**How Parent Perceptions Relate to Elementary Children's Portable Technology Use by
Gender and Grade-Level**

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Abstract

This study examined how parents' reports of children's technology usage in the home varies by child's gender or grade level. Framed by technology adoption models, this mixed-method study gathered parent reports of their elementary child's use of portable technology for entertainment and learning in the home, collected from 120 surveys and 13 individual interviews with those who were also survey respondents. Results across the four 2x2 ANOVAs yielded three significant main effects: gender and entertainment devices; gender and entertainment apps; grade level and learning apps. No significant effects were found among any of the interaction variables or within the ANOVA summary for learning devices. Interview data revealed girls are interested in reading with Kindle, whereas parents are reluctant to provide boys with portable technology because of boys' preference to play games. Strategies are provided for teachers, support specialists, and parents to improve how children use technology. Implications for app developers are suggested.

Keywords: elementary education, informal learning, mixed-method, portable technology, reading

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Introduction

Recent national survey data found 98% of families with children own smart devices such as smartphones and tablets (Rideout, 2017). These findings are especially compelling in comparison to technology ownership in 2011, where a study of 1,463 homes with children from birth to eight-years-old found only half of homes reported smartphone ownership (Rideout, Saphir, Pai, Rudd, & Pritchett, 2013). This study is an early empirical attempt to examine how demographic characteristics may relate to elementary children's use of portable technology in the home. We specifically inquired about children using technology to support reading in comparison to how children used the same devices for entertainment. The term mobile technology is typically associated with and limited to smartphones and tablets (Martin & Ertzberger, 2013; Stevens & Kitchenham, 2011) but our study expands on the term mobile technology and instead uses portable technology. We broadly define portable technology as transportable technology equipped with app affordances, such as smartphones, eReaders, tablets, laptops, and LeapPad learning devices.

Technology ownership in the home has become widespread, yet limited research exists on how children use portable technology beyond the classroom. Prior research has focused on children's technology use in the classroom, has been exploratory, qualitative, and provided little examination of demographic characteristics (Hutchison, Beschorner, & Schmidt-Crawford, 2012; Toppel, 2014). Little research has evaluated demographic characteristics of children and their use of portable technology, therefore there is a need to study these factors because it is possible the way parents permit their child to use technology could be related to their child's demographic

characteristics. It is important to consider earlier research findings that have shown how characteristic differences influences children's interaction with technology (Korat & Or, 2010; Vekiri & Chronaki, 2008).

In this study, we strive to reveal a depth of understanding of how demographic characteristics may relate to the ways in which children use technology. Demographic characteristics examined in this study include child's gender and grade range (K-2/3-5). Findings from this study may inform teachers, support specialists, and parents, while also providing implications for app developers. The literature review begins with how parents support their child's learning outside of school, then we discuss how gender and grade is related to children interacting with technology, and we conclude with explicit examples of how children have been identified using technology to scaffold their reading skills.

Parental Role in the Home

Parents are head of a household, and in this role, they oversee executive financial decisions in the home, which includes monitoring their child's technology use. Helping their child succeed academically is perceived as an integral part of parents' role (Pomerantz, Moorman, & Litwack, 2007). Parents contend they "definitely should" (p. 206) be involved in their elementary child's education and believe helping their child with homework is highly important (Drummond & Stipek, 2004). As reported from national survey research, parents prioritized financial decisions to ensure their children have the necessary technology to complete schoolwork (Rideout & Katz, 2016).

Although parents believe technology is required to help their child achieve academic success, one study investigating the effect of mobile technology and its impact on the lives of 35 families found parents were primarily concerned with their child's technology use (Radesky et

al., 2016). Concerns centered on the notion that children using technology could squander creativity. Parents expressed the desire to use devices more strategically to benefit their child, admitting that devices were overused to relieve family stress.

With the ubiquity of technology devices in children's homes, it is critical to understand how parents' management of technology has now become a part of their parental role. Understanding the role of the parent to make decisions regarding portable technology can help clarify how a parent can best support children using portable technology in the home. This study's examination of demographic characteristics and technology behavior seeks to provide strategies that can assist with introducing and monitoring children's technology use in the home.

Child's Gender and Portable Technology Use

Child's gender has been linked to differences in perceptions of technology, technology acceptance, and technology use. In a national survey of parents' perceptions of their children's balanced media use, parents with boys expressed the greatest concerns about their child's health resulting from media use (Kucirkova, Littleton, & Kyparissiadis, 2017). Boys' perceptions toward computers have been identified as more positive, evidenced by higher computer self-efficacy mean scores (Vekiri & Chronaki, 2008). In a study that compared children's self-confidence with computer use, boys also reported higher self-confidence levels (Mumtaz, 2001). However, 562 sixth-grade students' attitude were measured using the Computer Attitude Questionnaire, and girls reported a higher mean score for attitude toward learning to use computers in the school setting (Almahboub, 2000).

Examining children's computer use, frequency of computer use varied between genders. Among a sample of 324 children ranging in age from eight to 10 years-old with computers in the home, 45% percent of boys used the computer daily compared to 33% of girls (Mumtaz, 2001).

