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## DIGITAL MEDIA AND ENGLISH LANGUAGE DEVELOPMENT OF DUAL LANGUAGE LEARNERS IN KINDERGARTEN

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DIGITAL MEDIA AND ENGLISH LANGUAGE DEVELOPMENT OF DUAL LANGUAGE  
LEARNERS IN KINDERGARTEN

BY

KASSANDRA MARAGKOPOULOU

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE

DEGREE OF

MASTER OF SCIENCE

IN

DEVELOPMENTAL SCIENCE

UNIVERSITY OF RHODE ISLAND

2021

MASTER OF SCIENCE THESIS  
OF  
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2021

## ABSTRACT

During the past decade there has been a significant increase in children's access to the internet and digital devices, such as computers and touch-screen devices. Literature concerning the digital media usage of Dual Language Learners (DLLs) and their English language development is limited, but the number of DLLs in the U.S. is increasing rapidly. The purpose of this study is to examine DLLs' digital media (frequency & content) usage and its impact on their receptive and expressive English language development in kindergarten. It also examines how factors, such as family digital media rules and DLLs' pre-K care arrangements may moderate their digital media's effect on English language development. This study used a sample of 7,432 Dual Language Learners in kindergartens across the U.S. This sample was extracted from a secondary dataset, the Early Childhood Longitudinal Study, Kindergarten Class of 2010-11 (ECLS-K:2011). The study employed descriptive statistics, mean differences analyses, correlations, and regression analyses (using coefficients) to examine the study questions and hypotheses. Results showed that DLLs' expressive and receptive language development varied based on their computer use frequency. DLLs' expressive and receptive English language development increased as their TV viewing frequency decreased. However, it did not vary based on the digital media content they consumed. Family digital media rules had no moderating effect on DLLs' language development, but their pre-K care arrangements did moderate the impact of TV viewing frequency on their receptive and expressive language development. Pre-K care arrangements also moderated the impact of DLLs' recreational digital media use on their receptive language development, but not on their expressive language development. These findings contribute to the limited literature on DLLs' digital media use in relation to their

language development. Results can be used by pediatricians to recommend the best use of digital media. Parents may also find this information helpful in deciding how often and how their children should use digital media. Early childhood educators and policymakers can also use these findings to advocate for the importance of preschool attendance and its impact on young DLLs' language development.

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# CHAPTER 1

## Introduction

### Problem Statement

A study in 2017 found that children aged five to eight years old spend an average of 2.56 hours a day on digital media (Rideout, 2017). This number tripled from 2013 to 2017 and there continues to be an upward trend in the amount of time young children spend on digital media. Based on the most recent Zero to Eight study, children aged five to eight years old now spend an average of three hours (3.05) a day on digital media (Rideout & Robb, 2020). The purpose of this study is to examine the relationship between kindergarten Dual Language Learners' (DLLs') digital media usage and its impact on their English language development. During the past decade there has been a significant increase in children's access to the internet and digital devices, such as computers and touch-screen devices (McFarland et al., 2018). According to the National Center for Education Statistics (NCES), in 2010, 19% of four year olds had access to the internet from home, whereas in 2017, 45% of them had internet access at home (McFarland et al., 2018). Literature concerning the digital media usage of DLLs and their English language development is limited, but the number of DLLs in the U.S. is increasing rapidly (Hammer, Hoff, Uchikosh, Gillanders, Castro, & Sandilos, 2014). As of 2018, there were 1 million DLLs in the U.S., comprising 32% of the nations' children aged 0 to 8 years old (Weyer, 2018). Prior research shows that insufficient English language knowledge is a serious problem for many young DLLs, because it limits their ability to understand texts they come across at school (Silverman & Hines, 2009).

Some researchers suggest that educational digital media could assist DLLs in developing their English language, but others believe that the increasing use of digital

media could have negative effects on DLLs' English language development (Duch, Fisher, Ensari, Font, Harrington, Taromino, Yip, & Rodriguez, 2013; Silverman & Hines, 2009; Verhallen, Bus, & De Jong, 2006). More research is needed to examine the relationship between the increasing use of digital media and DLLs' English language development.

### **Digital Media Usage Among Kindergartners**

According to a 2017 survey, digital media usage increases significantly at the age of five (Rideout, 2017). At this age, children start having a digital media usage average of three hours a day. As of 2017, 59% of children aged five-eight years old own a tablet, 39% own an educational device, 26% own a handheld video game player, and 7% have their own smartphone. Children's digital media use has increased significantly since 2011, but prior research presents mixed findings regarding the relationship between digital media and kindergartner's development (Hu, Johnson, Teo, & Wu, 2020; Lieberman, Bates, & So, 2009; Newman, 2018; Patterson, 2002). In addition, although there are still some differences in children's access to media based on their household income, the digital divide has decreased significantly since 2011 (Rideout, 2017).

### **Significance**

As the number of DLLs in kindergarten and their exposure to digital media increase, it is important to explore the possible association between digital media usage and their English language development. Prior literature has researched DLLs' English language development, but research regarding factors that influence it, such as children's experiences and habits at home and at institutional learning centers, is limited (Hammer et al., 2014). The development of digital media during the past decade has led to young children spending more and more time on digital devices, both at home and in institutional learning settings. It is thought that this additional time spent on media may be one of the

factors that could impact DLLs' English language development. Depending on what digital media content is consumed, time spent on media could have both negative and positive consequences.

Despite the increased research efforts, the use of digital media by young children and its impacts on language development among Dual Language Learners still remains a controversial topic (Lieberman, Bates, & So, 2009; Newman, 2018; Patterson 2002; Rosenqvist, Lahti-Nuuttila, Holdnack, Kemp, & Laasonen, 2016). It is well documented that DLLs' lower English language proficiency can limit their school readiness (Crosnoe, 2007; Hernandez & Cervanter, 2011) and academic achievement through eighth grade (Halle, Hair, Wandner, McNamara, & Chien, 2012; Han, 2011). DLLs who have not achieved English language proficiency by first grade fall behind in both reading and mathematics (Halle, Hair, Wandner, McNamara, & Chien, 2012). Those achieving English proficiency by first grade also develop more positive cognitive and behavioral skills than those who are unable to achieve English proficiency by first grade.

### **Study Objectives**

As digital media has been considered a critical part of young learners' daily learning and development, the purpose of this study is to examine how dual language learners' use of digital media, and factors that influence their digital use may impact their English language development. For the purpose of this study, "Dual Language Learners" refers to children whose primary language is a non-English language. The objectives of this study are as follows: The first objective is to examine DLLs' digital media screen time and content, and their English language development. Prior literature suggests that family rules regarding children's digital media usage, and DLLs' pre-K care arrangements can impact their English language development (Coyne et al., 2017; Lin, Cherng, Chen, Chen,

& Yang, 2015). In this study, pre-K care arrangements refers to the different caregiving arrangements parents made in order to take care of their children before they started kindergarten. These arrangements were separated into two groups: a) non-center-based pre-K care arrangements, and b) center-based pre-K care arrangements. Non-center-based pre-K arrangements included arrangements in which children were taken care of by a relative or non-relative at their home or some other location. Family digital media rules refers to the number of rules that parents set for their children regarding digital media consumption, including what programs they can watch, how many hours they may watch television, and how early or late they may watch television. Thus, the current study aims to examine how DLLs' Pre-K care arrangements and family rules regarding children's digital media may moderate how digital media impacts their English language development. For the purpose of this study, "digital media" refers to electronic devices children use, such as computers, TVs, videotapes and DVDs. The specific research questions are raised:

1. How does DLLs' English language development vary based on the time they spend using digital media? a) How does it vary based on their computer use frequency? b) How does it vary based on their TV viewing frequency?
2. How does DLL's English language development vary based on the digital media content they consume? a) Does it vary based on whether they use educational digital media or not? b) Does it vary based on whether they use recreational digital media or not?
3. How do family digital media rules moderate digital media impact on DLLs' English language development?

