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Original Paper

Portable Screen Time and Kindergarteners' Attention with Content as a Potential Moderator

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Abstract

Portable screens such as smart phones and tablets are a normal part of children's everyday lives, yet excessive media use presents a multitude of health and developmental concerns. Specifically, the impact of portable screen time on children's attention is unknown, and screen time could potentially result in negative outcomes including poor school readiness and social difficulties. The purpose of this study was to assess the relationship between portable screen time and kindergarteners' attention (the first research question), and to investigate learning content as a potential moderator (the second research question). Data were collected using the Preschool and Kindergarten Behaviors Scale, 2nd Edition attention subscales and questionnaires on portable screen time and content, and analyzed via hierarchical multiple regression. Results included a significant relationship between screen time and attention, where, as screen time increased, attention decreased, and insignificant findings for a moderating relationship between screen time and content on attention. It was recommended that adults monitor children's portable screen time to ensure attention is not compromised, and that screen time be utilized for educational purposes using quality programming. Recommendations for future research include studies which address portable screen time and learning content, structure/pacing, interactivity, and context of children's screen time.

Keywords

portable screen time, attention, kindergarten, executive function, content, learning content

1. Introduction

Today's children are bombarded with media in nearly all aspects of life. Portable media devices such as smart phones, tablets, and portable video games are essentially a normal part of children's day-to-day routines (Lillard, Drell, Richey, Boguszewski, & Smith, 2015; Radesky, Schumacher, & Zuckerman, 2015). Studies have shown that children spend two to seven hours daily in front of various screens (Barlett, Gentile, Barlett, Eisenmann, & Walsh, 2011; Lillard et al., 2015; Nathonson, Aladé, Sharp, Rasmussen, & Christy, 2014), and even longer when accounting for media multitasking (Bartlett et al., 2011; Pea et al., 2012). Preschoolers engage in approximately four hours of screen time daily (Lillard et al., 2015) and seventy percent of babies under the age of one now take part in some sort of screen time multiple times each week (Cingel & Krcmar, 2013). Screen time habits that are adopted in the preschool years have been reported to be sustained through school and adolescence, and often even into adulthood (Zhao et al., 2018). Research on whether or not young children can learn from interactive screens is minimal, and the social and emotional impacts of portable screen time on young children need to be ascertained (Radesky et al., 2015). As such, it can be argued that it is unclear what the impact of extensive media use has on children's learning and development, either positive or negative.

The general problem is that research has implicated excessive media use by young children (American Academy of Pediatrics, 2011; American Academy of Pediatrics, 2016; Barlett et al., 2011; Jago et al., 2014; Radesky et al., 2015; Pea et al., 2012) in the formation of negative outcomes including decreases in executive function and increases in aggression (Barr, Lauricella, Zack, & Calvert, 2010; Lillard et al., 2015; Nikkelen, Valkenburg, Huizinga, & Bushman, 2014). Recently, media use has shifted to include mobile devices such as smartphones, handheld games (Pea et al., 2012) and tablets (Radesky et al., 2015). Children have been reported to take part in 20% of their entire screen time while using portable devices (Pea et al., 2012). Some research has found smartphones and tablets to be beneficial to learning (Koh, Loh, & Hong, 2013; Larabee, Burns, & McComas, 2014). However, research pertaining to portable screen time and behavior is nonexistent (Radesky et al., 2015), and, while content or programming has been investigated in relation to television time, it has been largely overlooked in relation to other forms of screen time (Lerner & Barr, 2014). In spite of widespread smartphone and tablet use by young children (Radesky et al., 2015), the specific problem is that the relationship between portable screen time and children's attention, a component of executive function, is unknown.

2. Literature Review

To better understand the relationship between screen time and children's attention, cognitive processes were explored. This included executive function, as well as the positives and negatives of screen time in relation to learning and attention. The literature review also noted the importance of the kindergarten age with regard to development and screen time.

