Mobile Technology in Early Childhood Education

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Abstract

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Current research on mobile technology suggests that there may be significant potential benefits to early learning and skill development for young children, particularly children with disabilities. Literature also suggests there may be collateral effects of mobile technology use, including a potentially decreased number of social interaction opportunities. This study discusses literature on the subject and builds upon it by exploring common mobile technology practices of inclusive early childhood educators across the United States and effects they observe with their students. Descriptive and inferential statistics were used to analyze practices and observations. Relationships between practices and child outcomes reported were also explored. Results indicate that educators who used inclusive practices during mobile technology use were more likely to report higher levels of social interaction and benefits to skill development across domains. A number of trends and observations of mobile technology use with young children both with and without disabilities are discussed.

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DEDICATION

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Chapter 1. INTRODUCTION

Technology is becoming increasingly present in preschool classrooms, though collateral effects on learning are not yet fully understood. As mobile technology becomes ubiquitous in our culture, it is no longer a question of if these devices should be used in the classroom, but how.

Preschool children are entering the classroom increasingly at ease with mobile technology, such as touch screen tablets and phones (Couse & Chen, 2010). Parent reports showed that 88% of children ages 24-36 months use computers daily (Lauricella, Pempek, Barr, & Calvert, 2010), and most parents at least occasionally allow their young child to use a smart mobile device, despite believing that children younger than 7 years should not have access to them (Chiong & Shuler, 2010). Over half of children under age 8 (n=1,384) have regular access to a mobile device at home (Rideout, 2011), and twice as many young children use the devices in 2013 compared to parent reports in 2011 (72% and 36%, respectively) (Rideout, 2015). As mobile technology becomes more available and applications (apps) are designed and targeted for children beginning at birth, usage among young children is likely to rise across contexts.

Researchers and educators have long been interested in the potential effects of technology on learning and development. Early studies on the use of computers showed potential to support learning, particularly in the mathematics and language skill areas (Bittman, Rutherford, Brown, & Unsworth, 2011; Magnan & Ecalle, 2006; Shamir & Schlafer, 2011; Slavin & Lake, 2008; Wang, Kedem & Hertzog, 2004; Weiss, Kramarski, & Tails, 2006). However, these studies used games designed for desktop computers and tabletop games, and most used highly structured designs that didn't allow for collaboration or natural interaction (Clements, 2002; Hendrix, van Herk, Verhaegh, & Markopoulos, 2009; Piper, O'Brien, Ringel, & Winograd, 2006; Hourcade, 2011).

Today's mobile technologies attempt to remedy that by allowing for interactivity. Mobile technology includes tablet devices like the iPad®, and other multi-touch information communication technologies (ICT), such as smartphones. Early studies on mobile technology showed benefits to mathematics skills (Zaranis, Kalogiannakis, & Papadakis, 2013), letter recognition and name writing abilities (Neumann, 2014) and social behaviors (Campaign for a Commercial-Free Childhood, 2012), but the research base is young. The same study by Neumann (2014) that found benefits to literacy skills also found that more time spent with mobile technology did not equate to more benefits to children's skills. The authors concluded that the quality of social interactions that occurred between the adult and child during use was the most important factor in the outcome.

The emerging literature about technology shows that evidence-based practices such as modeling, scaffolding, adult facilitation and peer grouping strategies are key to supporting learning (Bittman et al., 2011; Burris & Wright 2001; Edwards, 2013; McManis & Gunnewig, 2012; Neumann 2014; NAYEC/Fred Rogers 2013; Parette, Blum, Boekmann, & Watts 2009; Plowman, McPake, & Stephen, 2012; Plowman & Steven 2007). Developmental appropriateness of software and application choice also contributes to positive learning effects (Zaranis et al., 2013). Which technology is used and how determines effect on social interaction, skill development, engagement, and exploration.

Others have warned against the use of technology with children ages birth to eight, citing potential negative effects if used incorrectly (Cordes & Miller, 2000; Campaign, 2012). Two reviews of the literature warned that computer time does not replace other screen activities, such as television and video games, but is added to them, thereby reducing traditional opportunities for physical play and learning (Campaign, 2012; Subrahmanyam, Kraut, Greenfield, & Gross, 2000). Chiong & Shuler (2010) reported that over a third of parents reported rarely or never interacting with their child during mobile technology use, though 97% of children in the survey responded that they prefer to use the devices with someone else rather than alone. A 2013 survey (n=485) found that 55% of early childhood teachers offer technology (including desktop computers and mobile technology) to students at least once every day, and only 26% of tablet device time is teacher-directed (Simon, Nemeth, & McManis, 2013). There are potential isolating effects if mobile technology is replacing social interaction.

The same survey (Simon, et al., 2013) found that 65% of early childhood teachers in the sample used technology with children with special needs, though specific practices and devices were not reported. There is no similar data available for inclusive early childhood classrooms. And yet, programs and apps are increasingly being designed for children with special needs. A search for iPad® apps that target children with special needs produces thousands of titles, and the Apple® store even has a portion of their site dedicated to the use of an iPad® in special education classrooms. These apps are designed to be bright, interactive, and intuitive on even the most basic levels.

Many of these apps are targeted at children with autism spectrum disorders (ASD) to increase social interaction and peer acceptance (Hourcade, Bullock-Rest, & Hansen, 2012; Hourcade, Williams, Miller, Huebner, & Liang, 2013). Applications have proven especially effective for conveying emotion and functional requesting of preferred stimuli (Fernandez-Lopez et al, 2013, Van Der Meer et al, 2011). Despite the proliferation of apps designed for children with special needs, we don't yet know efficacy or collateral effects. Four systematic literature reviews have concluded that there are potential benefits, but the evidence base is too young to make claims about the efficacy of mobile technology as a whole to support learners with special needs (Istenic & Bagon, 2014; Kagohara et al., 2013; Stephenson & Limbrick, 2013; Zaranis et. al., 2013). Specific teaching practices, temporal and social settings, and level and type of disability are all factors in supporting learning using mobile technology.

Literature reviews about this new technology for all young children have also concluded that there is a significant gap in research, making it difficult to know mobile technology's effects on learning and development (Bennett, Maton, & Kervin, 2008; Burden, Hopkins, Male, Martin, & Trala, 2012; Neumann, 2014). While older forms of technology have shown benefits to learning for young children, these may not translate to today's mobile technologies (Bittman et al., 2011; Plowman & Stephen 2003; Schmidt & Vandewater, 2008). Lau, Higgins, Gelfer, Hong, & Miller (2005) found that teachers perceived greater gains in skills from computer use for children with disabilities than without disabilities, despite both groups of children performing the same. Another study that explored effect on literacy skills of reading eBooks as compared with paper books with young children found that both parents and children focused too much on interactive features in the eBooks, causing distraction from the story that contributed to decreased recall ability and story comprehension (Parish-Morris, Mahajan, Hirsh-Pasek, Golinkoff,

& Collins, 2013). And in a research and recommendations summary on the topic, Lerner and Barr (2015) cautioned educators to consider the transfer deficit that has been observed with infants and toddlers and the potential reduction in the number of opportunities for social interaction.