Similarly, a study of 340 fifth and sixth-grader's computer use identified 47% of boys using computers each day compared to 24% of girls (Vekiri & Chronaki, 2008). In contrast, a study of 515 children revealed Black girls' Internet use surpassed that of Black boys (Jackson et al., 2008). Jackson and colleagues' (2008) found that regardless of race, boys played video games the most. Regarding academic differences with gender, five and six-year-old girls achieved greater academic gains in phonological awareness skills with the use of computer-aided instruction (Wild, 2009).

Despite some research on child's gender and how it appears to be related to perceptions and use of technology, previous data collection took place in contexts that did not include portable technology devices. While the investigation of child's gender and computer use can inform children's general perceptions of technology, it is necessary to conduct additional research on how child's gender may be associated with portable technology use. Our study addresses this gap in research, to understand how children's demographic characteristics may lead to distinct uses of technology devices and apps.

Child's Age and Portable Technology Use

In addition to child's gender, age appears to be related to how children use technology under parental supervision. An early study to examine technology ownership and children's use among those from birth to six-years old demonstrated children are growing up in a "media-saturated environment" (Vandewater et al., 2007, p. e1006). To illustrate children's media exposure, parents reported that 27% of five to six-year-olds had a computer in their home and were using the computer an average of 50 minutes per day, compared to four percent of those aged 0-2 who used the computer for 61 minutes daily. Also, 20% of three to four-year-olds were reading electronic books for 36 minutes per day, with 10% of five to six-year-olds reading for 47

minutes each day. A more recent study of 350 children ages six months to four years reported 64% of four-year-olds ($n = 72$) owned their own tablet (Kabali et al., 2015). Other research on child's age and technology use frequency shows older children are using technology more frequently, where 56% of those between 10 and 13 reportedly use the computer daily in comparison to 35% of children between ages six and nine (Rideout & Katz, 2016). These studies provide evidence that show as children get older they use technology more frequently.

Although parents appear to be adopting more technology in the home, recent research shows parents are conflicted on how they feel about their young child using technology. A study which examined 709 parent perceptions of their children between birth and age eight found that parents with children birth to age two and those between six and eight years-old expressed the greatest concern for their child's health associated with using technology (Kucirkova et al., 2017). However, another study which closely examined 35 families and the effect of mobile technology use on family life found "caregivers expressed feeling a need to introduce their child to mobile technology at an early age so that the child could keep up with trends in education, social connection, and employment opportunities" (Radesky et al., 2016, pp. 504-505).

Collectively, research on children's age and technology use illustrates how children's demographics can impact parents' portable technology adoption decisions and children's exposure to technology. Yet, further research is needed to understand the role of children's demographics on their access to and use of technology to support reading development and entertainment in the home.

Children Reading with Technology

Perhaps because portable technology is a newer innovation (e.g, iPhone was released in 2007, iPad in 2010), limited research exists on children reading with the portable technologies

investigated in our study. Of the research that has been done, studies have found young children are capable of navigating touchscreen technology (Levy, 2009), interested in reading digitally (Korat & Or, 2010), and benefit academically from using various technologies (e.g., e-book, CD-ROM) to support their reading development (Moon, Wold, & Francom, 2017; Takacs, Swart, & Bus, 2015).

Children have been documented using portable technologies from a very young age. Even though preschool and kindergarten-aged children could not read text, they were capable of reading app icons on technology screens (Levy, 2009). Levy's (2009) conclusion indicates a potential advantage of using technology to develop early reading skills, where "many of the children reported that they understood the meaning of printed prompts that appeared regularly on screen even though they could not decode the print" (p. 86).

In addition to children successfully navigating technology, children also appear to enjoy using technology to support their reading development. Similar studies investigated children's discourse initiatives while reading and revealed children were more engaged and initiated more discourse initiatives when reading electronic books in comparison to reading print books (Korat & Or, 2010; Parish-Morris, Mahajan, Hirsh-Pasek, Golinkoff, & Collins, 2013). In fact, one study found 22 third-grade students preferred reading with e-books (Jones & Brown, 2011).

Research has also shown the academic benefits of children reading with technology. A meta-analysis of over 2,100 children reading technology-enhanced storybooks that examined 43 studies (e.g., e-book, CD-ROM, video book) found children achieved gains in story comprehension and expressive vocabulary resulting from multimedia features such as illustrations, music, and sound effects (Takacs et al., 2015). When combined with traditional

print-based instruction, the integration of iPad apps to support literacy standards in the classroom have led to gains in reading comprehension and motivation (Moon et al., 2017).

Although most of the prior research that has explored children reading with technology does not include supporting reading development with a tablet or smartphone, the use of other technologies to improve children's literacy learning provides support for our study's investigation of how children are using portable technology to develop their reading in the home.

Technology Adoption

The Unified Theory of Acceptance and Use of Technology (UTAUT) is a comprehensive technology adoption model containing four social and organizational learning theories and four technology adoption models (Venkatesh, Morris, Davis, & Davis, 2003). This model includes decisions that predict technology use and contains demographic characteristic moderators which may be related to how parents permit their child to use portable technology for reading and entertainment in the home. Attitude has been recognized as a significant predictor of technology use (Davis, 1993), therefore this study added the attitude construct from the Technology Acceptance Model (Davis, Bagozzi, & Warshaw, 1989) to its conceptual framework (Figure 1).