4. How does DLL's pre-K care arrangement moderate digital media impact on their English language development?

## CHAPTER 2

### Literature Review

#### Theoretical Background

The current study is grounded in Vygotsky's sociocultural theory (Vygotsky, 1986) and Bronfenbrenner's bioecological theory (Bronfenbrenner, 1979). In this study, sociocultural theory is used to discuss how children's interactions with digital media and their environment influence their language development. According to Vygotsky (1978), direct engagement with the environment has a greater impact on language development. From a Vygotskian perspective, home environment and parenting practices could impact the effect of digital media on Dual Language Learners' (DLLs') English language development. For example, one study that examined the impact of TV viewing of three and four year olds' on their language development at age five found that there was a negative relationship between children's language development and their TV viewing, but the findings were no longer significant once factors such as parent scaffolding were taken into account (Blankson, O'Brien, Leerkes, Calkins, & Marcovitch, 2015). Based on this study, a child whose digital media consumption is mediated through parents' rules may develop the English language more effectively.

Bioecological theory suggests that children's development is impacted by different environmental systems; a set of nested contexts (Newman & Newman, 2016; Patel, 2011). It could be argued that the increase in DLLs' use of digital media is influenced by the macrosystem, which includes cultural and societal patterns and values, and by the chronosystem, which includes the impact of change in children's environment (Bronfenbrenner, 1979). The use of digital media has become a societal pattern in U.S. society and has led to a change in the environments in which children develop. One could



claim that this change in the pattern and value of digital media impacts how young DLLs develop English language.

Bioecological theory was developed prior to technology development, but in recent years it was suggested that an ecological techno-subsystem can provide a framework for examining the relationship between technology and child development (Johnson & Pupilampu, 2008). According to this concept, children's interactions with both living (e.g., family members) and nonliving (e.g., computers) "elements of communication, information and recreational technologies" in their environment influence their development (Johnson & Pupilampu, 2008). A study validated the conceptual framework of the ecological techno-subsystem by examining the association between children's internet use at home (techno-subsystem), their socioeconomic status (microsystem) and their cognitive development (bioecology) (Johnson, 2010). The study found that although socioeconomic status did have some impact on cognitive development, most of the variance in children's cognitive development was associated with their internet use at home. Specifically, approximately 29% of the differences in children's level of expressive language was linked to their use of technology at home (techno-subsystem). Based on this information, the ecological techno-subsystem provides a conceptual framework for understanding DLL's English language development in association with their digital media usage.

### **DLLs and Demographic Characteristics**

Prior to reviewing previous research regarding DLLs and their digital media use, it is important to understand who comprises DLLs. Dual Language Learners are a diverse group with different national, linguistic, cultural and racial origins. According to data from the 2016 American Community Survey, the majority of DLLs (16.1 million) were Spanish

speakers, 3.7 million spoke some other Indo-European language, and 3 million used an Asian or Pacific Island language (U.S. Census Bureau, 2016). In comparison to English speaking families, dual language households are characterized by higher poverty rates (24% vs. 17%), and children in these families are more likely to have lower English language development (U.S. Census Bureau, 2016). They are also more likely to live in two-parent households. There is limited information concerning their digital media usage, but a study conducted by the Joan Ganz Cooney Center found that 71% of parents of DLLs believe that educational media helps their child learn English; 30% of them believe it helps them “a lot” and 41% of them believe it helps them “some” (Chiong & Shuler, 2010; Rideout, 2014). Existing studies reported that parents allow their children to use digital media because they think it is educational and believe it supports their development (Rideout, 2017; Rideout, & Robb, 2020).

### **Digital Media Frequency and DLLs’ English Language Development**

This could lead to DLLs spending a lot of time on digital media, but as previously noted, prior literature concerning digital media and DLLs’ English language development is limited. There are few studies that explored the association between DLL or bilingual infants’ and toddlers’ digital media usage and their English language development. The first one examined television viewing in relation to the vocabulary development of monolingual English, monolingual French, and English-French bilingual infants and toddlers (Hudon, Fennell, & Hoftyzer, 2013). They found that time spent watching television was not associated with the children’s language development. This contradicts another study, which examined the relationship between digital media use, media content, and language development among 119 Hispanic infants and toddlers (Duch, et al., 2013). According to this study, toddlers who spent more than two hours per day watching

television had lower communication scores. This might be explained by the time-displacement hypothesis, which argues that children who spend a lot of time watching TV may not engage in other activities that are associated with increased language development (Koshal, Koshal, & Gupata, 1996). Similarly, the American Pediatric Association suggests that TV viewing should not replace play, reading aloud, and social interactions which have been shown to promote language development (Council on Communications and Media, 2016; Uchikoshi, 2006).

Silverman (2013) implemented two studies aimed at exploring the role of videos in supporting the language development in a population composed mostly of DLLs and kindergarteners from low income households. Based on these two studies, watching videos impacts vocabulary learning in the same way as listening to books. These studies also found that repeated viewing of videos can lead to increased expressive vocabulary (Silverman, 2013). However, these studies only examined the impact of video viewing, whereas digital media has many other components, such as video games and educational apps. In addition, because there was limited diversity in the studies' populations (the majority of children were from low-income families), the researchers did not examine the ways in which other factors, such as income and parental interactions, may influence their results. More research is needed to fully understand DLLs' digital media use and its impact on their English language development.

### **Digital Media Content and DLLs' English Language Development**

Recent research has started to examine how other digital media factors, such as digital media content and rules, may impact DLL's language development. Hudon et al. (2013) found that poor quality of television viewing, such as viewing television at an earlier age, background television, and unattended television viewing, was associated with lower

vocabulary development. This was most common for the development of English vocabulary of bilingual toddlers. From a Vygotskian perspective, one could argue that when children are viewing television unattended, there is a lack of parental scaffolding. Scaffolding refers to the ways in which adults support children's development and learning, by offering just the right amount of help each time (Belland, 2014; Wood, Bruner, & Ross, 1976). Prior research suggests that parent scaffolding during digital media consumption impacts the ways in which digital media influences language development (Christakis et al., 2009; Lavigne, Hanson & Anderson, 2015)

Similar results were found in Duch et al.'s study (2013). They found that language development differed based on the media content children were exposed to. For example, there was an association between child-directed media and low language development, but there was no association between adult-directed media and low language development. However, because 92% of these families were Spanish speaking, it is argued that parents may not have been able to interact and scaffold their children during the consumption of this media. That is, Spanish speaking children could achieve greater English language development if parents were able to support their English language learning. This connects to Bronfenbrenner's bioecological theory which claims that contextual factors in children's environments - in this case the digital media content that is available to them, and the support they are receiving from their parents - impact their development (Bronfenbrenner, 1979).

Contextual digital media factors could also include whether the media consumed is educational or recreational. Although some recent studies have examined how educational vs. recreational digital media impact monolinguals' language development, there are very few studies that have done this for DLLs. Some studies have found a positive

association between educational digital media consumption and DLLs' language development. For example, Uckikoshi (2006) conducted a study in which he discovered that viewing English educational TV programs was linked to higher expressive and receptive English language development among dual language kindergartners. A study conducted by Silverman and Hines (2009), focused on exploring the influence of multimedia-enhanced read-aloud vocabulary instruction on DLLs' and non-DLLs' English vocabulary development. They found that multimedia-enhanced read-aloud vocabulary instruction led to a decrease in the gap between non-DLLs' and DLLs' general vocabulary knowledge. Based on these results, it seems that it would be beneficial to DLLs to consume more educational digital content rather than recreational digital content.

### **Family Digital Media Rules**

In many families, though, there are no limits to what type of digital media children consume, nor rules concerning when and how often digital media is consumed (Rideout, 2017). This is critical, because the American Academy of Pediatrics (AAP) and the Child Mind Institute both advise parents to have boundaries on how much and when digital media is used (Coyne et al., 2017; Ehmke, 2019). It is also suggested that parents should have rules regarding what kinds of programs their children can view. They claim that such boundaries are beneficial to children's development. From a bioecological perspective, these rules help create the environment in which children grow up, and influence their development. One could argue that a child whose parents set boundaries on their digital media consumption will experience digital consumption differently, and thus develop different skills. From a Vygotskian perspective, digital consumption rules act as a form of parental scaffolding that impact how and when children consume and understand different forms of digital media.