Nevertheless, current research also shows that mobile technology has potential to support early learning and social connections (Lerner & Barr, 2015). Research is beginning to emerge that show devices may be able to help children achieve independence in functional skills, build home-school connections, increase recall, and promote access to social settings and learning activities across education needs (Gauvreau, 2015; Istenic & Bagon, 2014; Stewart & Umeda, 2014). Before we can understand the effects of mobile technology in early childhood special education on development and learning, we must explore how it's used by teachers and any effects they observe.

1.1 STATEMENT OF PROBLEM

Mobile technology is vibrant and intuitive. Touch screens can be easily manipulated, with very little fine motor skills necessary when compared with traditional computers. These attributes make mobile technology highly interesting to children. There is potential to use this high level of interest to increase motivation for learning difficult concepts and engaging in social interactions, particularly for children with special needs (Couse & Chen, 2010; Hourcade, Bullock-Rest, & Hansen, 2012; Fernandez-Lopez et al., 2013; Zaranis et al., 2013; Lerner & Barr, 2015). Even young children with severe disabilities are able to learn to use a mobile device, achieving independence quickly (Geist, 2012; Stephenson & Limbrick, 2013). Mobile technology devices are socially acceptable, and may even increase access to classroom activities and promote inclusion and autonomy (Istenic & Bagon, 2014; Fernandez-Lopez et al., 2013).

Though we know that mobile technology is used often in young children's lives and has the potential to support learning in inclusive early childhood classrooms, we don't yet know the effects teachers see in classrooms across the country. There are currently no published reports about the common mobile technology practices of inclusive early childhood educators. This gap in research creates a problem area that this survey attempts to preliminarily address. Once these uses and observations are known, relationships between practices and outcomes can be further explored.

1.2 RESEARCH QUESTIONS

The purpose of the present survey was to examine teacher's perspectives on the use of mobile technology by surveying educators in early childhood classrooms about their specific practices and observations surrounding mobile technology. The study focused on three broad questions, with specific research questions about comparisons, frequencies, and relationships supporting each. Variables explored were informed by the literature reviewed above.

1) How is mobile technology being used in early childhood classrooms?

FREQUENCY OF USE

a. What are the differences in frequency of mobile technology use between teachers of infants and toddlers, preschool, and kindergarten through 2nd grade?

2) Is there a difference between the mobile technology practices used with children with and without identified special needs?

DIFFERENCES BETWEEN EDUCATION NEED GROUPS

b. What are the differences in targeted skill areas during mobile technology use between children with special education needs and children with general education needs reported by inclusive early childhood educators?

c. What are the differences in social grouping during mobile technology use reported by inclusive early childhood educators during mobile technology use between children with general education needs and children with special education needs?

3) What effects on learning and skills do teachers observe in their classrooms?

EFFICACY

d. What are the average ranks reported by early childhood educators of perceived efficacy of mobile technology at targeting skills across and within math, social and emotional, and language and literacy domains?

e. Is perceived efficacy of mobile technology use reported by early childhood educators for promoting skills across domain areas for young children uniquely predicted by inclusion practices, child-directed usage, or teacher involvement?

SOCIAL INTERACTION

f. Is there a difference in social interaction levels during mobile technology reported by teachers between age groups?

g. Is high social interaction of young children with special education needs in inclusive classrooms, as reported by teachers, during mobile technology use significantly predicted by routine type (free choice, whole group, small group, or transition time)?

h. Can high social interaction of young children with special education needs, as reported by teachers, be predicted from child-directed usage, adult involvement, or inclusion practices in inclusive classroom

Chapter 2. METHOD

2.1 PARTICIPANTS

The subject population consisted of inclusive early childhood educators in the United States. Eligible teachers served both children with and without special needs, from birth to age 8. Children with special needs are defined for this purpose as being served by an Individualized Family Service Program (IFSP) or Individualized Education Program (IEP). To be included in the study, participants must have been an educator that worked in an early childhood classroom that serves children from birth to age 8. Classrooms include school-and center-based settings. Schools that were approached included public elementary schools (including those with developmental preschools) and state-funded birth to three early intervention centers. Educators that did not directly work in a classroom with these criteria, and those that worked with children older than age 8 were excluded from this study. Educators that worked in a home-based setting, private preschool, or a day/child care center were excluded. The response rate for the survey was 62%: of the 214 potential participants that were contacted, 133 responded to the survey. Table 1 shows descriptive statistics by age group of survey respondents.

Table 1
Survey Respondents by Classroom Age Group

	M = 2.11	*SD* = .517
Age	*N*	%
Birth - 3	21	15.8
Preschool (ages 3-5)	96	72.2
Elementary (Grades K - 2)	16	12
Total	133	100

2.2 SAMPLING PLAN

A multistage clustering sample plan was used to identify potential participants for the survey, with a primary sampling unit of states. 10 states were randomly selected. Excel® was used to generate random numbers (seeds) in order to randomly select units at each stage (states, school districts, and schools, when appropriate). A secondary sampling unit of school districts was used. 1 school district was randomly selected within each of the 10 states. Excel® was then used again to randomly select geographically dispersed schools and early intervention centers within selected school districts that contained more than 9 schools. Early intervention centers were identified in each randomly selected district through each state's website. From the 10 randomly selected school districts across the United States, 38 schools and early intervention centers were approached for potential participation. Schools and early intervention centers were approached using an email invitation sent directly to the principal of each school, using the procedures described in the following section.

2.3 PROCEDURES

The present study used a self-administered survey design for data collection, in an online web format with 20 total questions. Review of existing literature about mobile technology practices and survey design was used to develop survey questions and item response scales. After initial design, this survey tool was tested with graduate students, redesigned, and presented to a member of the target population using Dillman’s (2011) tailored design method. The revised questionnaire was then evaluated by an early childhood special educator using a cognitive interview procedure (Beatty & Willis, 2007). Survey procedures were next pilot tested by 3 early childhood educator volunteers at a university laboratory school. Changes to item wording on some questions were then made prior to distribution of the survey invitations.

The survey was accessed by direct link emailed to the randomly selected educators described above. The survey was administered through the University of Washington Catalyst survey tool and responses were anonymous (no respondent information or information about computer location was collected). Children with special needs were defined to participants as children served by an Individualized Family Service Plan (IFSP) or an Individualized Education Plan (IEP). Other definitions and clarifications were embedded into the survey. Questions requested responses about routine classroom practices with mobile technology and teacher observations relating to device use with their students. Mobile technology was defined as mobile touchscreen devices, such as smartphones and tablets (such as an iPad®). All survey items can be viewed in Appendix II.