2.1 Theoretical Framework

Cognitive processes were the overarching theoretical framework of this study. More specifically, this study addressed attention development as a component of executive function. Executive function is the overarching construct of task- and goal-oriented behaviors (Cartwright, 2012; Reck & Hund, 2011) or an "umbrella term" (Wagner Fuhs & Day, 2011, p. 404; Willoughby, Wirth, Blair, & Greenberg, 2012, p. 226) encompassing inhibition, attention, and working memory (Barr et al., 2010; Reck & Hund, 2011; Nathanson et al., 2014; Wagner Fuhs & Day, 2011). Executive function is believed to be grounded in both neurological development and environmental impacts. Because executive function begins to develop in infancy, many researchers believe this component of executive function to be based upon the genetic formation of neural circuitry (Cuevas & Bell, 2014; Nathonson et al., 2014), whereas later executive development, such as the growth experienced during the toddler and preschool years, to be based on environmental experiences due to the brain's neuroplasticity (Nathonson et al., 2014). Executive function is closely linked to preschool and early kindergarten emergent literacy and math skills (Brock, Kim, & Grissmer, 2018a; Brock, Murrah, Cottone, Mashburn, & Grissmer, 2018b), and is correlated with school readiness (Cuevas & Bell, 2014; Huber et al., 2018; Nathanson et al., 2014; Wagner Fuhs & Day, 2011).

2.2 Learning and Academic Achievement

A preponderance of research has addressed the negative health outcomes related to screen time. Screen time has been noted to be, "a major public health issue," and potentially addictive (Stiller, Schwendemann, Bleckmann, Bitzer, & Mößle, 2018, p. 31), a likely cause of obesity (Conners-Burrow, McKelvey, & Fussell, 2011; Karuppiah, 2015), a cause of eye strain and poor posture (Karuppiah, 2015), and connected to a plethora of social and emotional problems (Conners-Burrow et al., 2011; Zhao et al., 2018). Specifically, media use results in distractions from other relevant tasks, such as sustained attention on toys, parent and child interactions, and homework for older children (Barr et al., 2010; Mößle, Kleimann, Rehbein, & Pfeiffer, 2010; Nikkelen et al., 2014; Ostrov, Gentile, & Mullins, 2013), and inappropriate content may also lead to addictive tendencies (Stiller et al., 2018). Media use is thought to displace other language-rich interactions with parents or other caregivers, potentially impacting language development (Radesky et al., 2015; Swartz, 2017; Zhao et al., 2018).

While excessive screen time is often linked to negative health outcomes because of its sedentary nature, Sisson, Broyles, Baker, and Katzmarzyk (2011) discovered that not all leisure-time sedentary behaviors, including computer use, television viewing and reading, produced negative health, specifically weight, outcomes. This lends credence to the assertion that portable screen time may be able to be used as a successful learning tool in spite of its sedentary nature. Research has noted that educational programming that may promote positive results entails programs that have specific literacy, numeracy and/or social and emotional or character development goals (although some research has also found that children still overlooked the program's moral) (Ostrov et al., 2013), programs that are well-designed (not simply marketed to young children), programs that are for children two years of age and older (Barr et al., 2011), programs that require children to be mentally active, engaged, and socially interactive, and programs where learning is meaningful (Hirsch-Pasek et al., 2015). Apps that are considered educational are those that contain active, engaging, meaningful and socially interactive content, all under the auspice of a learning goal (Hirsch-Pasek et al., 2015; Radesky et al., 2015).

Interactive screen time is also an area of screen time research demonstrating possible positive outcomes, particularly in relation to portable screens. Interactive screen time in which the user interacts with the interface can potentially increase children's number sense, basic math skills, and even problem solving and geometric skills (Lieberman, Bates, & So, 2009). Additionally, further emergent research has indicated that Visuomotor Integration (VMI), or a child's ability to comprehend and manipulate visual input, including letters and numbers and hands-on learning materials, paired with executive function, are important in developing children's reading and math skills (Brock et al., 2018a; Brock et al., 2018b). A preponderance of the research has also indicated that the benefits of screen time are improved when learning technologies are both interactive between the both the user and the screen (Hirsh-Pasek et al., 2015; Hsin, Li, & Tsai, 2014; Lerner & Barr, 2014; Lieberman et al., 2009) and between the user and the parent, caregiver or teacher (Hirsh-Pasek et al., 2015; Hsin et al., 2014). As such, context of interactive media use may play a role in whether or not children learn from such interactive media (Radesky et al., 2015).