## **Pre-K Care Arrangements, Digital Media and DLL Language Development**

Children's language development is also often supported by parental interactions. However, in some cases, parents are unable to do so due to language barriers. In certain cases, DLLs whose parents do not speak English proficiently are able to enhance their English language through their interactions in pre-K settings. Thus, another factor that may interact with digital media usage and affect DLLs' English language development is their pre-K care arrangements. Uchikoshi (2006) found that kindergarteners who had attended preschool or Head Start had a higher expressive language development than children who had stayed at home.

Similar results have been found regarding DLLs' receptive English language development. A study implemented in Germany, examined children's experiences in early childhood education and care and the German receptive vocabulary of single language learners and DLLs (Kohl, Willard, Agache, Bihler, & Leyendecker, 2019). According to this study, DLLs who enter early childcare centers at an earlier age developed larger vocabularies. Early age at entry was especially beneficial to children whose parents did not speak the language.

These findings are supported by other related research. A longitudinal study examined the extent to which age of entry was associated with DLLs' English language development (Yazejian, Bryant, Freel, & Burchinal, 2015). They found that DLLs who entered child care centers at an earlier age developed better receptive language than children with later entry to child care centers. That is, children who have center-based care arrangements before kindergarten are more likely to have higher English language development than those who are taken care of by a relative in a non-center setting.

Although prior literature fails to discuss DLLs' pre-K care arrangements in relation to their digital media usage and English language development, a study found that children in center-based pre-K care arrangements use educational digital media (Dore & Dynia, 2020). Specifically, findings suggested that computers and tablets are mostly used for instructional purposes in preschool classrooms, which may enhance children's language development. This is further supported by one study that found that using specific educational digital applications in conjunction with dual language picture books gave children more opportunities to develop their language (McGlynn-Stewart, Murphy, Pinto, Mogyorodi, & Nguyen, 2018).

### **Study's Hypotheses**

Based on prior research, the following questions and hypotheses are made:

Q1: How does DLLs' English language development vary based on the time children spend using digital media? a) How does English language development vary based on their computer use frequency? b) How does it vary based on their TV viewing frequency?

H1-a: DLLs' receptive English language development in kindergarten varies based on their computer use frequency.

H1-b: DLLs' expressive English language development in kindergarten varies based on their computer use frequency.

H1-c: DLLs' receptive English language development in kindergarten varies based on their TV viewing frequency.

H1-d: DLLs' expressive English language development in kindergarten varies based on their TV viewing frequency.

Q2: How does DLL's English language development vary based on the digital media content they consume? a) Does it vary based on whether they use educational digital media or not? b) Does it vary based on whether they use recreational digital media or not?

H2-a: DLL's receptive English language development varies based on whether they consume educational digital media or not.

H2-b: DLL's receptive English language development varies based on whether they consume recreational digital media or not.

H2-c: DLL's expressive English language development varies based on whether they consume educational digital media or not.

H2-d: DLL's expressive English language development varies based on whether they consume recreational digital media or not.

Q3: How do family digital media rules moderate digital media impact on DLLs' expressive and receptive English language development?

H3: The number of family digital media use rules influences the way DLLs' digital media usage is associated with their English language development in kindergarten.

Q4: How does DLL's pre-K care arrangement moderate digital media impact on their English language development?

H4-a: DLLs' pre-K care arrangement influences the way their computer use is associated with their English receptive language development in kindergarten.

H4-b: DLLs' pre-K care arrangement influences the way their computer use is associated with their English expressive language development in kindergarten.



H4-c: DLLs' pre-K care arrangement influences the way their TV viewing is associated with their English receptive language development in kindergarten.

H4-d: DLLs' pre-K care arrangement influences the way their TV viewing is associated with their English expressive language development in kindergarten.

H4-e: DLLs' pre-K care arrangement influences the way their educational digital media use is associated with their English receptive language development in kindergarten.

H4-f: DLLs' pre-K care arrangement influences the way their educational digital media use is associated with their English expressive language development in kindergarten.

H4-g: DLLs' pre-K care arrangement influences the way their recreational digital media use is associated with their English receptive language development in kindergarten.

H4-h: DLLs' pre-K care arrangement influences the way recreational digital media use is associated with their English expressive language development in kindergarten.

## CHAPTER 3

### Methodology

#### Dataset & Participants

This study used a sample of 7,432 Dual Language Learners (DLLs) in kindergartens across the U.S. Participants came from diverse socioeconomic backgrounds. The majority of the children were White (65.1%), 10.9% of them were African American, 12.5% were Hispanic, 4.3% were Asian, 0.5% were Native Hawaiian/Pacific Islanders, 0.7% were American Indian/Alaska-Natives, and 6% were from two or more Non-Hispanic races. Over half the children were male (51.6%), and the rest were female (48.4%). Participants demographic information is presented in Table 1.

Table 1

*Demographic Information (n = 7,432)*

	<i>n</i>	<i>%</i>
Sex		
Female	3,599	48.4
Male	3,833	51.6
Race		
White	4,838	65.1
Black/African American	808	10.9
Hispanic	916	12.3
Hispanic/No race specified	12	2.0
Asian	321	4.3
Native Hawaiian/Pacific Islander	38	0.5
American Indian/Alaska Native	52	0.7
Two or more Non-Hispanic Races	447	6.0
Parents' Marital Status		
Married	5235	70.4
Separated	224	3.0
Divorced/Widowed	442	5.9
Never Married	680	9.1
Domestic Partnership	160	2.2
Unknown	691	9.3
Parents Education Level		
8 <sup>th</sup> Grade or Below	48	.6

Table 1 (continued)

	<i>n</i>	%
9 <sup>th</sup> - 12 <sup>th</sup>	264	3.6
High School Diploma	1244	16.7
Voc/Tech Program	377	5.1
Some College	2245	30.2
Bachelor's Degree	1970	26.5
Graduate/Professional School –No Degree	175	2.4
Master's Degree or Higher	1109	14.9
Parent1 Employment		16.7
35+ hours	2981	40.1
Less that 35 hours	1529	20.6
Looking for Work	356	4.8
Unemployed	1816	24.4
Unknown	691	9.3
Parent2 Employment		
35+ hours	4,863	65.4
Less that 35 hours	275	3.7
Looking for Work	198	2.7
Unemployed	265	3.6
Unknown	691	9.3
Household Income		
Less than 25,000	1,164	15.7
25,000 – 50,000	1,518	20.5
50,000 – 75,000	1,457	19.5
75,000 – 200,000 +	3,293	44.3

*Note:* A total of 7,432 Dual Language Learners with English as a second language were extracted from the public data of ECLS-K: 2011 study

This sample was extracted from a secondary dataset, the Early Childhood Longitudinal Study, Kindergarten Class of 2010-11 (ECLS-K:2011). The present study used data collected during the Spring of 2011, when children were in kindergarten (National Center for Education Statistics, 2019). Restricting the data in the kindergarten wave of the ECLS-K:2011 study to participants whose primary language spoken at home was a non-English language (DLLs), and excluding missing data resulted in a final sample of 7,432 ( $n = 7,432$ ). The descriptive statistics of the sample including missing data were compared to those of the sample which excluded missing data to see if there were any significant differences that may alter the study's findings. After finding no significant

differences between the two sets of descriptive statistics, participants who responded “don’t know”, “not applicable”, “not ascertained”, or refused to answer, were also excluded from this study.

The ECLS-K:2011 follows a nationally representative sample of children from both public and private schools attending kindergarten in 2010-11. Multistage cluster sampling was used to ensure the sample was representative. The public-use data file provides data at the child level for each of the 18,174 children who participated in at least one of the Kindergarten data collections. The study’s universe includes children and their families, teachers, and schools in the United States. Data was collected over a period of five years, with the Kindergarten data being collected during Fall 2010 and Spring 2011. Survey data were collected through parent, teacher, and school administrator interviews and questionnaires, as well as home care and center care questionnaires. In addition, direct and indirect cognitive assessments were used to assess children’s language, reading, mathematics, science and executive function skills.