Email invitations were sent to the education leader at each randomly selected school, with a request that they forward the survey on to the relevant early childhood educators at their school/center. For this purpose, education leaders included school principals and school directors. Education leaders were contacted for potential participation using publicly listed email addresses as provided on school/center websites. Inclusion and exclusion criteria were explained in the initial invitation email, and were repeated on the first page of the web survey. Invitations to participate were first sent to educator leaders rather than educators in order to increase credibility, and reduce non-response and coercion factors (Christian, Dillman, & Smyth, 2007).

The invitation email described study procedures, relevance, rights and potential risks. The invitation then requested voluntary participation, and provided contact information for questions. The invitation email included the link to the voluntary, anonymous survey, which potential participants were able to click on if they wished to respond to the survey. Study procedures, rights, and risks were repeated on the first page of the web survey, and response to an item about voluntary participation was required to begin the survey. Inclusion and exclusion criteria were explained in the initial invitation email and were repeated on the first page of the web survey. Once potential participants navigated to the second page of the web survey, they were required to answer questions about the type of setting they work in, and with which age group they educate. Responses that indicated exclusion criteria were met thanked respondents for their time and ended the survey.

Two weeks after the initial invitations are sent, follow-up emails were distributed. This email thanked responders and reminded potential participants about the survey.

Potential coercion and undue influence were minimized in a number of ways. First, the invitation email and first page of the survey both informed potential responders that participation was voluntary, anonymous, and could be withdrawn at any time by simply ending the survey. In order to progress into the survey, participants agreed that they were volunteering for the survey. Using email as the mode of communication, rather than contact by phone, also reduced potential coercion and undue influence. In order to further minimize coercion or undue influence, no gifts or payments was offered in exchange for participation.

2.4 DATA ANALYSIS

Survey items requested information that yielded frequency of mobile technology practices used with young children. For several items, teachers were asked to differentiate practices and observations between children with and without special needs. Response categories included a variety of scales, including dichotomous, three-point, Likert, and semantic scales. Single- and multiple-select response categories were also included.

Categorical responses were effect coded as dichotomous variables using values of -1 and 1, where 1 corresponded with positive responses and -1 with negative responses. For example, question # 12 asked respondents to report during which common classroom routines they used mobile technology with their students, with a multiple-select response category. Each routine was then treated as a dichotomous variable with effect coding, so that if a teacher reported using devices during free choice and small group routines, their responses would be coded as 1 for those variables and -1 for the other routine variables.

Some other categorical responses were grouped together within items for ease of interpretation. For example, question # 10 asked how often teachers use inclusive grouping during mobile technology use (children with and without special needs using mobile technology together at the same time), with a Likert scale of never to every time as a response category. Effect coding was used to treat the responses as a dichotomous inclusion variable: responses of never and rarely were grouped together as -1, while responses of often and every time were coded together as 1.

Other dichotomous variables were parsed out from categorical response items. For example, question # 9 requested that teachers report on whether children usually use mobile devices alone, together with other children and no adults, one-on-one with an adult and no other children, or together with an adult and other children. Within the item, they were asked to differentiate between children with and without special education needs. From this item, dichotomous variables of teacher and peer involvement were effect coded. Another example is question # 8, in which response categories were child-directed or teacher-directed device use. Child-directed usage was coded as a 1, while teacher-directed use was coded as a -1 and used as a reference category.

Inferential and descriptive statistics were used to identify trends, differences between age groups and student needs, and explore relationships between variables. The software package SPSS® was used to facilitate analysis and G*Power® was referenced to evaluate power. Several different statistical methods were used to explore specific research questions, as described in the results section below. Models included multiple comparison procedures, ANOVA, chi-square tests, and multiple logistic regression analyses.

Chapter 3. RESULTS

The purpose of this survey was exploratory, with a goal of gaining an initial understanding of mobile technology practices in inclusive early childhood classrooms. Chi-square tests were used to identify differences in mobile technology practices between children with special education needs and children with general education needs. Multiple comparison procedures and ANOVA were used to determine differences in practices between age groups. Logistical regression was used to determine the amount of variance explanatory variables had on social interaction and reported effect on skill development. Correlation tables for logistic regression analyses are presented in Appendix I.

3.1 FREQUENCY OF USE

A one-way, between-subjects, fixed-factor ANOVA was conducted to determine if the mean frequency of mobile technology use of students reported by teachers differed by age group. Teachers reported frequency of use on a 0-3 nominal scale. Dummy coding was used for response choices: never = 0, rarely (a few times a month or less) = 1, occasionally (once per week to several times a week) = 2, and often (once a day or more) = 3. The Levene's test provides evidence that the homogeneity of variance assumption was not violated, $F(2,29) = 2.31$, $p = .117$.

From Table 2, we see that the one-way ANOVA did not detect any significant effect of age group on frequency of mobile technology use with young children in inclusive early childhood classrooms, $F(2, 29) = 1.16$, $p = .329$, $\omega^2 = .01$. Across the sample, teachers reported using mobile technology with their students a few times a month or less (*M* = 1.11).

Table 2.
One-Way Analysis of Variance of Frequency of Mobile Technology Use by Age Group

			Frequency by Age Group			
Age Group	*M*	*SE*	*F*	*(df)*	*p*	ω^2
			1.16	(2,29)	.329	0.01
Age						
Birth - 3	1.33	(0.34)				
Preschool	0.78	(0.17)				
Elementary	0.67	(0.48)				

3.2 Differences in Practices Between Education Need Groups

We conducted chi-square tests of independence to determine differences in mobile technology practices between young children with special education needs and general education needs. Practices investigated were target skill areas and social grouping. Descriptive statistics showing differences between the groups are presented in Table 3.

3.2.1 *Targeted Skill Areas*

Differences in targeted skill areas of mobile technology use reported by teachers between education need groups were examined. Target areas included increased positive behavior (including self-regulation), academic concepts, and increased communication and social interaction.

There were significant differences between the two groups on use of mobile technology to support learning academic concepts, $\chi^2(1, N = 79) = 10.60, p = .001$.

Results show that teachers in the sample are more likey to use mobile technology to support learning academic concepts for children with special needs than children with general education needs. There were no significant differences detected between education need groups on use of mobile technology to support communication and social interaction, $\chi^2(1, N = 79) = .60, p = .533$. There were also no significant differences detected between education need groups on use of mobile technology to increase positive behaviors, $\chi^2(1, N = 79) = 2.34, p = .169$.