2.3 Social and Emotional Development

In addition to impacting learning and academic achievement, screen time also impacts social and emotional development. Researchers and early childhood experts have long posited that children's viewing of violent media results primarily in negative outcomes such as aggression and ADHD-related behaviors (Anderson et al., 2003; Karuppiah, 2015; Nikkelen et al., 2014; Ostrov et al., 2013; Radesky et al., 2015). This is particularly the case when it comes to preschool-aged children, potentially because of the formative nature of children at this age coupled with the fact that these children also may not have a clear understanding of fantasy versus reality (Nathonson et al., 2014; Ostrov et al., 2013). When it comes to screen time habits, boys' screen time has resulted in larger video game use than girls (Cingel & Krcmar, 2013; Hartmann, Jung, & Vorderer, 2012). Boys' use of video games is concerning in that video games often coincide with violent content, and, as noted, violent content of media has been linked to greater aggression, violent behavior and ADHD-related behaviors (Anderson et al., 2003; Karuppiah, 2015; Ostrov et al., 2013; Radesky et al., 2015). Whereas boys tended to demonstrate physical aggression post violent screen time, girls tended to demonstrate more relational aggression, or indirect aggression, causing relationship difficulties (Conners-Burrow et al., 2011; Ostrov et al., 2013). Additionally, lower Socio-Economic Status (SES) has resulted in greater screen time for girls along with unequal access to media devices (Carson, Spence, Cutumisu, & Cargill, 2010). Lower SES children are considered at-risk and may be more susceptible to the negative outcomes associated with excessive screen time.

It has been noted that responsively attending to the needs of young children and providing positive social environments may improve executive function by ensuring positive neural development and opportunities to practice executive function skills, respectively (Kraybill & Bell, 2013). Many researchers have also reiterated the fact that interactions are needed with parents and caregivers in order for healthy development (both cognitive and social and emotional) (Nathonson et al., 2014; Swartz, 2017; Zhao et al., 2018); thus, interactive screen time between parents and children may serve to aid in the development of executive function. When parents use media as a tool to occupy children for whatever reason, it has the potential to undermine the value of such interactive programming (Zhao et al., 2018). Screen time used for the purpose of occupying children's time and/or keeping them quiet has been dubbed an, "electronic babysitter" (Zhao et al., 2018, p. 161), and this act essentially eliminates audio input that may potentially aid children in moving information into long term memory, provided the content was intended to be learned (Radesky et al., 2015). Moreover, children need to develop their own means of regulating their behavior rather than relying on screens (Nathonson et al., 2014; Radesky et al., 2015). As such, it is clear that the context of screen time is an important factor in determining screen time's impact on children.

2.4 Kindergarten-Aged Children

Kindergarten-aged children, or children about ages five or six, are also an important population to discuss in and of themselves, as they are developmentally unique. First, because executive function is closely linked to emergent literacy and math skills (Brock et al., 2018a; Brock et al., 2018b), differences in executive function skills translates into differing levels of school readiness (Cuevas & Bell, 2014; Huber, Yeates, Meyer, Fleckhammer, & Kaufman, 2018; Nathanson et al., 2014; Wagner Fuhs & Day, 2011). As such, as children enter kindergarten, they present with a multitude of variances in executive function skills, thus school readiness. Second, the ages of five to six are the end of marked improvement in executive function, including attention (Cartwright, 2012). As such, the kindergarten year is a pivotal year in the final formation of executive function skills, and, in the case of this study, attention. Third, screen time habits have been noted to be formed in early childhood (Zhao et al., 2018), and, in particular, portable smartphone addiction in later life significantly impacted both loneliness and shyness (Bian & Leung, 2015). As such, as children enter kindergarten, solidifying healthy screen time habits is essential to present and future health and well-being.

2.5 Research Questions

Previous research has documented the mixed effects of fast paced non-educational versus educational programming on executive function (Huber et al., 2018; Lillard et al., 2015; Nathonson et al., 2014) and this study attempted to clarify this issue while investigating content as a potential moderator. When examining the primary construct of children's portable screen time in relation to attention with content as a potential moderator, data were collected and analyzed to address the following research questions:

1) Is there a relationship between kindergarteners' portable screen time and their attention?

2) To what extent, if any, does the type of content viewed by kindergarteners (learning content vs non-learning content) moderate the relationship between portable screen time and their attention?

3. Method

The purpose of the non-experimental causal comparative design was to ascertain the relationship between portable screen time and kindergartener's levels of attention via a snapshot of children's current portable screen time and content viewed. Thus, the two research questions were the focus of this study. Portable screen time served as the independent variable and attention the dependent variable, with content as a potential moderator.

