages are in years. Personal well-being represented the average of standardized and reverse coded depression and role overload, and relational well-being represented the average of standardized relationship satisfaction, coparenting quality, and reverse coded conflict frequency. For an explanation of the other variables, please refer to the measures section.

* $p < .05$, ** $p < .01$

Table 5

Regression Predicting Frequency of Child's Tablet Use for Mothers who Owned a Tablet ($N = 225$)

	R^2	ΔR^2	B	$SE\ B$	β	t
Step 1	.180	.158**				
Mother's age			.010	.021	.033	0.472
Child's age			.470	.091	.318	5.136**
Number of children			-.030	.078	-.024	-0.381
Mother's tablet use			.197	.045	.270	4.434**
Income			-.000	.000	-.078	-1.137
Education			-.014	.075	-.012	-.185
Step 2	.222	.042**				
Personal well-being			-.146	.111	-.093	-1.312
Relational well-being			-.213	.106	-.143	-2.000*

Note: All estimates are the final model estimates. $F(8, 216) = 7.705$, $p < .001$, $R^2 = .222$.

* $p < .05$, ** $p < .01$