The ECLS-K:2011 is sponsored by the National Center for Education Statistics (NCES) within the Institute of Education Sciences (IES) of the U.S. Department of Education (Tourangeau et al., 2015). This longitudinal study aims to provide reliable data that allows researchers to understand children’s development and learning in the elementary grades, as well as how these are influenced by their early experiences in school and at home. The data can be used to understand how home, classroom, school, and community factors in children’s lives are associated with their cognitive, social, and emotional development.

Continuous quality was ensured throughout the data collection through staff training programs, assessment certifications, ongoing staff observations and evaluation

activities. Validity of parent interviews and school visits was controlled by having a percentage of them selected for validation. The preLAS tests that were used to measure children's English skills have been found to be valid and reliable methods of measuring DLLs' English proficiency.

Resources required for this study include the ECLS-K-:2011 Kindergarten Public use raw data file, the ECLS-K:2011 Electronic Codebook, the parent questionnaires, and a description of the preLAS assessments. The above resources are all public use files that can be downloaded from the National Center for Education Statistics website. The ECLS-K-:2011 Kindergarten Public use raw data file and the ECLS-K:2011 Electronic Codebook was used to create the present study's raw data file on SPSS Version 26. IRB exempt approval was received from the University of Rhode Island's Institutional Review board to use this data for the present study.

### **Key Variables**

**English language.** In the present study English language refers to English expressive and receptive language. English expressive and receptive language are the dependent variables in this study. Receptive language was defined as their ability to understand instructions in English. It was assessed with the use of the preLAS "Simon Says" task (Duncan & DeAvila, 1998). During this task, children played a game in which they had to follow simple, direct instructions that were given by the assessor in English. The assessor scored them as correct, incorrect, or no response. For each correct answer they got one point. Total scores ranged from 0 to 10 (see Appendix A).

Children's expressive language was defined as their ability to name objects and talk about them. It was assessed through the preLAS picture vocabulary task "Art Show" (Duncan & DeAvila, 1998). Children were shown certain pictures, asked to identify an

object and answer questions about it, such as “What is it?” and “What can you do with it?”. The person who administered the test scored them as correct, incorrect, or no response. For each correct answer they got one point. Total scores ranged from 0 to 10.

**Family digital media rules.** Family digital media rules were defined as the number of rules that parents set for their children regarding digital media consumption. It was measured by asking parents, “Are there family rules for {CHILD} about any of the following... What programs {CHILD} can watch? How many hours {CHILD} may watch television? How early or late {CHILD} may watch television?”. Parents responded to each of these questions with yes or no. First, three dummy variables were created for each of these questions respectively. Responses for each of these questions were coded as yes = 1, and no = 0. Then, these three variables were combined to create a composite numeric variable used to measure the overall number of family digital media rules. Children were considered to have three family digital media rules if they responded yes to all three of the previously mentioned questions. Children were considered to have two family digital media rules if they responded yes to any two of the previously mentioned questions. Children were considered to have one family digital media rule if they responded yes to any one of the previously mentioned questions. Children who responded no to all three questions were considered to have no family digital media rules. Thus, the number of family digital media rules ranged from 0 to 3.

**Pre-K care arrangements.** Children’s pre-kindergarten care arrangement was measured by asking parents a series of questions. They were asked, “Did {CHILD} receive care from a relative on a regular basis the year before (he/she) started kindergarten?”, to which they responded with yes or no. Pre-K care arrangement data was also collected by asking parents, “Now I'd like to ask you about any care {CHILD} received from

nonrelatives in a private home, not including child care centers.} Did {CHILD} receive care from a nonrelative on a regular basis the year before (he/she) started kindergarten? This includes home child care providers, regular sitters or neighbors”. Finally, parents were asked, “Did{CHILD}attend a daycare center, nursery school, preschool or pre-kindergarten program on a regular basis the year before {he/she} started kindergarten?” (see Appendix A). Parents responded with yes or no to all these questions. Based on this information, a variable was created in order to determine each child’s pre-K care arrangements. Its attributes included the following: (a) no non-parental care, (b) relative care in child’s home, (c) relative care in another home, (d) relative care in varying locations, (e) nonrelative care at child’s home, (f) nonrelative care in another home, (g) nonrelative care in varying locations, (h) center-based Program, and (i) 2 or more types of care with equal hours. Based on the above, a dummy variable was created so that the attribute center-based program was equal to 1, and all other answers were recoded into non-center-based pre-K arrangements which was equal to 0.

**Digital media frequency.** For the purpose of this study, digital media frequency comprised two subcategories: a) how frequently children use a computer during a week, and b) as the total number of hours children spent watching television during a week. To measure the first subcategory of digital media frequency, computer use frequency, parents were asked, “In an average week, how often does {CHILD} use the computer?”. The participants could respond from a Likert-type scale where 1 = never, 2 = once or twice a week, 3 = 3 to 6 times a week, or 4 = every day (See Appendix A). To measure the second subcategory of digital media frequency, TV viewing frequency, parents were asked the following questions: 1) “On any given weekday, how many hours of television, videotapes, or DVDs on average does {CHILD} watch at home? How about: a) Before 8:00 a.m.? b)

Between 8:00 a.m. and 6 p.m.? (c) After 6 p.m.?", and 2) "How about on Saturday and Sunday?" (See Appendix B). For each of these questions parents responded with a numeric value of the hours spent watching TV. The sum of these responses was used to create a new composite variable, which measured the total number of hours children spent watching TV during one week (Appendix A).

**Digital media content.** Digital media content comprised two different purposes for which digital media was used: a) educational media and b) recreational media. Each purpose of digital media content was measured through a parent interview in the spring of 2011 (see Appendix B).

To measure the first purpose for which DLLs used digital media, which was children's use of educational media, parents were asked "Does {CHILD} use the computer ... To play with programs that teach {him/her} something, like math or reading skills?". Parents' answers were coded as yes = 1 and no = 0 through a binary variable. To measure children's second purpose for which they used digital media - the use of recreational media - parents were asked "[Does {CHILD} use the computer ...] to play with drawing or art programs?", and "[Does {CHILD} use the computer ...] to get on the Internet?". First, parents' answers for each of these questions were coded as yes = 1 and no = 0. Then, a composite dummy variable was used to measure children's overall recreational use of digital media. Children whose parents answered yes to either one of the initial questions were considered individuals that used recreational digital media and were coded as yes = 1, whereas children who answered no to both the initial questions were considered individuals that did not use recreational digital media and were coded as no = 0.



### **Preparation for Analysis.**

The ECLS-K: 2011 Electronic Codebook and the raw data file were used to create a dataset on SPSS, which included the variables that were needed to test this study's hypotheses. The study's sample population was limited to 7,432 by excluding all non-DLLs, all missing cases, as well as those who responded "don't know", "not applicable", "not ascertained", or refused to answer. Prior to conducting data analysis, the dependent variables were tested for normality. Results of Pearson's skewness coefficient showed that the dependent variables were negatively skewed. Even after re-coding, normality was not met. Based on this, the following data analysis was conducted.

### **Data Analysis**

Data analysis was conducted in SPSS Version 26 (IBM Corp, 2018). This study employed two Kruskal Wallis  $H$  tests, two correlation tests, and four Mann-Whitney  $U$  tests to test hypotheses H1-a to H1-d, and H2-a, to H2-d respectively. For the Kruskal Wallis  $H$  tests, the Tamhane post-hoc was used, because the assumption of homogeneity of variances was not met. Spearman's rho was used in the correlational analysis, and the  $z$  distribution was used to determine whether the mean differences are statistically significant in the Mann-Whitney  $U$  tests. Using Baron and Kenny's (1986) procedures and Hayes' (2016) PROCESS procedure, moderation models for the study questions 3 and 4 will be examined by ANOVAs and Regression Analyses.

In sum, this study employed descriptive statistics, mean differences analyses, correlations, and regression analyses (using coefficients) to examine the study questions and hypotheses. All variables will be appropriately coded and standardized before entering into analyses.