3.1 Study Design

Portable screens were selected for this proposed study on attention, a component of executive function, due to the fact that they are widely available and used by young children (Pea et al., 2012), and research on the effects of these devices is largely missing from the literature (Radesky et al., 2015). The non-experimental causal comparative design offered the opportunity to determine children's current portable screen time viewing and type of content viewed, as these variables were presumably already in place, and to analyze these in relation to attention.

3.2 Methodology

To answer the first research question, while considering a typical weekend day, children's parents completed a screen time and content questionnaire based upon Ostrov et al. (2013). Because the study only addressed portable screen time, parents focused on providing their children's screen time viewing for smartphones, tablets, handheld video game consoles, and laptops to the nearest half hour. Portable screen time was reported to the nearest half hour rather than as a range of time (i.e., 0-2 hours, 2-4 hours, etc.) to ensure that any relationship between screen time was not overlooked. For example, a half hour of screen time may not bear the same relationship to attention as does one hour of screen time. Lastly, when completing the questionnaire, parents were asked to document typical screen time on smartphones, tablets, video game consoles and laptops separately in an attempt to obtain the most accurate data possible. The individual portable screen times were summed to obtain an overall amount of screen time.

Additionally, to answer the first research question, parents evaluated attention using the Preschool and Kindergarten Behaviors Scale, 2nd Edition (PKBS-2, Merrell, 2002) and a 4-point rating scale (0 for *Never*, 1 for *Rarely*, 2 for *Sometimes*, and 3 for *Often*) where higher scores are indicative of decreases in attention. The PKBS-2 was chosen because the purpose of the study was to investigate attention, a component of executive function, and the PKBS-2 contains an attention subscale. The PKBS-2 has been utilized in previous research with good internal reliability (Azevedo et al., 2014; Metwaly, 2015) with the attention subscale, called the Attention Problems/Overactive subscale (PBKS-AP/O: 8 items;

Problem Behavior Scale questions 1, 6, 14, 15, 16, 20, 25, 39), having demonstrated good reliability when statistically isolated from the remaining PKBS-2 subscales (Azevedo, 2014).

To answer the second research question, when completing the questionnaire, parents also listed the programs, apps or games watched or played during their children's typical screen time. Again, each device type was listed separately in an attempt to obtain the most accurate data. These programs, apps or games were then rated as learning or non-learning based upon recommendations from Radesky et al. (2015) using www.commonsensemedia.org with a three star or better rating used as an educational rating. Non-learning content included any other content such as video games (Angry Birds or Bubble Witch, etc.), movies, television shows streamed onto portable devices, or simply internet browsing on portable devices. Occasionally, apps were unable to be located on the aforementioned website. In this case, if they were instead found in the app store and were categorized as educational, they were categorized as learning programs. All other shows, games or apps that were not located on the website or on the app store were assumed to be non-learning. A learning index was calculated by dividing the number of learning items by the total number of items. Utilizing a rating system that was already in place allowed for greater objectivity of content type, rather than relying on parents to identify learning versus non-learning programming.

Demographic control variables were input into the analysis first as modeled in previous research (Klassen, 2010; Lu, 2019; Xu et al., 2016). A theory driven hierarchical multiple regression (Field, 2009) was then used to ensure assumptions were met. After assessing reliability and validity and checking assumptions, regression analyses were utilized to answer both research questions, with portable screen time as the independent variable, the possible moderator of content acting as a second independent variable, and the dependent variable, attention. In order to better analyze the interaction term data, z-scores were calculated and utilized. This allowed screen time and learning index, two variables with different measures, to be compared utilizing a mean of zero and a standard deviation of one.

3.3 Results

The mean attention score was just under 8 ($M = 7.79$, $SD = 5.522$), where higher attention scores were indicative of decreased attention. Mean screen time was about 2 hours ($M = 1.934$, $SD = 1.475$) and the mean learning index was about .25 ($M = .2566$, $SD = .282$) indicating that about 25% of children's portable screen time was educational in nature. See Table 1 for full descriptive statistics.