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This conceptual model contains five indicators that have been shown to impact behavioral intention, which lead to technology use: performance expectancy, effort expectancy, facilitating conditions, social influence, and attitude. Performance expectancy is the extent an individual believes system use will result in job performance gains (Venkatesh et al., 2003); whereas in this context, it is the belief that using portable technology to help children read contributes to parents' perception they are supporting their child academically. Effort expectancy is the ease associated with system use (Venkatesh et al., 2003); in this study, it is the amount of

effort required by parents to help their child learn to read using portable technology. Social influence is an individual's perception that others around them support their system use (Venkatesh et al., 2003); therefore, in this study, social influence is the extent parents believe important others think they should use portable technology to help their child learn to read. Venkatesh and colleagues' (2003) define facilitating conditions as the amount of organizational and technical infrastructure to support system use; in this context, it is parents' accessibility, support, and perceived knowledge of how to help their child use portable technology to learn to read. Attitude is determined by the extent "the system makes work more interesting" (Venkatesh et al., 2003, p. 460) and since it is derived from relevant beliefs, attitude directly effects behavioral intention (Davis et al., 1989). In this study, attitude is a combined measure of how much a parent favors their child's technology use for learning to read and the extent the child likes to use portable technology for reading.

Each of the four predictors from the UTAUT and the attitude construct from the Technology Acceptance Model impact the outcome variable, behavioral intention. Behavioral intention is the likelihood a person would perform the target behavior (Venkatesh et al., 2003). In this study, behavioral intention is the likelihood parents would adopt portable technology for their child in the home. Moderators examine how individual character traits may be related to how parents permit their child to use portable technology. Moderating characteristics in this study include child's gender and child's age (measured by grade level).

Research Question

Guided by technology acceptance models, the following research question was addressed:

How might child's gender and grade-level be related to a parent's perception of how their child uses portable technology devices and apps for entertainment and learning (to support reading) in

the home?

Method

Research Design

A mixed-method explanatory sequential design (Creswell, 2013) explored how child's gender and grade level may be related to how parents permit their child to use portable technology in the home. First, quantitative data of the devices and apps children use in the home for learning and entertainment were returned from 120 parent surveys. Survey responses were analyzed by conducting four 2x2 factorial analyses of variances (ANOVAs). Descriptive statistics such as means and standard deviations were obtained to compare groups. Using the survey respondent participants, 13 individual interviews were conducted in accordance with technology adoption models to explore parent perceptions regarding children's portable technology use in greater detail. Thematic analysis helped explain parent perceptions and decisions of how their child's gender and grade-level may be related to their child's use of portable technology in the home.

Participants and Context

Participants included parents of K-5 children representative of 46 classrooms at two elementary schools located in the southeastern region of the United States. School one, a charter school operating under a large public-school district and a choice school for parents to send their children, is situated in a suburban community just outside of a major city. Defined by other than Caucasian within the school's improvement plan, 37% of students were minority, with 17% receiving free and reduced lunch. Parents were limited to one response per household and only

reported on their youngest elementary-aged child in an attempt to elicit more information about children learning to read (as opposed to reading to learn) with portable technology.

School two is a title one developmental research school associated with a flagship university in a rural setting. In this school, parents apply to enroll their child, and acceptance is based on gender, race/ethnic origin, family income, exceptional student status, and academic achievement. Demographics of each student who attends the research school are carefully applied to the admission criteria because this school contains students with demographics representative of the state where it is located. School two contains 52% minority representation and 24% of students receive free or reduced lunch.

Survey participants. Survey participants included 120 parents of children from different homes. Participants were primarily female (81%, $n = 97$), Caucasian (69%, $n = 83$), between the ages of 35-44 (65%, $n = 78$), with a graduate degree (31%, $n = 37$). Recipients of free and reduced lunch were identified as having low SES (19%, $n = 23$). Responses included slightly more data on boys (57%, $n = 68$) and children in K-2 grades (65%, $n = 78$).

Interview participants. Individual interviews were conducted with 13 parents who also participated in the survey (Table 1). Interviewees were selected carefully, with attempts to interview an equal number of parents from each school, along with a representation of parents with varying levels of behavioral intention regarding how they permit their child to use technology in the home, family demographics and socio-economic status, and child's gender and grade level. Participants were primarily female (92%, $n = 12$), Caucasian (62%, $n = 8$), between the ages of 35-44 (62%, $n = 8$), with a graduate degree (15%, $n = 2$). Recipients of free and reduced lunch were identified as having low SES (38%, $n = 5$). Children's gender and age

representation was nearly equal, with parents who reported on their son's technology use (54%, $n = 7$) and whose child was in grades K-2 (54%, $n = 7$).