## CHAPTER 4

### Findings

#### Descriptive Statistics

The receptive English language scores of Dual Language Learners (DLLs) who participated in the study ranged from 0 to 10, with a minimum of 0, a maximum of 10, a mode and median of 10 and a mean equal to 9.80 ( $SD = .69$ ). Most DLLs ( $n = 6458, 86.9\%$ ) scored a 10 on their receptive test, 9.7% ( $n = 722$ ) got a score of 9, 2.2% ( $n = 163$ ) score an 8, and the rest 1.2% ( $n = 89$ ) got a score of 7 and below. The mean score of their expressive English language score was 9.85 ( $SD = .67$ ). Expressive English language scores ranged from 0 to 10. Out of the 7,432 DLLs, 92.2% ( $n = 6,849$ ) scored a 10 on their expressive English language test, 3.4% ( $n = 250$ ) scored a 9, 3.4% ( $n = 253$ ) scored an 8, and 1.1% ( $n = 80$ ) scored a 7 or below.

DLLs' computer use frequency was ranged from 1 to 4 ( $M = 2.56, SD = .78$ ). Out of the 7,342 participants, 3.4% ( $n = 249$ ) reported that they never used the computer, 51.6% ( $n = 3,834$ ) said they used the computer once or twice a week, 30.5% ( $n = 2,269$ ) said they use the computer three to six times a week, and 14.5% ( $n = 1,080$ ) reported using the computer every day. The TV viewing frequency of DLLs was ranged from 0 to 30 ( $M = 6.06, SD = 3.76$ ). Approximately 14.7% of participating DLLs reported watching TV for five hours a week, 11.8% reported a TV viewing frequency of four hours a week, 10.8% reported a TV viewing frequency of six hours a week, 10.4% reported a TV viewing frequency of two hours a week. Only 9.4% said they had a TV viewing frequency of seven hours a week, 9% reported a TV viewing frequency of three hours a week, 7.3% reported a TV viewing frequency of eight hours a week, and 5.4% said they had a TV viewing frequency of nine hours a week.

Table 2

*Descriptive Statistics from the Spring 2011 wave of ECLS-K:2011(n=7,342)*

	<i>n</i>	%	Mean	<i>SD</i>
PreLAS Simon Says Score/ receptive language			9.80	.69
PreLAS Art Show Score/ expressive language			9.85	.67
Computer Use Frequency			2.56	.77
Never	249	3.4		
Once or Twice a Week	3,834	51.6		
3-6 Times a Week	2,269	30.5		
Everyday	1,080	14.5		
TV Viewing Frequency			6.06	3.76
Educational Digital Media Use			.88	.33
Yes	6,504	87.5		
No	928	12.5		
Recreational Digital Media Use			.90	.30
Yes	6,674	89.8		
No	758	10.2		
Primary type of non-parental care pre-K			.60	.49
Non-Center Based	2,939	39.5		
Center-Based	4,493	60.5		
Number of Family Digital Media Rules			2.44	.77

*Note:* A total of 7,432 Dual Language Learners with English as a second language were extracted from the public data of ECLS-K: 2011 study.

Approximately 87.5% ( $n = 6,504$ ) of the children reported using educational digital media, whereas 12.5% ( $n = 928$ ) claimed they did not use educational digital media ( $M = .88$ ,  $SD = .33$ ). The range of educational digital media use was from 0 (meaning no use) to 1 (meaning they used it). Out of all the participants, 89.8% ( $n = 6,674$ ) reported that they used recreational digital media, whereas 10.2% ( $n = 758$ ) said they did not use recreational digital media ( $M = .89$ ,  $SD = .30$ ). Recreational digital media use ranged from 0 (meaning no use) to 1 (meaning they used it).

Approximately 95.2% ( $n = 7,074$ ) of families claimed they had a rule regarding what their child could watch, 64.8% ( $n = 4,814$ ) said they had a rule regarding how many

hours their child could watch TV, and 84.4% ( $n = 6,270$ ) claimed they had a rule concerning when their child could watch TV. The overall number of family digital media rules ranged from 0 to 3 ( $M = 2.44$ ,  $SD = .77$ ). Approximately 59.9% ( $n = 4,454$ ) said they had three family digital media rules, 26.5% ( $n = 1,966$ ) said they had two family digital media rules, 11.6% ( $n = 864$ ) said they had one family digital media rule, and 2% ( $n = 148$ ) said they had no family digital media rules.

Approximately 60.5% ( $n = 4,493$ ) of families claimed their children had center-based pre-K care arrangements, whereas the rest ( $n = 2,939$ , 39.5%) said their children had non-center-based pre-K care arrangements. More descriptive statistics are shown in Table 2.

### **Preliminary Analysis**

Prior to employing ANOVAs, expressive language development and receptive language development were tested for normality by examining their Pearson's skewness coefficients. They were both significantly skewed; the Pearson's skewness coefficient of expressive language development was -7.2, and the Pearson's skewness coefficient of receptive language development was -7.7. Even with transformation, they remained significantly skewed. For this reason, the non-parametric version of ANOVA, Kruskal-Wallis  $H$  test, and the non-parametric correlation test, Spearman's  $\rho$  correlation test, were used for this study's analysis.

Prior to conducting group comparison, data were evaluated for homogeneity of variances through a Levene's test of equality of variances, which showed that the assumption of homogeneity of variances was not met. Based on these results, Mann-Whitney  $U$  tests were used to examine whether DLLs' expressive and receptive English

language development varies based on the digital media content they use. The Tamhane T2 post hoc test was also conducted to evaluate pairwise differences among means.

### **Digital Media Frequency and DLLs' English Language Development**

In order to examine hypothesis 1a, which was that DLLs' receptive English language development in kindergarten varies based on their computer use frequency, a Kruskal-Wallis  $H$  test was used. The predictor, computer use frequency, had four attributes: never, once or twice a week, three to six times a week, and every day. The Kruskal-Wallis  $H$  was significant,  $\chi^2(3, 7,432) = 13.49, p < .05$ . The strength of the relationship between computer use frequency and receptive English language, as assessed by  $\eta^2$ , was very small (.002). The result of Tamhane T2 post hoc test indicated that DLLs who used the computer three to six times a week scored significantly ( $p < .05$ ) higher in receptive English language ( $M = 9.84$ ) than DLLs who used the computer every day ( $M = 9.74$ ). However, there were no significant differences between the other groups. Results are shown in Table 3.

A second Kruskal-Wallis  $H$  test was used to test hypothesis 1b which was that DLLs' expressive English language development in kindergarten varies based on their computer use frequency. The predictor, computer use frequency, had four attributes: never, once or twice a week, three to six times a week, and every day. The Kruskal-Wallis  $H$  was significant,  $\chi^2(3, 7,432) = 18.03, p < .05$ . The result of the Tamhane T2 post hoc test indicated that DLLs who never used the computer showed significantly ( $p < .05$ ) higher expressive English language ( $M = 9.90$ ) than DLLs who used the computer every day ( $M = 9.80$ ). There was also a significant difference in the mean expressive English language scores of DLLs who used the computer three to six times a week ( $M = 9.88$ ) and those who used the computer every day ( $M = 9.80$ ). There was no significant difference between the

Table 3

*Mean Differences in Receptive and Expressive Language Development by Computer Use Frequency (n = 7,432).*

<b>Receptive Language Development (<math>\chi^2= 13.49^*</math>)</b>						
Measure	<i>n</i>	Mean	<i>SD</i>	0	1	2
0. Never	249	9.80	.70			
1. Once or Twice a Week	3,843	9.80	.70	.00		
2. Three to Six Times a Week	2,269	9.84	.56	.04	.03	
3. Every Day	1,080	9.74	.85	-.06	-.07	-.10*
<b>Expressive Language Development (<math>\chi^2=18.03^*</math>)</b>						
Measure	<i>n</i>	Mean	<i>SD</i>	0	1	2
0. Never	249	9.90	.49			
1. Once or Twice a Week	3,843	9.84	.71	-.06		
2. Three to Six Times a Week	2,269	9.88	.54	-.02	.04	
3. Every Day	1,080	9.85	.77	-.11*	-.04	-.08*

*Note:* A total of 7,432 Dual Language Learners with English as a second language were extracted from the public data of ECLS-K: 2011 study.

\* $p < .05$

mean expressive language scores between the other groups. Results are shown in Table 3.