3.2.2 *Social Grouping*

Social grouping factors included peer- and adult-involvement during mobile device use. The difference between young children with general education needs and young children with special education needs on teacher involvement in mobile technology activity was statistically significant, $\chi^2(1, N = 62) = 18.98, p < .001$. Results (see Table 3) show that teachers in the sample are more likey to be involved in the mobile technology activity than children with general education needs. There were significant differences between the two groups on peer involvement, $\chi^2(1, N = 62) = 5.26, p < .05$. Results show that children without IEPs/IFSPs were more likely to have peers involved in the device activity than children with IEPs/IFSPs, as reported by their teachers.

Table 3. *Target Skill Areas and Social Grouping Descriptive Statistics*

	Education Need (n = 79)			
	General Education Needs		*Special Education Needs*	
Practices	*M*	*SD*	*M*	*SD*
Target Skill				
Academic Concepts***	0.64	0.48	0.84	0.37
Communication	0.17	0.38	0.37	0.49
Social Interaction	0.08	0.27	0.2	0.4
Positive Behaviors	0.15	0.36	0.28	0.45
Social Group				
Peer Involvement*	0.78	0.42	0.48	0.5
Adult Involvement***	0.7	0.46	0.66	0.48

* $p < 0.05$, *** $p < .001$

3.3 EFFICACY

3.3.1 *Perceived Efficacy for Supporting Specific Skills*

We conducted post-hoc *t*-tests with a Bonferroni adjustment to control Type I error to .05 to examine differences between age groups on reported efficacy of mobile technology at supporting specific skills and skills across domains. Teachers were asked how effective they believed mobile technology was at supporting skill areas, given a 1-5 Likert scale (1 = not at all effective, 3 = moderately effective, 5 = very effective). Levene's tests were examined to ensure the homogeneity of variance assumption was met.

***Math*:** Results showed that the birth to three group (M = 2.33, SD = 1.51) reported significantly lower efficacy of mobile technology to support math skills than the preschool group (M = 3.57, SD = 1.05), $t(59)$ = -2.57, adjusted p = .038. There were no other significant differences between the groups. Teachers across age groups ranked support of math skills as moderately effective (M = 3.45, SD = 1.15).

Language and literacy: Results showed that there were no significant differences between age groups in perceived efficacy of mobile technology's support of language and literacy skills. Across age groups, teachers reported support of language and literacy skills as moderately effectively (*M* = 3.35, *SD* = .99).

Social and emotional skills: Results showed that there were no significant differences between age groups in perceived efficacy of mobile technology's support of social and emotional skill development. Teachers across age groups ranked support of social and emotional skills as not effective (*M*= 2.65, *SD* = 1.23).

Across domains: Across age groups, teachers reported that mobile technology was moderately effective at promoting skills (including math, language, literacy, social, emotional/self-regulation, and creative art skills), *M* = 3.16, *SE* = .90. No significant differences between age groups were detected.

3.3.2 *Multiple Logistic Regression for Efficacy Across Skills*

Logistic regression analysis was conducted to determine whether efficacy of mobile technology at supporting learning across skill areas (math, communication, literacy, creative/art, social, and emotional skills) in young children could be uniquely predicted by inclusion practices, child-directed usage, or teacher involvement. Efficacy was effect coded as a dichotomous variable, where 1 = moderate or high reported efficacy, and -1 = low levels of efficacy across skills.

Of the three predictors in the model, only use of inclusion practices was significantly uniquely predictive of reported efficacy of mobile technology across skills. We estimate that, for fixed levels of child-directed usage and adult involvement, teachers who reported using inclusion practices during mobile technology use had a 5.32 times larger odds of reporting moderate or high efficacy of mobile technology for supporting skills across domains for all children. Effect coding was used, so the coefficient was doubled- 2.66*2 = 5.32.

In other words, teachers had a 74% (for the other covariates set to -1) ability of reporting that mobile technology is effective at promoting skills across domain areas for all children, when children with special education needs used the device together with children without special education needs. This compared to only a 26% predicted probability when used with only an adult and/or other children with similar education needs and the other covariates were set to -1. However, it is important to recognize that this model accounts for an approximate estimated variance of only 24% in the outcome, indicating that this model is a modest fit. Therefore, these results should be interpreted with caution; effect size is medium (Cohen 1988).

We did not detect a significant difference for the other two predictors in the model. Child-directed device usage was not statistically significant for efficacy of skill promotion. Teacher involvement in the mobile technology activity was also not uniquely predictive of skill promotion efficacy.

Model fit was evidenced by non-statistically significant results on the Hosmer-Lemeshow test, x^2 (n = 92) = 2.40, *df* = 5, p = .791. A test of the full model with the set of predictors against the null model with no predictors was $x^2(3) = 10.51$, $p < .05$, indicating that the set of predictors reliably distinguished between teachers who reported high and moderate or low levels of efficacy across skills. Using the Nagelkerke R^2 statistic, the approximate variance accounted for in perceived efficacy of mobile technology use is about 24%. Model sensitivity was 73% and specificity was 94%, with an overall hit rate of 79%, which was better than the null model's hit rate of 73%.

The assumptions of logistic regression were tested. Examination of noncollinearity shows a VIF value of 1.045 (below the value of 10.0 that would indicate concern) and tolerance of .957 (above the value of .10 which would suggest multicollinearity), which indicates evidence of noncollinearity. In terms of collinearity diagnositics, similar condition indexes were observed and eigenvalues did not indicate intercorrelations, suggesting the assumption of noncollinearity has not been violated. Examination of a scatterplot of standardized residuals assessed independence; all cases except three fell within the range of -2.0 to +2.0, demonstrating the assumption of independence has been met. In review of outliers, Cook's distance values were less than 1 (the recommended value), with a maximum value of .10. Leverage value range was .025 - .105 (under the recommended value of .50), suggesting outliers are not problematic. Two DfBeta values beyond 1 suggested there may be undue influence. However, due to the small sample size, these cases were retained.

Table 4 presents the results for the model, including regression co-efficients, Wald statistics, odds ratios, and 95% confidence intervals for the odds ratios. Table 5 shows group means and standard deviations of predictors for teachers who reported mobile technology as effective and not effective for supporting learning.