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Data Collection and Analysis

Survey design. The survey used in this study measured parents' reports of their child's access to technology devices and app usage for learning and entertainment in the home. Items for this study were extracted from a larger survey which contained 22 Likert-scale (1 – strongly disagree to 7 – strongly agree) items that were adapted from the UTAUT survey (Venkatesh et al., 2003). For this research investigation of how demographics may be related to technology use, we queried ten demographic items about the parent and child and four items to obtain a measure of the child's technology device and app usage.

To determine which apps to include on the survey, the primary researcher canvassed the Apple app store for the most frequently downloaded apps, read app recommendations from the Common Sense Media and International Literacy Association websites, and inquired with six classroom teachers and four parents about which apps children were using. As a result, 20 entertainment and 20 reading apps were included on the parent survey. Parents were asked to "Choose the applications or programs your child uses for entertainment" and "Choose the applications or programs your child uses for learning." Parents were advised to select all the apps their child used by selecting the box next to the app icon, with an option to list additional apps. Some entertainment apps included Netflix, Minecraft, Fruit Ninja, Angry Birds, Crossy Road,

and Despicable Me. Some learning apps included Spelling City, ABC Mouse, Kindle, and Starfall.

Determining which portable technology devices to include on the survey followed a similar procedure, where the researcher looked at the usage data provided by the same parents and teachers. Again, an online search was conducted, but this time using the Google search engine and the Amazon store helped determine device availability and popularity. As a result, 13 devices were provided as choices for both entertainment and learning, with the option to contribute additional devices. Parents responded to “When using portable technology for entertainment, what device(s) does your child use?” and “When using portable technology for learning, what device(s) does your child use?” Some device choices included iPhone, laptop, LeapPad, and Kindle.

To improve face validity of survey items, six cognitive interviews were held with parents similar to our study participants. Five subject matter and methodological experts employed in the fields of educational technology, reading, and survey design commented on each item's accuracy, clarity, and comprehensiveness. Feedback were carefully addressed and contributed to the survey's clarity, such as “use consistent language across all questions,” and “can a parent can understand the phrase portable technology?”. Once survey design was complete, the electronic survey was designed using Qualtrics® and was distributed electronically to the parents by each teacher. The researchers also provided a set of flyers to each teacher with the survey link and a QR code for parents to access the survey.

Survey analysis. To search for how demographic characteristics may be related to children's device and app usage, four 2x2 factorial ANOVAs were performed among the total

responses within each variable. Independent variables include gender and grade level (K-2, 3-5), with entertainment devices, entertainment apps, learning devices, and learning apps as dependent variables. Due to size constraints of the grade groups (e.g., only seven parents reported on their fourth-grade child compared to 38 with children in first-grade), data within the grade level variable was combined dichotomously and organized into K-2 and third through fifth-grade groups. Data of each child's device and app usage were analyzed descriptively.

Interview design. Within one month of survey completion, parents who were interested in an individual interview and met the interview criteria as described above were contacted and scheduled within a two-week timespan. A guided interview protocol, aligned with the study's UTAUT framework, was developed for each parent interview in accordance with Patton's (1990) semi-structured interview approach. Under this study's explanatory sequential design, one open-ended question addressed each of the UTAUT predictor and outcome variables, with probing questions to deepen responses and note characteristic differences. For example, the question addressing the attitude construct asked, "how does your child feel about using portable technology to help them learn to read?" The term "learn to read" was defined as an ongoing process, and parents were informed that beyond learning to read with technology, "I am also referring to your child reading and practicing existing reading skills." To inquire about individual demographic characteristics (e.g., gender and grade level), parents responded to, "what specific technology devices and apps does your child enjoy using most often?" Some probing questions to gather additional data included, "How do you feel about your child using portable technology devices to learn to read?" and parents were asked to provide examples, prompted with "Tell me about a time when..."

The primary researcher in this study conducted and audio-recorded the interviews within a private room at each school. Each interview lasted between 27 and 47 minutes, which provided an opportunity to elicit rich data and expand each parent's individual survey response. Field notes were documented on the interview protocol, and each interview was transcribed after all interviews were completed.

Interview analysis. In accordance with the study's explanatory design, thematic analysis (Braun & Clarke, 2006) helped to deductively analyze the interview transcripts for patterns of how child's gender and grade level may be related to their use of portable technology. Thematic analysis is a method of examining data for emergent themes, a recursive process of thematic coding and analysis where researchers engage in "searching across a data set...to find repeated patterns of meaning" (Braun & Clarke, 2006, p. 15). Although research questions were not labeled as themes, this deductive approach to thematic analysis granted us the ability to code according to the research model. To determine whether adequate coding was reached, Clarke and Braun's (2013) suggestion to remove data from the codes was followed; where, if the codes alone successfully evoke data, then the codes are meaningful and should be retained. To accomplish this level of analysis, we adhered to Braun and Clarke's (2006, p. 24) recommendation to repeatedly visit these narrative questions: "What does this theme mean?;" "What are the assumptions underpinning it?;" "What are the implications of this theme?;" "What conditions are likely to have given rise to it?;" "Why do people talk about this thing in this particular way?" This approach contributed to our understanding of the devices and apps parents permit their children to use in the home.