A Spearman's *rho* correlation test was run to examine hypothesis-1c, which was that DLLs' receptive English language development in kindergarten varies based on their TV viewing frequency. The results showed a significant negative relationship ( $r = .068$ ,  $p < .01$ ) between DLLs' receptive English language development and their TV viewing

frequency. In other words, DLLs who spent more hours watching TV had lower receptive English language skills than those who spent fewer hours watching TV.

A second Spearman's *rho* correlation test was run to examine hypothesis-1d, which was that DLLs' expressive English language development in kindergarten varies based on their TV viewing frequency. The results showed a significant negative relationship ( $r = -.042, p < .01$ ) between DLLs' expressive English language development and their TV viewing frequency. That is, DLLs who spent more hours watching TV had lower expressive English language skills than those who spent fewer hours watching TV.

### **Digital Media Content and DLLs' English Language Development**

**Educational digital media and receptive English language development.** A Mann-Whitney *U* test was used to test hypothesis-2c, which was that DLL's receptive English language development varies by educational digital media. Results showed that there was no significant difference in DLLs' receptive English language scores ( $z = -.993; p > .05$ ) based on their educational digital media usage (see Table 4).

Table 4

*Mean Differences in Receptive Language Development by Educational and Recreational Digital Media Use (yes vs. no) (n = 7,432)*

Variable	<i>n</i>	Mean rank	<i>z</i>	<i>p-value</i>
Educational Digital Media Use			-0.993	.32
Yes	6504	3721.97		
No	928	3678.97		
Recreational Digital Media Use			-1.037	.30
Yes	6674	3721.59		
No	758	3671.67		

*Note:* A total of 7,432 Dual Language Learners with English as a second language were extracted from the public data of ECLS-K: 2011 study.

\*two-tailed

**Recreational digital media and receptive English language development.** A

Mann-Whitney *U* test was used to test hypothesis-2d, which was that DLL’s receptive English language development varies based on whether they consume recreational digital media or not. Results (see Table 4) showed that there was no significant difference in DLLs’ receptive English language scores ( $z = -1.037; p > .05$ ) based on their recreational digital media usage.

**Educational digital media and expressive English language development.** A

Mann-Whitney *U* test was used to examine hypothesis-2a, which was that DLL’s expressive English language development varies based on whether they consume educational digital media or not. Results (see Table 5) showed that there was no significant difference in DLLs’ expressive English language scores ( $z = -1.637; p > .05$ ) based on their educational digital media usage.

Table 5

*Expressive Language Development by Educational and Recreational Digital Media Use (yes vs. no) (n = 7,432)*

Variable	<i>n</i>	Mean rank	<i>z</i>	<i>p-value</i>
Educational Digital Media Use			-1.637	.10
Yes	6504	3723.67		
No	928	3666.23		
Recreational Digital Media Use			-0.319	.75
Yes	6674	3715.25		
No	758	3715.25		

*Note:* A total of 7,432 Dual Language Learners with English as a second language were extracted from the public data of ECLS-K: 2011 study.



### **Recreational digital media and expressive English language development.**

A Mann-Whitney  $U$  test was used to examine hypothesis-2b, which was that DLL's expressive English language development varies based on whether they consume recreational digital media or not. Results (see Table 5) showed that there was no significant difference in DLLs' expressive English language scores ( $z = -.319; p > .05$ ) based on their recreational digital media usage.

### **Family Digital Media Rules on Language Development**

Next, Baron, and Kenny's (1986) moderation procedure and Hayes' (2016) PROCESS procedure were employed to test hypothesis 3, which was that family digital media use rules influence the way DLLs' digital media usage (TV viewing, computer use frequency, educational digital media consumption, and recreational digital media consumption) is associated with their English expressive and receptive language development in kindergarten

Two-way ANOVA was used to test how family digital media rules moderate the association between DLLs' computer use frequency and their receptive language development. There was no statistically significant interaction,  $F(15, 7416) = .78, p = .64$ , between the effects of DLLs' computer use frequency and family digital media rules on their receptive English language development (see Table 6).

Two-way ANOVA was used to test how family digital media rules moderate the association between DLLs' computer use frequency and their expressive language development. There was no statistically significant interaction,  $F(15, 7416) = .96, p = .47$ , between the effects of DLL's computer use frequency and family digital media rules on their expressive language development (see Table 6).

Table 6

*Receptive and Expressive Language by Interaction of Computer Use and Family Digital Media Rules (n = 7,432)*

Source	Receptive Language					Expressive Language				
	<i>df</i>	MS	<i>F</i>	<i>p</i>	$\eta^2$	<i>df</i>	MS	<i>F</i>	<i>p</i>	$\eta^2$
Computer Use Frequency	3	1.57	3.34	.02	.001	3	1.67	3.74	.01	.002
Family Digital Media Rules	3	.56	1.20	.31	.000	3	.27	.61	.61	.000
Computer Use Frequency x Family Digital Media Rules	9	.37	.78	.64	.001	3	.43	.96	.47	.001

*Note:* A total of 7,432 Dual Language Learners with English as a second language were extracted from the public data of ECLS-K: 2011 study.

To test the hypothesis that family digital media rules moderate the association between Dual Language Learners' TV viewing and receptive language development, a hierarchical multiple regression was implemented. In the first step, TV viewing and family digital media rules were included in the analysis. TV viewing frequency and family digital media rules accounted for a significant amount of variance,  $R^2 = .004$ ,  $F(2, 7429) = 15.86$ ,  $p < .001$ , in DLLs' receptive language development (see Table 7). An interaction variable between TV viewing frequency and family digital media rules was created. Next, the interaction term between TV viewing frequency and family digital media rules was added to the regression model, which did not account for any significant proportion of the variance,  $R^2 = .004$ ,  $F(1, 7428) = 10.74$ ,  $p > .05$ , in DLLs' receptive language development (see Table 6). Hence, family digital media rules did not moderate DLLs' TV viewing frequency's impact on their receptive language development.

Table 7

*Receptive and Expressive Language by Interaction of TV Use and Family Digital Media (DM) Rules (n = 7,432)*

Construct	Step	Variable	<i>B</i>	<i>SE B</i>	<i>pB</i>	<i>df1</i>	<i>df2</i>	<i>F</i>	<i>F change</i> <i>p value</i>	<i>R</i> <sup>2</sup>
Receptive Language	1	TV Use Frequency	-.012	.002	.00					
		Family DM Rules	-.015	.100	.15	2	7429	15.86	.00	.004
	2	TV Use Frequency	-.008	.006	.20					
		Family DM Rules	-.004	.019	.83					
		TV Use Frequency x Family DM Rules	-.002	.003	.48	1	7428	10.74	.48	.004
Expressive Language	1	TV Use Frequency	-.007	.002	.00					
		Family DM Rules	-.004	.010	.72	2	7429	4.97	.01	.001
	2	TV Use Frequency	-.004	.006	.50					
		Family DM Rules	.003	.018	.85					
		TV Use Frequency x Family DM Rules	-.001	.002	.65	1	7428	3.38	.65	.001

*Note:* A total of 7,432 Dual Language Learners with English as a second language were extracted from the public data of ECLS-K: 2011 study.

*pB* = significance of *B*

To test the hypothesis that family digital media rules moderate the association between Dual Language Learners' TV viewing frequency and expressive language development, a hierarchical multiple regression was implemented. In the first step, TV viewing frequency and family digital media rules were included in the analysis. TV viewing frequency and family digital media rules accounted for a significant amount of

variance,  $R^2 = .001$ ,  $F(2, 7429) = 4.97$ ,  $p < .001$ , in DLLs' expressive language development (see Table 7). An interaction variable between TV viewing frequency and family digital media rules was created. Next, the interaction term between TV viewing frequency and family digital media rules was added to the regression model, which did not account for any significant proportion of the variance,  $R^2 = .001$ ,  $F(1, 7428) = 3.38$ ,  $p > .05$ , in DLLs' expressive language development (see Table 6). Hence, family digital media rules did not moderate DLLs' TV viewing frequency's impact on their expressive language development.