Table 1. Descriptive Statistics with Skewness and Kurtosis of Non-Standardized and Standardized Variables and Interaction Term

	N	Mean	Std. Deviation	Skewness/ Std. Er.		Kurtosis/ Std. Er.	
Attention	38	7.790	5.522	1.000	.383	.953	.750
Screen Time	38	1.934	1.476	.688	.383	.240	.750
Learning Index	38	.2566	.283	.926	.383	.040	.750
Screen Time x Learning Index (Interaction Term)	38	.6362	.963	2.129	.383	4.284	.750
Z score: Screen Time	38	-.027	.999	.688	.383	.240	.750
Z score: Learning Index	38	-.007	1.01	.926	.383	.040	.750
Z Screen Time x Learning Index (Interaction Term)	38	.339	1.05	.843	.383	1.873	.750

To answer the first research question, Model 1 accounted for approximately 17.8% of the variability in attention, $R^2 = .178$, $F(2, 35) = 3.777$, $p < .05$, adjusted $R^2 = .131$. Model 2, then, addressed the potential relationship between screen time and attention. The difference between model 1 and model 2 was not significant. However, model 2 in its ability to predict attention was statistically significant, $F(3, 34) = 3.342$, $p < .05$. In model 2, approximately 22.8% of the variability in the outcome was attributed to the addition of screen time into the model. See Table 3 for full results of each regression model. To answer the second research question, the learning index was input into model 3, producing insignificant change from the previous model. However, similar to model 2 in its ability to predict attention, it was statistically significant, $F(4, 33) = 2.639$, $p = .05$. Finally, model 4 of the hierarchical regression analyses addressed the whether or not learning content moderated the relationship between screen time and attention.

Table 2. Pearson Correlations for Main Study Variables (N=38)

		Z score: Screen Time	Z score: Learning Index	Z score: Screen Time x Learning Index
Pearson Correlation	Attention	.27*	-.08	-.09
	Z score: Screen Time	1.00	.34**	.29
	Z score: Learning Index	.34**	1.00	.23
	Z score: Screen Time x Learning Index	.08	.23	1.00

* *p* = .05. ** *p* < .05.

Table 3. Hierarchical Multiple Regression Analyses Predicting Attention from Screen Time and Learning Index

	Model 1		Model 2		Model 3		Model 4	
Predictor	B	β	B	β	B	B	B	β
Constant	19.34		18.57		18.17		18.24	
Gender	-3.79**	-.35	-3.71**	-.34**	-3.37	-.31	-3.52	-.32
Qualifies for Free or Reduced Lunch	-3.17	-.30	-2.78	-.27	-2.86	-.27	-2.68	-.26
Screen Time			1.26	.28	1.50	.27	1.51	.27
Learning Index					-0.73	-.13	-.59	-.11
Screen Time x Learning Index							-0.44	-.08
R^2	0.18		0.23		0.24		0.25	
F	3.78**		3.34**		2.64*		2.12	
ΔR^2	0.18		0.05		0.02		0.01	
ΔF	3.78**		2.21		0.64		0.27	

* *p* = .05. ** *p* < .05.

The full model of portable screen time and learning content predicting attention, model 4, was neither statistically significant in its change from the previous model, nor was it statistically significant in its ability to predict attention. As shown in Table 3, the greatest amount of change in explained variability of the outcome, outside of the demographic control variables, was between model 1 and model 2. Models 3 and 4 show very little increase in their ability to account for variability in the outcome.

4. Limitations

Limitations included the fact that only portable screens were investigated. Children's total screen time, including television, home computer time, portable screen time, and media multi-tasking or multiple devices used simultaneously, such as a television on in the background, may play a role in children's attention. An additional limitation included the fact that parents reported children's attention, portable screen time, and listed games, apps and shows. They may have inaccurately reported data, or they may have modified data up or down, or to include or exclude certain programming, depending on what they believed was ideal. Potential threats to validity included selection and mortality (Creswell, 2009). One avenue undertaken in this study to mitigate the possibility of selection threats included the fact that printed materials were sent home to recruit participants, rather than electronic means of recruitment. Mortality, or attrition, was also a potential threat to validity which may have been addressed through ensuring a large enough sample size. In this study, only two data sets had to be excluded due to missing data. Reliability of the screen time and content measures may have been compromised, as well, due to lack of test-retest assessments.