Results

Descriptive statistics (M , SD) were obtained and four 2x2 factorial ANOVAs were performed to answer our research question, *How might child's gender and grade-level be related to a parent's perception of how their child uses portable technology devices and apps for entertainment and learning (to support reading) in the home?*

Comparison of Children's Technology Use

The top three entertainment devices used by both boys and girls include iPhone, iPad, and laptop. Nearly twice as many boys use a laptop for entertainment compared to girls. Another difference is that children in lower elementary grades use the iPad whereas more children in upper elementary grades use a laptop. According to parent reported data, boys are more frequent users of entertainment apps, with Minecraft, YouTube, and Netflix the preferred app choices by boys. While girls play YouTube, Netflix, and Fruit Ninja most frequently, fewer girls engage with entertainment apps compared to boys.

In a learning context, boys use more learning devices than girls. The number of boys and girls who use iPad and laptop are balanced; however, more boys use iPhone whereas more girls use Kindle. The number of boys using learning apps, though greater than girls', is less than the number of boys who are using entertainment apps. Regarding learning apps, boys are using Istation, PBSKids, and YouTube. With some similarities, girls' preference for learning apps include YouTube, Istation, and PBS Kids, with a greater number of girls who use the Kindle app.

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ANOVAs

Four 2x2 factorial ANOVAs compared the main effects of gender and grade and searched for interaction effects between gender and grade on entertainment devices, gender and grade on

entertainment apps, gender and grade on learning devices, and gender and grade on learning apps. Results across the four 2x2 ANOVAs yielded three significant main effects. After evaluating the skewness and kurtosis of the dataset, the assumption for normality was not violated. According to the Levene's test, homogeneity of variances was violated for entertainment apps. There were no violations found for entertainment devices, learning apps, and learning devices. In consideration of the violation on entertainment apps, we reran the data using nonparametric tests and the results led to the same conclusions as the ANOVAs results presented in this paper.

Results of the 2x2, gender by grade level ANOVA on parent reports of student usage of entertainment devices indicates the only significant effect was the main effect for gender, ($F(1, 117) = 4.03; p = .047$; partial $\eta^2 = .034$), with boys' mean scores significantly higher ($M = 2.48, SD = 1.49$) than girls' mean scores ($M = 1.98, SD = 1.45$). The interaction effect was not significant, indicating that the effect of gender does not vary by grade level.

Results of the 2x2, gender by grade level ANOVA on parent reports of student usage of entertainment apps indicates the only significant effect was the main effect for gender, ($F(1, 117) = 9.28; p = .003$; partial $\eta^2 = .076$), with boys' mean scores significantly higher ($M = 4.80, SD = 3.20$) than girls' mean scores ($M = 3.29, SD = 2.03$). The interaction effect was not significant, indicating that the effect of gender does not vary by grade level.

Results of the 2x2, gender by grade level ANOVA on parent reports of children's usage of learning devices indicates there were no main effects or interaction effects.

Results of the 2x2, gender by grade level ANOVA on parent reports of student usage of learning apps indicates the only significant effect was the main effect for grade, ($F(1, 116) = 6.50; p = .012$; partial $\eta^2 = .055$), with K-2 grade-level scores significantly higher ($M = 3.53, SD$

= 2.21) than grades 3-5 mean scores ($M = 2.50$, $SD = 1.78$). The interaction effect was not significant, indicating that the effect of gender does not vary by grade level.

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Interview Findings: Thematic Analysis

Interview data supports our survey findings, particularly that parents reported that overall, boys use more technology in the home. Survey findings that boys had more access to devices and apps was revealed during interview analysis, through parent explanations that their son had greater access to technology and preferred to play games on portable technology. Interview data also revealed parents of boys are especially fearful that their child may become consumed by technology.

Another finding among interview data is that girls use Kindle as a learning tool. A mom of a kindergarten girl relayed her daughter's excitement to use technology, "she uses different devices at home to help her read, too. She loves technology, she has two tablets, [and] she has a computer that she knows how to get around to different programs and different websites online without my help, so it's pretty amazing." Social influence of others using technology in the community and at school also contributed to parents of girls supporting their daughter reading with technology.

My husband and I had this conversation, that us growing up, third grade you were learning cursive, and so they don't teach that anymore. They don't teach it anymore and I realized, holy crap! They teach technology. I mean, even from kindergarten, they're teaching little kids how to use technology, so it really made me aware of that. We're in that technological age. So for me, and that's why I went ahead, like I said, I was really

cut-and-dry with my kids on, okay, no electronics. No this. No that. But with [my daughter] I realized that Kindle helps not only with getting access to different books that we can't get somewhere else, but that there were different learning applications that she could do on a tablet.

This same mom explained how she and her daughter “were struggling with her reading chapter books and capturing her attention,” so “we just got her a Kindle in October, so she’s just starting to get that library going.”