To test the hypothesis that family digital media rules moderate the association between Dual Language Learners' educational media content and their receptive language development, a hierarchical multiple regression was implemented. In the first step, educational media content and family digital media rules were included in the analysis. Educational media content and family digital media rules did not account for a significant amount of variance,  $R^2 = .001$ ,  $F(2, 7429) = 2.82$ ,  $p > .05$ , in DLLs' receptive language development (see Table 8). An interaction variable between educational media content and family digital media rules was created. Next, the interaction term between educational media content and family digital media rules was added to the regression model, which did not account for any significant proportion of the variance,  $R^2 = .001$ ,  $F(1, 7428) = 1.94$ ,  $p > .05$ , in DLLs' expressive language development (see Table 8). Hence, family digital media rules did not moderate DLLs' educational media content's impact on their receptive language development.

To test the hypothesis that family digital media rules moderate the association between Dual Language Learners' educational media content and their expressive

Table 8

*Receptive and Expressive Language by Interaction of Educational Media Content and Family Digital Media (DM) Rules (n = 7,432)*

Construct	Step	Variable	B	SE B	pB	df1	df2	F	F change p value	R <sup>2</sup>
Receptive Language	1	Educational Media	-.008	.010	.42					
		Family DM Rules	.055	.024	.02	2	7429	2.81	.06	.001
	2	Educational Media	.002	0.27	.94					
		Family DM Rules	.084	.072	.25					
		Educational Media x Family DM Rules	-.012	0.29	.68	1	7428	1.93	.68	.001
Expressive Language	1	Educational Media	-.001	.010	.94					
		Family DM Rules	.056	0.023	.02	2	7429	2.88	.06	.001
	2	Educational Media	-.014	.026	.60					
		Family DM Rules	.021	.071	.77					
		Educational Media x Family DM Rules	.015	.029	.60	1	7428	2.01	.60	.001

*Note:* A total of 7,432 Dual Language Learners with English as a second language were extracted from the public data of ECLS-K: 2011 study.

*pB* = significance

language development, a hierarchical multiple regression was implemented. In the first step, educational media content and family digital media rules were included in the analysis. Educational media content and family digital media rules did not account for a significant amount of variance,  $R^2 = .001$ ,  $F(2, 7429) = 2.88$ ,  $p > .05$ , in DLLs' expressive language development (see Table 8). An interaction variable between educational media

content and family digital media rules was created. Next, the interaction term between educational media content and family digital media rules was added to the regression model, which did not account for any significant proportion of the variance,  $R^2 = .001$ ,  $F(1, 7428) = 2.01$ ,  $p > .05$ , in DLLs' expressive language development (see Table 8). Hence, family digital media rules did not moderate DLLs' educational media content's impact on their expressive language development.

To test the hypothesis that family digital media rules moderate the association between Dual Language Learners' recreational media content and their receptive language development, a hierarchical multiple regression was implemented. In the first step, recreational media content and family digital media rules were included in the analysis. Recreational media content and family digital media rules did not account for a significant amount of variance,  $R^2 = .000$ ,  $F(2, 7429) = 1.52$ ,  $p > .05$ , in DLLs' receptive language development (see Table 9). An interaction variable between recreational media content and family digital media rules was created. Next, the interaction term between recreational media content and family digital media rules was added to the regression model, which did not account for a significant proportion of the variance,  $R^2 = .001$ ,  $F(1, 7428) = 2.10$ ,  $p > .05$ , in DLLs' receptive language development (see Table 9). Hence, family digital media rules did not moderate DLLs' recreational media content's impact on their receptive language development.

To test the hypothesis that family digital media rules moderate the association between Dual Language Learners' recreational media content and their expressive language development, a hierarchical multiple regression was implemented. In the first step, recreational media content and family digital media rules were included in the

Table 9

*Receptive and Expressive Language by Interaction of Recreational Media Content and Family Digital Media (DM) Rules (n = 7,432)*

Construct	Step	Variable	B	SE B	pB	df1	df2	F	F change	R <sup>2</sup>
Receptive Language	1	Recreational Media	-.007	.010	.52					
		Family DM Rules	.042	.026	.11	2	7429	1.52	.22	.000
	2	Recreational Media	.048	.032	.13					
		Family DM Rules	.193	.088	.03					
		Recreational Media x Family DM Rules	-.061	.034	.07	1	7428	2.09	.07	.001
Expressive Language	1	Recreational Media	.001	.010	.93					
		Family DM Rules	.007	.026	.79	2	7429	.038	.96	.000
	2	Recreational Media	.011	.031	.73					
		Family DM Rules	.034	.086	.69					
		Recreational Media x Family DM Rules	-.011	.033	.74	1	7428	.063	.73	.000

*Note:* A total of 7,432 Dual Language Learners with English as a second language were extracted from the public data of ECLS-K: 2011 study.

*pB* = significance of B

analysis. Recreational media content and family digital media rules did not account for a significant amount of variance,  $R^2 = .000$ ,  $F(2, 7429) = 0.38$ ,  $p > .05$ , in DLLs' expressive language development (see Table 9). An interaction variable between recreational media content and family digital media rules was created. Next, the interaction term between recreational media content and family digital media rules was added to the regression model, which did not account for any significant proportion of the variance,  $R^2 = .000$ ,  $F(1,$

7428) = 0.63,  $p > .05$ , in DLLs' expressive language development (see Table 9). Hence, family digital media rules did not moderate DLLs' recreational media content's impact on their expressive language development.

### **Pre-K Care Arrangements and Digital Media on DLL Language Development**

In order to test hypothesis 4, which was that DLLs' pre-K care arrangement influences the way their digital media usage is associated with their English language development in kindergarten, moderation was used.

A two-way ANOVA was used to test the sub-hypothesis that pre-K care arrangements moderate the association between Dual Language Learners' computer use frequency and their receptive language development. There was no statistically significant interaction,  $F(7, 7424) = 1.00$ ,  $p = .40$ , between the effects of DLL's computer use frequency and pre-K care arrangements on their receptive language development (see Table 10).

Table 10

*Receptive and Expressive Language by Interaction of Computer Use and Pre-K Care Arrangements (n = 7,432)*

Source	Receptive Language					Expressive Language				
	<i>df</i>	MS	<i>F</i>	<i>p</i>	$\eta^2$	<i>df</i>	MS	<i>F</i>	<i>p</i>	$\eta^2$
Computer Use Frequency	3	2.27	4.85	.00	.001	3	2.08	4.67	.00	.002
Pre-K Care Arrangements	1	1.20	2.57	.11	.000	1	.15	.33	.57	.000
Computer Use x Pre-K Care Arrangements	9	.47	1.00	.40	.001	3	.22	.50	.69	.000

*Note:* A total of 7,432 Dual Language Learners with English as a second language were extracted from the public data of ECLS-K: 2011 study.

A two-way ANOVA was used to test the sub-hypothesis that re-K care arrangements moderate the association between Dual Language Learners' computer use



frequency and their expressive language development. There was no statistically significant interaction,  $F(7, 7424) = .50, p = .69$ , between the effects of DLL's computer use frequency and pre-K care arrangements on their expressive language development (see Table 10).

To test the sub-hypothesis that pre-K care arrangements moderate the association between Dual Language Learners' TV viewing frequency and their receptive language development, a hierarchical multiple regression was implemented. In the first step, TV viewing frequency and pre-K arrangements were included in the analysis. TV viewing frequency and pre-K arrangements variables accounted for a significant amount of variance,  $R^2 = .004, F(2, 7429) = 16.70, p < .001$ , in DLLs' receptive language development (see Table 11). An interaction variable between TV viewing frequency and pre-K care arrangements was created. Next, the interaction term between TV viewing frequency and pre-K care arrangements was added to the regression model, which accounted for a significant proportion of the variance,  $R^2 = .006, F(1, 7428) = 14.38, p < .01$ , in DLLs' receptive language development (see Table 11). Examination of the interaction plot (*Figure 1*) showed that high TV viewing frequency and non-center-based pre-K care arrangements led to lower receptive language development. However, among DLLs with high TV viewing frequency, those in center-based pre-K arrangements had much higher receptive language development than those in non-center-based pre-K care arrangements. At low TV frequency viewing, DLLs' receptive language development was very similar for those who had center-based pre-K care arrangements or non-center-based pre-K care arrangements. Hence, pre-K care arrangements moderated DLLs' TV viewing frequency's impact on their receptive language development.