Table 4
Logistic Regression Model of Mobile Technology Practices with Young Children for Reported Efficacy at Supporting Learning

						95% CI for Exp (β)	
	B	*SE*	Wald	*p*	Exp (β)	Lower	Upper
Intercept (constant)	-1.56	0.50	13.13	.00	0.21		
Inclusion practices	0.98	0.43	5.242	0.022	2.66	1.15	6.16
Child-directed usage	0.60	0.36	2.70	0.1	1.81	0.89	3.69
Adult involvement	-1.05	0.38	0.08	0.783	0.90	0.43	1.90

Note: All variables were dichotomous and effect coded so that -1 = a negative response and 1 = an affirmative response

Table 5 *Group Means (and Standard Deviation) of Predictors for Ranked Efficacy of Mobile Technology at Supporting Skill Development in Young Children*

Predictor	Moderately or Highly Effective at Supporting Skills	Low Reported Efficacy for Supporting Skills
Inclusion Practices	3.29 (.21)	2.97 (.23)
Child-directed usage	3.36 (.20)	2.90 (.24)
Adult involvement	3.22 (.19)	3.04 (.25)

3.4 Social Interaction During Mobile Technology Use

3.4.1 *Differences Between Age Groups*

We conducted post-hoc *t*-tests to control Type I error to .05. Specifically, we used a Games-Howell adjustment to account for unequal variances and determine if there were any differences between age group means regarding the reported level of social interaction during mobile technology use. Results showed that the birth to three age group (M = 2.00, SD = 0.00) reported significantly higher levels of social interaction during mobile technology use than the preschool age group, t(59), adjusted p = .008, d =

.71. There were no other differences detected between the groups: the preschool group (*M* = 1.72, *SD* = .66) did not differ from the elementary group (*M* = 1.33, *SD* = .58), $t(59) = .10$, $p = .587$, and the elementary group did not differ significantly from the birth to three group, $t(59) = 2.01$, $p = .313$.

3.4.2 *Social Interaction by Classroom Routine for Children with Special Education Needs*

Logistic regression analysis was conducted to determine whether average or higher levels of social interaction of children with special education needs during mobile technology use could be predicted from routine type (free choice/center time, whole group, small group, and transition times).

Of the predictors in the model, only the small group routine was a statistically significant predictor of social interaction levels. We estimate that, for fixed levels of other routines, respondents who reported mobile technology use during small group times had a 4.05 times larger odds of reporting average or higher than average social interaction than those who did not report use during small group time. Effect coding was used, so the coefficient was doubled- 2.02*2 = 4.05. Table 6 presents the results for the model, including regression co-efficients, Wald statistics, odds ratios, and 95% confidence intervals for the odds ratios.

Another way to interpret this is using predicted probabilities: holding the other predictors constant and set to -1, young children with special education needs using mobile technology devices during small group routines had a 78% predicted probability of having a typical or higher than typical level of social interaction, compared to 22% predicted probability of not using mobile technology during this routine. However, it is important to recognize that this model accounts for an approximate estimated variance of only 15% in the outcome, indicating that this model is a modest fit.

No difference was detected for the other two predictors in the relating to social interaction level for children with special education needs during mobile technology use. Device use during whole group routines was not statistically significant for average or higher levels of social interaction. Mobile technology device use during free choice routines was also not uniquely predictive of social interaction level. Table 7 shows group means and standard deviations of teachers who reported low and average or higher levels of social interaction for routine variables.

Model fit was evidenced by non-statistically significant results on the Hosmer-Lemeshow test, x^2 (n = 92) = 3.10, *df* = 5, *p* = .68. A test of the full model with the set of predictors against the null model with no predictors was significant, $x^2(3) = 10.38$, $p <$ .05, indicating that the set of predictors reliably distinguishes between young children who had average or higher levels of social interaction during mobile technology use and those who had lower levels. Using the Nagelkerke R^2 statistic, the approximate estimated variance accounted for in high social interaction during mobile technology use by the predictors is about 15%. Model sensitivity was 99% and specificity was 92%, with an overall hit rate of 75%, which was better than the null model's hit rate of 62%.

The assumptions of logistic regression were tested. Examination of noncollinearity shows a VIF value of 1.126 (below the value of 10.0 that would indicate concern) and tolerance of .89 (above the value of .10 which would suggest multicollinearity), which indicates evidence of noncollinearity. Examination of eigenvalues and condition indexes in collinearity diagnostics indicated the assumption of noncollinearity has not been violated. Independence was assessed by examination of a scatterplot of standardized residuals; all cases except one fell within the range of -2.0 to +2.0, demonstrating the assumption of independence has been met. In review of outliers, Cook's distance values were less than 1 (the recommended value), with a maximum value of .02. Leverage value range was .02 - .21 (under the recommended value of .50), suggesting outliers are not problematic. No DFBeta values beyond 1 were observed, further indicating that there were no outliers with undue influence.

Table 6

Logistic Regression Model of Classroom Routine at Social Interaction During Mobile Technology Use with Young Children with Special Needs

						95% CI for Exp (β)	
	B	*SE*	Wald	*p*	Exp (β)	Lower	Upper
Intercept (constant)	0.58	0.32	3.17	0.075	1.78		
Free Choice	-0.03	0.31	0.01	0.931	0.97	0.53	1.79
Whole Group	-0.12	0.34	0.14	0.712	0.88	0.46	1.71
Small Group	0.71	0.30	5.51	0.019	2.02	0.53	1.79

Note: All variables were dichotomous and effect coded so that -1 = a negative response and 1 = an affirmative response.

Table 7

Group Means (and Standard Deviation) of Routine Predictors for Rate of Social Interaction During Mobile Technology Use with Young Children with Special Needs

Predictor	Average of Higher Rate of Social Interaction During Use	Low Reported Efficacy for Supporting Skills
Free Choice	.22 (.20)	.22 (.23)
Whole Group	.15 (.25)	.29 (.17)
Small Group	.53 (.20)	`-.20 (.95)

Examination of squared correlations indicate that use during small group routines uniquely predicts a level of social interaction that is average or higher than the level that occurs with no mobile technology use, but it does have a small relationship with use during free choice routines. Use during free choice and whole group routines have small relationships with the outcome, but those relationships are overshadowed by its overlap with these predictors. Correlations are presented in Appendix I, Table 2.a.

3.4.3 *Social Interaction by Social Grouping Practices for Children with Special Education Needs*

Logistic regression analysis was conducted to determine whether typical or higher than typical levels of social interaction of children with special education needs during mobile technology use in inclusive classrooms could be predicted from child-directed usage, adult involvement, or inclusion practices. Teachers were asked to define a typical rate of social interaction as the level that is average for the children in their classroom during routines without mobile technology across the day.

Of the three predictors in the model, only inclusion practices were significantly uniquely predictive of average or higher social interaction. We estimate that, for fixed levels of child-directed usage and adult involvement, children with special needs whose teachers reported using inclusion practices during mobile technology use had a 32.09 times larger odds of having average or higher social interaction during mobile technology use than those whose teachers did not report using inclusive practices during mobile technology use. Effect coding was used, so we doubled the co-efficient- 16.05*2 = 32.09.

In other words, young children with special education needs had a 97% predicted probability (for the other covariates set to -1) of having average or higher levels of social interaction during mobile technology use when using the device together with children with general education needs, compared to only a 3% predicted probability when used with only an adult and/or other children with special education needs, for the other covariates set to -1.