Parents of girls also remarked that Kindle has allowed for convenient access to books. A dad of a third-grade girl spoke about the convenience of reading digitally, “we got the Kindle app and I just buy the book on Amazon and it's a one click, boom.” Despite the convenience of Kindle, parents of girls relayed the need to safeguard their child while using technology. One mom monitors her third-grade daughter because with “you can age limit Kindle free time, and so I think her limit is seven...and it will give you all the books you want with my Amazon membership.” She explained that “the best parental controls were on the Kindle because I can control their content from my computer at home.”

Interview data from parents with boys revealed very little about boys reading with technology; rather, data emphasized boys’ substantial exposure to entertainment applications. Interestingly, when asked if her son used Kindle, the mom of a third-grade boy realized, “it’s not something that I’m modeling for them, so maybe they just don’t even know it’s there.” One mom’s first-grade son’s technology usage could be described as “primarily entertainment.” Parents’ provided examples of their boy using entertainment apps. In one family, mom shared that when the dad upgraded his iPhone, “we took the cellular plan off it, so he could just use it to play games...he’s on the Disney website playing the little games.” Another mom relayed “we

have a tablet, so we have applications that we download that has different games.” Still another mom stated “my fiancé’s son has an iPad that they play little dirt-racing games...all he does is game.” To provide an example of how YouTube was used, one boy accesses “YouTube, he likes looking up video games, like how people get past certain spots.”

Though boys are reportedly using technology for entertainment in the home, parents appear to be concerned about their son using too much technology, relayed by one mom whose son “could play on a tablet all day long...the tablet he uses for games.” A mom of a first-grade boy who prefers to play digital games confessed her biggest fear is technology becoming too “consuming,” such that “if I leave him with a device, he will walk to the bathroom, go into the bathroom with it in his hand.” Speaking to the importance of the role of the parents with providing access to technology, “nowadays, this is all they wanna do is sit there and play games all day long, if you let them.”

Discussion

In response to recent ubiquitous smart device adoption in homes with children (Rideout, 2017), this research provides some explanation into how children are using portable technology in the home, which may inform responsible and educational uses of technology. Our study examined parents’ reports of how children’s demographics may be related to how they use technology devices in the home. UTAUT helped frame this study with its understanding of how parent decisions contribute to the ways in which elementary children are permitted to access and use technology for entertainment and reading. The results of our study allow us to unpack the data from 120 parent surveys and 13 individual interviews with the same parent participants, to demonstrate how child gender and grade level may be connected to how a child engages with technology in the home. Our research findings are important to disseminate to teachers, support

specialists, parents, and app developers, to provide guidance for introducing technologies based on parent perceptions of the child's interests, tendencies, and experiences using portable technology in the home.

Child's gender plays a distinctive role in technology use (Mumtaz, 2001; Vekiri & Chronaki, 2008). Our findings contribute to this prior research in a new way. Child's gender appears to distinguish how a child engages with portable technology in the home as a reading support tool and entertainment device. As indicated by this study's overall mean scores of device and app usage, boys are using more devices and apps than girls. Interestingly, the only category where boys are not the dominant user of all ages is girls in K-2 who are using learning apps more frequently than both boys and girls in grades 3-5. Our interview findings also show that parents of boys admit their child uses technology devices and apps more frequently than girls. These are important findings because they contradict some parts of prior research findings by Vekiri and Chronaki (2008), particularly that boys in their study were reportedly exposed to more technology but received increased parental support.

The results of the ANOVAs show a significant relationship between gender on both entertainment devices and entertainment apps. Our survey also reports boys are using iPhone to play games such as Angry Birds, Bike Race, and Minecraft, whereas girls reportedly use the Kindle device and less devices and apps overall. These app choices show boys in our sample prefer to use racing and coding apps. To explain these apparent preferences, Minecraft coding allows users to program the actions of the game by clicking and dragging items from the toolbox to the workspace, and then the actions are seen live in the game space (Bergensten, 2016). To further illustrate how boys and girls in our sample differ on their use of technology devices and apps, 13% of boys ($n = 16$) used Kindle to read compared to 35% ($n = 42$) of girls. The same

difference was noted between gender for use of the Kindle app where 16% ($n = 19$) of boys use the Kindle app compared to 37% ($n = 44$) of girls. We consider the importance of parent modeling since parents of girls in our interview sample provided support and modeling for reading with Kindle.

Our results also contribute to Mumtaz's (2001) early conclusions about boys and technology use behavior, who found that boys preferred to play games on the computer while girls browsed the Internet and emailed friends. Our results demonstrate boys still prefer to play games, however girls in our study were reportedly given increased parental support, opportunity, and encouragement to read on the Kindle and use educational reading applications (e.g., ABCmouse, Starfall). Given our additional contribution of girls' desire read with portable technology, it is important to consider other research that has shown girls' attitude toward reading tends to be more positive than boys (Logan & Johnston, 2009). Researchers over extended time periods have concluded that girls exhibit a more positive attitude toward reading, therefore it is possible girls also spend more time reading than boys, regardless of the medium.

Since girls in our study appeared to enjoy reading on the Kindle or Kindle app and boys preferred to play interactive games, we believe boys might prefer reading on technology devices if the apps were more interactive in nature (e.g., highlighted words, audio-read aloud) and contained more game-like features. We would also like to highlight that parents of boys in our sample expressed concern about their child's consumption of entertainment on portable technology and whether these devices could also be used for learning purposes. An awareness by parents, teachers, support specialists, and app designers that girls may be more willing to read on portable technology, coupled with developing learning apps with game-like learning preferences, this may expand opportunities for how children engage with educational technology.