5. Discussion

The first research question involved determining whether or not there was a relationship between portable screen time and children's attention. Models 1 and 2 indicated the greatest accountability for the variability in attention attributable to screen time, and model 2 was statistically significant in predicting attention from screen time. The correlation matrix confirmed this small but statistically significant relationship. This small positive relationship between screen time and attention scores, where higher attention scores indicated decreased attention, aligned with current research in which screen time in general resulted in negative outcomes (Huber et al., 2018; Lillard et al., 2015; Nathonson et al., 2014; Nikkelen et al., 2014; Zhao et al., 2018). Furthermore, recent experimental research noted television programming to result in immediate deficits in executive function (Lillard et al., 2015; Huber et al., 2018). Thus, the use of portable screens may mirror previous research utilizing any type of screen, potentially addressing the general problem that the impact of portable screen time on attention was unknown. In this study, findings may have been impacted by parents misreporting data, intentionally or otherwise. Additionally, although the rating scale used to determine the learning index was based upon recommendations by Radesky et al. (2015) for quality educational programming, the measure may have been too subjective given the fact that some parents explicitly listed their children's programming, whereas others did not. In order to further investigate, additional research is needed similar to the current study, albeit with test-retest measures in place for screen time and learning index measures to ensure reliability. Additionally, future research utilizing a larger sample size will allow for better analyses of the full model and the predictors independently.

The second research question involved determining whether or not learning index moderated the relationship between screen time and attention. Models 3 and 4 illustrated very small changes in R^2; moreover, these changes, and the models themselves, were insignificant. Therefore, learning content, and the interaction between learning content and screen time, did not predict attention very well. This is contrary to previous research that has indicated that screen time designed for children with specific learning goals has been found to be beneficial for children (Barr et al., 2010; Hsin et al., 2014; Kirkorian, Wartella, & Anderson, 2008; Lieberman et al., 2009; Ostrov et al., 2013; Wartella, Richert, & Robb, 2010). More specifically, smartphones and tablets have been shown to aid in learning, as well (Koh et al., 2013; Larabee et al., 2014), which again is contrary to what was found in this study. Thus, the second research question in this study was unable to address the general problem that the impact of portable screen time on attention was unknown. This discrepancy with regards to content as a moderator between this study and previous research could potentially be because of the unconfirmed reliability of either or both the screen time and learning index measures. It could also be indicative of the fairly small sample size in this study, as well. As such, additional research is needed utilizing appropriate test-retest measures for screen time and learning index measures to ensure reliability, along with larger cases of data to assess both the model as a whole and its individual predictors.

5.1 Recommendations

An important factor when considering recommendations for practice is the fact that while theory may dictate caution when using screens, the reality of practice indicates that screen time is here to stay (Christakis & Zimmerman, 2009). From a theoretical standpoint, this study did, in fact, demonstrate small significant levels of predictability in attention based upon portable screen time, where, as screen time increased, attention decreased. However, from a realistic standpoint, smartphone and tablet use by young children has become widespread (Radesky et al., 2015), and usage continues. Moreover, although the moderating effect of learning content was inconclusive in this study, because previous research has demonstrated that content of television viewing impacts whether or not children learn (Barr et al., 2010; Nathonson et al., 2014; Radesky et al., 2015), it is likely safe to assume that content does, in fact, impact what children can take away from screen time. As such, recommendations for practice include the fact that children's portable screen time should presumably be utilized for educational purposes, and monitored to both ensure attention is not compromised and that appropriate content is maintained. Teachers, parents and caregivers alike can play a role in developing children's healthy screen time.

5.2 Recommendations for Educators

Computers are becoming more and more prevalent in many early childhood classrooms (Ihmeideh, 2015), and, in some cases, portable screens are, as well. Because executive function has been linked to school readiness (Cuevas & Bell, 2014; Nathonson et al., 2014; Willoughby et al., 2012), particularly in at-risk populations (Wagner Fuhs & Day, 2011), with increased executive function associated with greater pro-social skills, fewer behavior challenges and improved academic performance (Cuevas & Bell, 2014; Kraybill & Bell, 2013; Willoughby et al., 2012), teachers will want to ensure that their students' executive function skills are not being compromised in the classroom due to excessive or inappropriate screen time. This can be done through the use of well-designed educational programming, and, ideally, interactive programming, as interactive screen time has been shown to benefit learning (Lieberman et al., 2009). Ideal screen time is that which is incorporated with well-designed content (Hirsh-Pasek et al., 2015), interactive to the user (Huber et al., 2018), and coupled with active engagement and support from parents or teachers (Hirsh-Pasek et al., 2015; Hsin et al., 2014).