We did not detect a difference for the other two predictors in the model (child-directed usage and adult involvement). Child-directed device usage was not statistically significant for average or higher levels of social interaction. Teacher involvement in the mobile technology activity was also not uniquely predictive of social interaction level.

The assumptions of logistic regression were tested. Examination of noncollinearity shows a VIF value of 1.26 (below the value of 10.0 that would indicate concern) and tolerance of .79 (above the value of .10 which would suggest multicollinearity), which indicates evidence of noncollinearity. In terms of collinearity diagnositics, similar condition indexes were observed and eigenvalues did not indicate intercorrelations, suggesting the assumption of noncollinearity has not been violated. Examination of a scatterplot of standardized residuals assessed independence; all cases except two fell within the range of -2.0 to +2.0, demonstrating the assumption of independence has been met. In review of outliers, Cook's distance values were less than 1 (the recommended value), with a maximum value of .02. Leverage value range was .025 - .11 (under the recommended value of .50), suggesting outliers are not problematic. Two DfBeta values beyond 1 suggested there may be undue influence by a few cases. However, due to the small sample size, these cases were retained; caution should be taken due to these possible outliers.

A test of the full model with the set of predictors against the null model with no predictors was significant, $x^2(3) = 52.49$, $p < .001$, indicating that the set of predictors reliably distinguishes between young children who had average or higher levels of social interaction during mobile technology use and those who did not. The approximate variance in social interaction accounted for by the set of predictors was .79 using Nagelkerke's formula. Model sensitivity was 95% and specificity was 82%, with an overall hit rate of 91%, which was better than the null model's hit rate of 74%. Good model of fit was evidenced by non-statistically significant results on the Hosmer-Lemeshow test, x^2 (n = 92) = 1.69, *df* = 5, *p* = .89, and large effect size indices when interpreted using Cohen (1988) (Nagelkerke R^2 = .79). These results suggest that the predictors, as a set, reliably distinguished between children with special education needs who had average or higher levels of social interaction during mobile technology use and those who had lower than average levels.

Table 8 presents the results for the model. This is followed by Table 9, which presents the group means and standard deviations of each predictor for both children whom teachers report lower than average and average or higher levels of social interaction during mobile technology use for children with special needs.

Overall, the model accurately predicted 93.5% of the teachers in our sample, with teachers who report low levels of social interaction during mobile technology use slightly more likely to be correctly classified correctly (95.7% of teachers reporting low social interaction compared to 92.3% of teachers reporting average or higher levels of social interaction).

Table 8

Logistic Regression Model of Social Grouping Practices at Social Interaction Level During Mobile Technology Use with Young Children with Special Needs

						95% CI for Exp (β)	
	B	*SE*	Wald	*p*	Exp (β)	Lower	Upper
Intercept (constant)	0.78	0.61	1.62	0.202	2.19		
Inclusion	2.78	0.60	21.49	0.001	16.05	4.96	51.88
Child-directed Usage	0.12	0.61	0.04	0.842	1.13	0.34	3.72
Adult Involvement	0.09	0.63	0.02	0.885	1.10	0.32	3.73

Note: All variables were dichotomous and effect coded so that -1 = a negative response and 1 = an affirmative response.

Table 9

Group Means (and Standard Deviation) of Social Grouping Predictors for Rate of Social Interaction During Mobile Technology Use with Young Children with Special Needs

Predictor	Average of Higher Rate of Social Interaction During Use	Low Reported Efficacy for Supporting Skills
Inclusion	.97 (.11)	-.85 (.12)
Child-directed Usage	.06 (.11)	.06 (.12)
Adult Involvement	.06 (.20)	.06 (.13)

Examining the squared correlations indicates that inclusion uniquely predicts the outcome of having average or higher than average levels of social interaction during mobile technology use. The correlations table 3.a. in Appendix I show the inclusion's relationship (shares over three-quarters of its variance) with the outcome. The table also demonstrates that the small relationships that the other two predictors have (child-directed use and teacher involvement) has with the outcome are small and are overshadowed by their overlap with each other.

Chapter 4. DISCUSSION

Teachers in the sample reported using mobile technology rarely with young children in their inclusive classrooms- a few times a month or less- and no differences in frequency between age groups was detected. This low frequency of use may be attributed to a number of factors, most notably access to devices, beliefs about efficacy, and training about mobile technology practices and activities. It would be interesting to examine these factors and their potential relationships with frequency of classroom device use. 27% of teachers reported never using MT with their students.

Of the teachers that said they use mobile technology with their students, more responded that they used to support academic concept learning with children with special education needs than with children with general education needs (83% compared to 64%). There were no differences between the groups on target skill areas of communication skills, social interaction, or positive behaviors. An average of 27% of teachers said they used the devices to promote communication and social interaction across the sample, while 21% reported using it to promote positive behaviors, including self-regulation skills. Since a majority of teachers in this sample reported using mobile technology to support academic concepts, particularly with children with disabilities, we recommend intervention and activity design in future research consider this priority to help ensure social validity.

Investigation about the differences in social grouping showed that adults were more likely to be involved in the activity during device use with children with general education needs than those with special needs (70% compared to 60%). Children without special needs were also more likely to use the device together with their peers compared to children with disabilities (78% compared to 48%). In other words, teachers reported using mobile technology to support academic concept development more with children with special needs, but were less likely to be involved in or group children together during the activity.

Teachers in the sample said that mobile technology was moderately effective at supporting skills across all domain areas. Examination of specific skill areas showed some significant differences between perceived efficacy: teachers ranked support of math and language and literacy skills as moderate, while reporting that mobile technology was not effective at promoting social and emotional skills, including self-regulation. Differences of efficacy between age groups showed that teachers of children ages birth to three perceived mobile technology to be significantly less beneficial for promotion of mathematic skills than preschool teachers did. There were no other differences between age groups within skill areas.

These rankings do not necessarily reflect the current research base, which is admittedly sparse. Early research on the subject shows that mobile technology may be particularly effective at supporting math skills for young children, as it can provide unique opportunities to support engagement with numbers and explore geometric shapes in multiple modes, thereby increasing spatial sense (Clements, 2002; Zaranis, Kalogiannakis, & Papadakis, 2013). Research on potential support of social and emotional skills is even more promising, particularly in regard to children with disabilities (Fernandez-Lopez, Rodriguez-Almendros, & Martinez-Segura, 2013; Van Der Meer et al, 2011). We recommend that teachers measure child outcomes to determine accurate effects of mobile technology activities on learning in their settings.