Results of the ANOVAs also indicate that grade is significant on learning apps, noted in this study by a larger number of children in lower elementary grades who were using more portable technology in the home. This finding is similar to another study, where preschool-aged children were given more e-books compared to children who were five-and-six-years old (Vandewater et al., 2007). A more recent study found parents of young children were socially compelled to permit technology use (Radesky et al., 2016). Taken together, these findings indicate that the recent uptick of portable technology adoption in homes with young children may be contributing to a possible normalization of technology use. With the growing presence of technology in homes, it may be interesting to continue investigating the ways a parent permits their child to use technology. It also could be worth investigating how this study's results may have differed if we had inquired about how parents permit their oldest child to use technology. An additional inquiry may be longitudinally tracking how children's use of technology for learning and entertainment and parents' support for educational technology in the home may change as the child gains more experience with technology.

Boys and girls in our study used technology in the home in distinctly different ways. This research could provide a starting point toward understanding how children's personal characteristics may be related to how they engage with technology. An awareness of preference differences for entertainment and learning in the home can be used to inform digital design and app development. The goal is for digital designers to work together with parents and teachers to improve future educational technology opportunities.

Limitations

We acknowledge some limitations within our study. This study was conducted at two school sites 100 miles apart from each other in the southeastern United States, where parents

were required to complete an application to enroll their child. For this reason, school site selection may limit the generalizability of our findings. The purpose of this study was to inquire about how portable technology is being used in the home to support reading development, and this purpose could have led some parents to overemphasize support for their child reading with portable technology in the home. It is also possible that parental reports of their child's interest in and use of technology may not align with their child's actions and perceptions.

Future Research

Based on our findings, we suggest educational researchers investigate, from the child's perspective, preferences toward portable technology devices and apps within entertainment and learning contexts. Children's perceptions could provide valuable insight to app developers, teachers, and support specialists insight when designing apps. Specifically, whether the device or application itself contains captivating features of interest to a gender, which could provide additional information to digital designers to create learning applications that appeal to both genders. For example, since boys in our study preferred racing and coding apps, app developers may want to appeal to boys by designing a reading game that includes interactive, game-like features. Because parents in our study reported children using more entertainment than learning apps, we also recommend obtaining a measure of time children are spending comparative to one another while using these apps.

Conclusion

This study's examination of parents' reports of their child's portable technology use for entertainment and learning in the home may be related to demographic characteristics provides interesting insights about how children are using portable technology in distinct ways in the home. Survey respondents ($n = 120$) and interview participants ($n = 13$) came from a sample of

46 kindergarten through fifth-grade classrooms between two schools in the southeastern United States. Technology adoption models (Davis et al., 1989; Venkatesh et al., 2003) guided the study's design and conceptual understanding of how parents permit their child to use technology and how children's use may be related to their demographic characteristics.

Employing four 2x2 factorial ANOVAs, we searched for group differences of children's access and use of entertainment devices, entertainment apps, learning devices, and learning apps. Descriptive statistics of group means and individual mean scores for each device and app were also obtained to further explain technology behavior. Thematic analysis of interview data provided an explanation from the parents' perspective of their child's technology preferences and use habits. Data from the ANOVAs outputs show gender is significant with entertainment apps and devices, while grade is significant with learning apps. Boys are using more entertainment apps and devices, in addition to more learning devices. Girls in K-2 fall close behind K-2 boys' when using learning apps, with boys and girls in upper elementary groups using learning apps the least.

Because children of different genders and grade levels within our study using technology in distinctly different ways, we encourage teachers, support specialists, parents, and app developers to be cognizant of how gender and age may be related to children's portable technology use. Additional research is needed to engage boys in educational technology use, particularly because it is possible children may respond to using the same technology within formal learning contexts based on their technology use in the home. We emphasize boys using more learning specific devices (e.g., Kindle) equipped with game-like features and apps. Last, with younger elementary children in our study using more technology, we recommend the advancement of educational technology with improved teacher and parent technology training.

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Figure 1. This study's conceptual framework

Table 1

Participant Demographic Characteristics (by percentage)

Demographic Characteristics	Survey (n = 120)	Interview (n = 13)
Parent Gender		
Female	81.00	92.31
Child Gender		
Male	57.41	46.15
Child Grade		
K	18.33	15.38
1	31.67	38.46
2	15.00	-
3	15.83	23.08
4	5.83	15.38
5	13.33	7.70
Race		
African-American	10.19	15.38
Asian/Pacific Islander	3.70	-
Caucasian/Non-Hispanic	68.52	61.54
Hispanic	12.96	23.08
Multi-ethnic	4.63	-
Age Range		
25-34	13.89	38.46
35-44	64.81	46.15
45-54	19.44	15.38
65+	1.85	-
Education		
High school diploma/GED	3.70	-
Some college	15.74	15.38
Associates	12.96	15.38
Bachelor's	29.63	38.46
Some graduate work	7.41	15.38
Master's	22.22	15.38
Doctoral	7.41	-
Other	0.93	-
SES		
Free/reduced lunch	19.44	38.46