In order to ensure screen time, either on tablets or computers, meets the aforementioned qualities, it is recommended that teachers make informed decisions regarding the types of programming utilized in their classrooms (Ihmeideh, 2015). This is especially important in light of the fact that, in one study, only 40% of teachers were able to identify starfall.com as acceptable programming, and 20% of teachers were unable to identify any acceptable programming at all (Arrow & Finch, 2013). It is recommended that teachers, or one or more designated school personnel, investigate the efficacy and appropriateness of programming via commonsensemedia.org (Radesky et al., 2015; Swartz, 2017) or through the use of The Haugland Developmental Software Scale (Ihmeideh, 2015).

Additionally, it is recommended that portable technological devices themselves be used in conjunction with already occurring developmentally appropriate practices in the classroom (Edwards & Bird, 2017). For example, the camera function on an iPad can be used by children to document the stages of their own plant growth, or the video camera function can be used collaboratively by children to document a small group Reader's Theater performance for later sharing and/or reflection.

5.3 Recommendations for Parents

Because parental monitoring has been shown to be paramount in impressing healthy screen time usage among children, it is recommended that parents institute a chronological approach to screen time. A chronological approach to screen time usage is instituted when very young children are not exposed to any screen time, followed by limited screen time with content monitoring and no bedroom media use for young children, and finally applying these same practices with older children and adolescents (Stiller et al., 2018). Ideally, when a chronological approach to screen time is in play, the introduction of technology is delayed altogether for very young children (with the exception of video chatting with family and close friends). Parents should not feel discouraged at delaying the introduction of screen time, or, with older children limiting their usage, as today's technology is, "intuitive" (Swartz, 2017, p.

141). Children, once introduced (or reintroduced) to technology, will pick up on the programming very quickly as today's technology is designed to be user-friendly.

As children begin to be introduced to screen time, it is recommended that parents institute a Family Media Use Plan (Swartz, 2017). A Family Media Use Plan can be found at www.healthychildren.org/MediaUsePlan, and it sets parameters for the use of screen time in the home. It should disallow screens in children's bedrooms and limit screen time. Moreover, screen time should not occur during meals and the hour prior to bedtime (Swartz, 2017).

5.4 Recommendations for Parents and Educators Collectively

While the above recommendations for parents may sound simple, parents may not have the knowledge needed to institute healthy screen time practices within the family dynamic. Moreover, screen time practices, often excessive, are likely already in place. As such, there is a clear need for parents to become educated on best-practices related to screen time. Therefore, it is recommended that schools partner with families to provide opportunities for parents to become empowered to make meaningful screen time decisions for their families. Perhaps this would entail a Family Night at school where the school personnel that evaluates the efficacy and appropriateness of programming presents research pertaining to screen time coupled with practical applications to be applied at home. Important research for schools to share is the fact that there are many facets of screen time to factor into the screen time equation (Huber et al., 2018), such as structure, or pacing, of screen time programming (Nikkelen et al., 2014), content (Swartz, 2017), and interactivity (Huber et al., 2018). Additionally, given the mixed and still unclear results pertaining to screen time and attention, children that demonstrate attention difficulties may be better suited for even greater limits and screen time monitoring until further research is completed.

5.5 Recommendations for Future Research

Recommendations for future research include studies, similar to the current study, which address portable screen time, again due to their widespread use (Radesky et al., 2015), and learning content. However, contrary to this study, these future studies will need to include reliable measures for all variables, along with ample data sets or a large enough sample size to allow for better analyses of the full model and the predictors independently. Additionally, future studies will need to address the reasons for children's portable screen time, along with the type of programming utilized. Previous research has indicated that the benefits of screen time are improved when learning technologies are both interactive between the user and the screen (Hirsh-Pasek et al., 2015; Hsin et al., 2014; Huber et al., 2018; Lerner & Barr, 2014) and between the user and the parent, caregiver or teacher (Hirsh-Pasek et al., 2015; Hsin et al., 2014). As such, context of interactive media use may play a role in whether or not children learn from such interactive media (Radesky et al., 2015). If portable screen time is used as a tool to occupy children for whatever reason, it has the potential to undermine the value of such interactive programming (Radesky et al., 2015; Zhao et al., 2018). Finally, both structure (Nikkelen et al., 2014), or pacing, content (Swartz, 2017), and interactivity (Huber et al., 2018) need to be investigated, ideally both collectively and separately.

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