The use of inclusive practices in early childhood classrooms had a unique and positive relationship with early learning in the present study. Educators who used inclusive practices during mobile technology use were more likely to report benefits to skill development across domains for all children. In addition to higher efficacy for supporting learning progress observed by teachers with all children, students with disabilities were more likely have average or higher than average levels of social interaction when inclusive social grouping was used during device use. This is consistent with decades of previous research that has found grouping children with and without special needs together promotes learning and social interaction for all children (Odom, Bussye, & Soukakou, 2011). The finding is interesting as it provides indication to us that the benefits of inclusion extended beyond traditional classroom activities to learning during mobile technology time for children in this sample.

We also examined the relationship of device use during common classroom routines with social interaction levels. Results indicated that teachers who reported using devices with their students during small group routines were more likely to observe average or high levels of social interaction for children with special needs. This may be due to several factors. One consideration is the more focused learning targets that tend to frame small group sessions as compared with other routines. This relationship may also be related to social grouping characteristics that occur during this time, such as planned peer arrangement and teacher guidance during the activity. Social grouping factors of adult and child involvement with social interaction were examined in this study and no difference was detected for this sample. However, it would be compelling to study similar relationships in a larger national sample. Though collinearity was not found to be problematic for this model, these relationships in future studies should carefully considered, since it may be true that teachers in the broader population who report mobile technology use are more likely to use them across all routines. For this sample, mobile technology use during small group routines, holding all other routines constant, was found to uniquely predict average or higher social interaction for children with special needs.

It would also be interesting to examine the relationship between mobile technology activity and levels of social interaction or reported efficacy for supporting skills, but it was not possible for this sample. The majority of teachers in the sample reported using mobile technology for targeted learning games and puzzles (71%), with low numbers of responses reporting use of eBooks, photos or camera, games for fun, and communication aids. Due to the small sample size and the uneven distribution of responses regarding mobile technology activity, model fit was not tenable for these cases.

An examination of the relationship between age and reported levels of social interaction during mobile technology use revealed that children in the birth to three age group had significantly higher levels of social interaction than preschool children. This may be due to the common teaching practices used with infants and toddlers that tend to be interaction-centered and more one-on-one with adults. Infants and toddlers generally require a higher level of support during device use, which likely leads to more social exchanges between the child and supporting adult. It is reasonable that the relationship-centered practices often used in birth-to-three education contribute to higher levels of social interaction across activities, including those with traditional materials and mobile technology devices. It also may be that birth to three teachers considered adult-child social interaction when responding to the survey item, while teachers in other groups may have focused more heavily on peer-peer interactions. As with other factors explored in the present study, we recommend further research to parse out specific practices between age groups in a larger random sample. This may be further evidence that relationship-centered practices have a place in all classrooms, though more research is needed to determine effect in this case.

As with any study however, there are some potential limitations. The primary limitation is the nature of the study- a survey about current practices. Random assignment to groups is not possible with studies of this type, and the anonymous nature of the survey does not allow for consideration of clustering effects. This may limit the generalization of these results to other samples. Additionally, since measures were taken at a single point in time, time may be confounded with the measured variables. Therefore, there are potential validity threats of selection and direction of causal inference.

Overall, this and other emerging research show that mobile technology has several potential benefits to supporting learning in early childhood classrooms, for children of all education needs. Teachers in this sample who reported grouping children with and without special needs together were more likely to report observing positive benefits of mobile technology for children in their classrooms. These benefits included increased skill promotion and high social interaction during use. Though there are many variables that can be considered when assessing child outcomes in the context of mobile technology use, knowledge of common classroom practices can reduce that list to a manageable number.

Chapter 5. REFERENCES

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Chapter 6. APPENDICES

6.1 APPENDIX I: CORRELATION TABLES

Table 1.a.
Teacher Report of Mobile Technology Practices on Efficacy of Skill Support: Correlations (N = 92)

	Effective Ranking at Skill Support	Inclusion	Child-Directed Usage	Adult Involvement
Effective Ranking at Skill Support	-			
Inclusion	.10*	-		
Child-Directed Usage	0.6	0	-	
Adult Involvement	0.07	0.03	.20**	-

Note: * Correlation is significant at the .05 level
** Correlation is significant at the .01 level

Table 2.a.
Teacher Report of Routine Variables on Social Interaction: Correlations (N = 92)

	Social Interaction	Free Choice	Whole Group	Small Group
Social Interaction	-			
Free Choice	-0.001	-		
Whole Group	0.002	.07*	-	
Small Group	.101*	0.016	.065*	-

Note: * Correlation is significant at the .05 level

Table 3.a.

Teacher Report of Social Grouping Variables on Social Interaction for Young Children with Special Needs: Correlations
(N = 92)

	Social Interaction	Inclusion	Child-directed Usage	Adult Involvement
Social Interaction	-			
Inclusion	.75**	-		
Child-directed Usage	0.0001	0.0001	-	
Adult Involvement	0.02	0.03	.21**	-

Note: ** Correlation is significant at the .01 level

6.2 APPENDIX II: SURVEY INSTRUMENT

A Survey Of Mobile Technology Practices in Early Childhood Classrooms

Question 1.

UNIVERSITY OF WASHINGTON

CONSENT FORM

for Mobile Technology Survey for Early Childhood Educators Researchers: Carina McGee, UW graduate student, College of Education Special Education Department, 208-651-2291, Susan Sandall, PhD

Researchers' statement

We are asking you to be in a research study. The purpose of this consent form is to give you the information you will need to help you decide whether to be in the study or not. Please read the form carefully. You may ask questions about the purpose of the research, what we would ask you to do, the possible risks and benefits, your rights as a volunteer, and anything else about the research or this form that is not clear. When we have answered all your questions, you can decide if you want to be in the study or not. This process is called "informed consent."

PURPOSE OF THE STUDY

This research project seeks to gain a better understanding about how mobile technology, such as smartphones and tablet devices like the iPad®, are used with young children in pre-kindergarten classrooms. The research project will help us better understand how this new type of technology is being used with children with and without special needs in the early childhood classroom. This information will help us better understand how often, why, and how mobile technology is used, so that we might study potential benefits and effects.

STUDY PROCEDURES

This study seeks to gain an initial understanding of these practices by surveying early childhood educators across the United States. The survey will be self-administered using an online web format. This online survey completed by you asks 20 total questions, and will take approximately 15 minutes. The questions will ask about how you use mobile technology in your classroom with students with and without special needs.

RISKS, STRESS, OR DISCOMFORT

You may experience some discomfort in completing the survey as you think about your mobile technology practices. There is risk that anonymity will not be maintained if you include personal identifiers in the open-ended answers in Part II of the survey. Personal identifiers include your name, contact information, name of school, or full student names. If personal identifiers are included in the survey, your answers will be deleted and not be recorded. No direct or indirect identifiers will be collected.

BENEFITS OF THE STUDY

You will not directly benefit from this study, though you may have access to the survey results at the completion of the study by contacting the lead researcher, listed at the top of this page and below. The information gathered from this study intends to better understand how mobile technology is being used in early childhood classrooms across the country, so that we might know trends and common practices. You may access findings by contacting Carina McGee at mcgee07@uw.edu or 208-651-2291.