Table 2

Individual Device and App Usage by Gender and Grade Level

Panel A: Entertainment Devices				
Boys (<i>n</i> = 61), Girls (<i>n</i> = 56)				
	Boy	Girl	K-2	3-5
iPad	60	59	65	48
Laptop	40	22	28	38
iPhone	44	19	31	33
Android Smartphone	27	21	27	19
Kindle	18	26	19	26
DVDPlayer	6	7	6	7
Galaxy Tablet	19	10	17	12
iPod	11	5	5	14
LeapPad	10	12	15	2
Chromebook	2	2	3	-
eReader	3	2	4	-
Netbook	-	-	-	-
Smartwatch	-	-	-	-

Panel B: Entertainment Apps				
Boys (<i>n</i> = 61), Girls (<i>n</i> = 56)				
	Boy	Girl	K-2	3-5
Angry Birds	37	19	32	21
Bike Race	19	2	10	12
Disney Jr.	19	22	29	5
Candy Crush	15	12	13	14
Fruit Ninja	40	26	32	36
Crossy Road	27	12	24	12
Despicable Me	27	14	28	7
Frozen Freefall	6	9	9	5
Hulu	6	2	4	5
Inside Outside Thought Bubbles	3	7	8	-
Kids Doodle	10	17	17	7
Lego Marvel Super Heroes	21	2	14	7
Minecraft	63	28	41	55
My Boo Virtual Pet	5	5	5	5
Netflix	52	47	46	55
Pet Rescue	5	9	6	7
Poptropica	3	3	3	5
Sims	10	3	8	5
SonicDash	15	3	6	14
YouTube	53	48	51	50

Panel C: Learning DevicesBoys ($n = 60$), Girls ($n = 56$)

	Boy	Girl	K-2	3-5
iPad	65	62	63	45
Laptop	63	59	46	43
iPhone	50	28	21	29
Android Smartphone	37	26	24	14
Kindle	21	38	17	26
DVDPlayer	23	19	4	2
Galaxy Tablet	21	14	15	12
iPod	16	19	8	10
LeapPad	15	15	17	-
Chromebook	8	3	3	-
eReader	5	3	1	-
Netbook	3	-	3	-
Smartwatch	-	.02	-	-

Panel D: Learning AppsBoys ($n = 60$), Girls ($n = 56$)

	Boy	Girl	K-2	3-5
ABCMouse	24	26	37	2
Accelerated Reader	23	19	19	24
Endless Alphabet	8	-	6	-
Hooked on Phonics	8	3	9	-
Istation	45	29	38	36
Little Writer	5	2	5	-
Kindle	16	29	21	26
PBSKids	35	29	44	12
Phonics	2	2	3	-
LeapFrog Learn to Read	6	16	15	2
Reading Comprehension	3	2	3	2
Read Me Stories	8	7	9	5
ScootPad	5	3	6	-
Endless Reader	8	5	10	-
SightWords	15	3	12	5
Spelling City	29	24	18	43
Starfall	23	17	26	10
Study Island	8	3	4	10
Super Why Power to Read	6	2	6	-
YouTube	32	41	35	40

Table 3

2x2 Factorial ANOVAs Results

Panel A: ANOVA Summary for Entertainment Devices					
Boys (<i>n</i> = 61); Girls (<i>n</i> = 56); K-2 (<i>n</i> = 77), 3-5 (<i>n</i> = 40)					
	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	η^2
Gender	1	8.75	4.03	.047*	.034
Grade	1	0.93	0.43	.513	.004
Gender x Grade	1	1.81	0.83	.364	.007
Total	117				

Panel B: ANOVA Summary for Entertainment Apps					
Boys (<i>n</i> = 61); Girls (<i>n</i> = 56); K-2 (<i>n</i> = 77), 3-5 (<i>n</i> = 40)					
	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	η^2
Gender	1	68.57	9.28	.003*	.076
Grade	1	3.54	0.48	.490	.004
Gender x Grade	1	2.43	0.33	.568	.003
Total	117				

Panel C: ANOVA Summary for Learning Devices					
Boys (<i>n</i> = 60); Girls (<i>n</i> = 56); K-2 (<i>n</i> = 76), 3-5 (<i>n</i> = 40)					
	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	η^2
Gender	1	5.31	2.66	.106	.023
Grade	1	4.95	2.49	.118	.022
Gender x Grade	1	3.42	1.72	.193	.015
Total	116				

Panel D: ANOVA Summary for Learning Apps					
Boys (<i>n</i> = 60); Girls (<i>n</i> = 56); K-2 (<i>n</i> = 76), 3-5 (<i>n</i> = 40)					
	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>	η^2
Gender	1	5.84	1.35	.247	.012
Grade	1	28.02	6.50	.012*	.055
Gender x Grade	1	0.16	0.04	.846	.000
Total	116				

*Significant at $p < 0.05$