CONFIDENTIALITY OF RESEARCH INFORMATION

The survey is completely anonymous, and no identifying information will be collected. If you reveal personal information in the open-answer response categories, your answers will be deleted and not recorded. The software, Catalyst, will be used to administer this survey and was designed by the University of Washington to ensure anonymity.

OTHER INFORMATION Participation in this survey is voluntary. You are free to decline participation by simply not responding to this invitation or clicking on the link. You may also decline or withdraw participation at any point during the survey by simply closing the web questionnaire.

SUBJECT INFORMATION

I volunteer to take part in this survey. If I have questions later about the research, or if I have been harmed by participating in this study, I can contact one of the researchers listed on this consent form. If I have questions about my rights as a research subject, I can call the Human Subjects Division at (206) 543-0098

Please select your answer below.

Choosing "agree" indicates that you:

· have read the above information· you volunteer participation· you are at least 18 years old

If you do not wish to participate, simply close this survey, or choose disagree below.

Required.

- (●) Agree
- ( ) Disagree

Question 2.
Are the students in your classroom 8 years old or younger?

Required.
- ◯ Yes
- ◯ No

Question 3.
Which type of classroom do you work in?

For the purpose of this survey, a student with special needs is a child that has an Individualized Family Service Plan (IFSP) or an Individualized Education Program (IEP)

Required.
- ◯ An inclusive classroom (a classroom that serves children with special needs and without special needs together at the same time)
- ◯ A classroom with only children with special needs (children with IEPs or IFSPs only)
- ◯ A classroom with only children without special needs (children without IFSPs or IEPs)

Question 4.
Which age group is your early childhood classroom?

Required.
- Birth to 3 years
- 3- 5 years (preschool)
- Kindergarten
- 1st grade
- 2nd grade

Hold control key (apple key for Mac) to select multiple answers.

Question 5.
How often do your students usually use mobile technology (such as a smartphone or tablet device, like the iPad®) in your classroom?

Required.
- ◯ Never
- ◯ Rarely (a few times a month or less)
- ◯ Occasionally (once per week to several times a week)
- ◯ Often (once a day)

Question 6.
What type of mobile technology do your students use the most in your classroom?

Choose N/A **only** if you don't have children with these needs in your classroom.

Required.

Children with special needs	Select one...
Children without special needs	Select one...

Question 7.
When you use mobile technology in your classroom, which students usually use it?

Required.

- ○ Only children without special needs
- ○ Mostly children without special needs
- ○ Everyone uses mobile technology equally
- ○ Mostly children with special needs
- ○ Only children with special needs

Question 8.

4

When you use mobile technology with your students, is it mostly:

Choose N/A **only** if you don't have children with these needs in your classroom.

Required.

	Child-directed (child is in control)	Teacher-directed (teacher is in control)	N/A
Children with special needs	○	○	○
Children without special needs	○	○	○

Question 9.
When your students use mobile technology during classtime, how do they usually use it:

Choose N/A **only** if you don't have children with these needs in your classroom.

Required.

	Alone	Together with other children and no adults	One-on-one with an adult and no other children	Together with an adult and other children	N/A
Children with special needs	◉	○	○	○	○
Children without special needs	◉	○	○	○	○

Question 10.
How often do children with and without special needs use a mobile technology device **together** at the same time?

Choose N/A **only** if you don't have children with these needs in your classroom.

Required.

- ○ 1- Never
- ○ 2- Rarely
- ○ 3- About half the time
- ○ 4- Often
- ○ 5- Every time
- ○ N/A

Question 11.
How is mobile technology usually accessed by students in your classroom?

Freely accessible means that there are no restrictions on access, and students can access the device without having to ask first.

Restricted means the device is only available when a teacher offers it.

Choose N/A **only** if you don't have children with these needs in your classroom.

Required.

	Freely available	Mostly available	Mostly restricted	Always restricted	N/A
Children with special needs	○	○	○	○	○
Children without special needs	○	○	○	○	○

Question 12.
During which routines do your students **WITH** special needs usually use mobile technology?

Choose N/A **only** if you don't have children with these needs in your classroom.

Required.
- ☐ Transitions
- ☐ Small group/table time
- ☐ Free choice/center time
- ☐ Circle time/whole group lessons
- ☐ Mealtime
- ☐ Personal care time (toileting, brushing teeth, washing hands)
- ☐ Outdoor/gym time
- ☐ N/A

Question 13.
During which routines do your students **WITHOUT** special needs usually use mobile technology?

Choose N/A **only** if you don't have children with these needs in your classroom.

Required.
- ☐ Transitions
- ☐ Free choice/center time
- ☐ Circle time/whole group lessons
- ☐ Mealtime
- ☐ Personal care time (toileting, handwashing, brushing teeth)
- ☐ Outdoor/gym time
- ☐ Small group/table time
- ☐ N/A

Question 14.
Do you most often use mobile technology with your students to:

Choose N/A **only** if you don't have children with these needs in your classroom.

Required.

	support learning concepts	support communication	use as a reward or positive reinforcement	support smooth transitions	promote social interaction	N/A
Children with special needs	☐	☐	☐	☐	☐	☐
Children without special needs	☐	☐	☐	☐	☐	☐

Question 15.
What activities on the mobile device do students in your classroom most often do?

Choose N/A **only** if you don't have children with these needs in your classroom.

Required.

Children with special needs	Select one...
Children without special needs	Select one...

Question 15. Response options:

- eBooks
- Communication aides
- Learning games or puzzles (such as math or literacy games)
- Games for fun (such as Angry Birds®)
- Photos or camera
- N/A

Question 16.

Compared with the level of social interaction that children in your classroom typically engage in, how much social interaction usually happens during mobile technology use?

Required.

- A lot less
- About the same
- A lot more

Question 17.

Part II.

Thinking about how you use mobile technology, what impacts on a child's development, learning, or social interaction do you see in your classroom?

Question 18.
Which apps (mobile technology programs) do you use the most?

Question 19.
Thinking about how you use mobile technology in your classroom, how effective do you think it is at promoting the following?

1= not at all effective, 3= moderately effective, 5= very effective

	1	2	3	4	5
Math skills	○	○	○	○	○
Literacy skills	○	○	○	○	○
Communication skills	○	○	○	○	○
Social skills	○	○	○	○	○
Emotional/self-regulation skills	○	○	○	○	○
Creative/art skills	○	○	○	○	○

Thank you for your time and participation in this anonymous survey. The information gathered from this study intends to better understand how mobile technology is being used in early childhood classrooms across the country, so that we might know trends and common practices. You may access findings by contacting Carina McGee at mcgee07@uw.edu

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