Table 11

*Receptive and Expressive Language by Interaction of TV Use and Pre-K Care Arrangements (n = 7,432)*

Construct	Step	Variable	<i>B</i>	<i>SE B</i>	<i>pB</i>	<i>df1</i>	<i>df2</i>	<i>F</i>	<i>F change</i>	<i>R<sup>2</sup></i>	<i>p value</i>
Receptive Language	1	TV Use	-.011	.002	.00						
		Frequency									
	2	Pre-K Care Arrangements	.031	.016	.05	2	7429	16.69	.00	.004	
		TV Use	-.018	.003	.00						
		Frequency									
		Pre-K Care Arrangements	-.050	.031	.10						
3	TV Use	.013	.004	.00	1	7428	14.38	.00	.006		
	Frequency x Pre-K Care Arrangements										
Expressive Language	1	TV Use	-.006	.002	.00						
		Frequency									
	2	Pre-K Care Arrangements	.013	.016	.40	2	7429	5.257	.00	.001	
		TV Use	-.011	.003	.00						
		Frequency									
		Pre-K Care Arrangements	-.042	.030	.17						
3	TV Use	.009	.004	.03	1	7428	5.059	.03	.002		
	Frequency x Pre-K Care Arrangements										

*Note:* A total of 7,432 Dual Language Learners with English as a second language were extracted from the public data of ECLS-K: 2011 study.

*pB* = significance of B

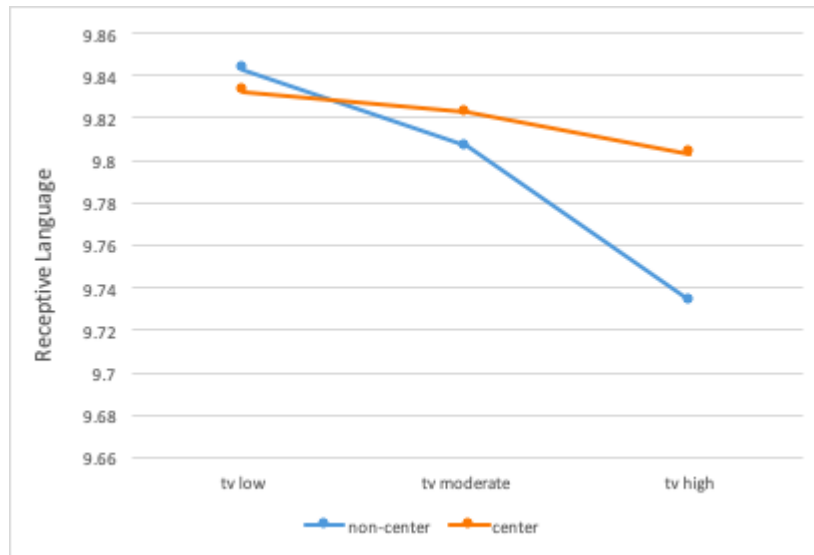


Figure 1. Receptive language based on interaction of TV viewing frequency and pre-K care arrangements

To test the sub-hypothesis that pre-K care arrangements moderate the association between Dual Language Learners' TV viewing frequency and their expressive language development, a hierarchical multiple regression was implemented. In the first step, TV viewing frequency and pre-K care arrangements were included in the analysis. TV viewing frequency and pre-K care arrangements accounted for a statistically significant amount of variance,  $R^2 = .001$ ,  $F(2, 7429) = 5.26$ ,  $p < .01$ , in DLLs' expressive language development (see Table 11). An interaction variable between TV viewing frequency and pre-K care arrangements was created. Next, the interaction term between TV viewing frequency and pre-K care arrangements was added to the regression model, which accounted for a significant proportion of the variance,  $R^2 = .002$ ,  $F(1, 7428) = 5.06$ ,  $p < .05$ , in DLLs' expressive language development (see Table 11). Examination of the interaction plot (Figure 2) showed that high TV viewing frequency and non-center-based pre-K care arrangements led to lower expressive language development. However, at low TV

frequency viewing, DLLs’ expressive language development was higher for those who had non-center-based pre-K care arrangements than for those in center based pre-K care arrangements. For those in non-center-based pre-K arrangements, expressive language seemed to decrease as TV viewing increased, whereas for those in center-based pre-K care arrangements, the decrease in expressive language development was much smaller. Hence, pre-K care arrangements moderated DLLs’ TV viewing frequency’s impact on their expressive language development.

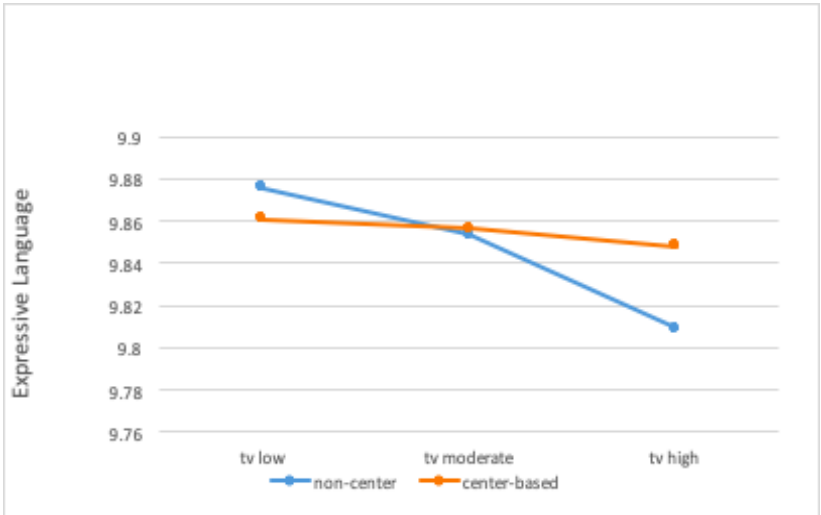


Figure 2. Expressive language based on interaction of TV viewing frequency and pre-K care arrangements

To test the sub-hypothesis that pre-K care arrangements moderate the association between Dual Language Learners’ educational digital media content and their receptive language development, a hierarchical multiple regression was implemented. In the first step, educational digital media content and pre-K care arrangements were included in the analysis. Educational digital media content and pre-K care arrangements accounted for a significant amount of variance,  $R^2 = .001$ ,  $F(2, 7429) = 5.31$ ,  $p < .01$ , in DLLs’ receptive language development (see Table 12). An interaction variable between educational digital media content and pre-K care arrangements was created. Next, the interaction term

between educational media content and pre-K care arrangements was added to the regression model, which did not account for a significant proportion of the variance,  $R^2 = .002$ ,  $F(1, 7428) = 3.72$ ,  $p > .05$ , in DLLs' expressive language development (see Table 12). Hence, pre-K care arrangements did not moderate DLLs' educational media content's impact on their receptive language development.

Table 12

*Receptive and Expressive Language by Interaction of Educational Digital Media and Pre-K Care Arrangements (n = 7,432)*

Construct	Step	Variable	B	SE B	pB	df1	df2	F	F change	R <sup>2</sup>	
<hr/>											
<i>p value</i>											
Receptive Language	1	Educational Media	.053	.024	.03						
		Pre-K Care Arrangements	.039	.016	.18	2	7429	5.31	.01	.001	
	<hr/>										
	2	Educational Media	.074	.038	.05						
		Pre-K Care Arrangements	.070	.046	.13						
		Educational Media x Pre-K Care Arrangements	-.036	.049	.46	1	7428	3.72	.46	.002	
<hr/>											
Expressive Language	1	Educational Media	.056	.023	.02						
		Pre-K Care Arrangements	.017	.016	.28	2	7429	3.47	.03	.001	
	<hr/>										
	2	Educational Media	.049	.037	.18						
		Pre-K Care Arrangements	.007	.045	.87						
		Educational Media x Pre-K Arrangements	.011	.048	.81	1	7428	2.33	.81	.001	
<hr/>											

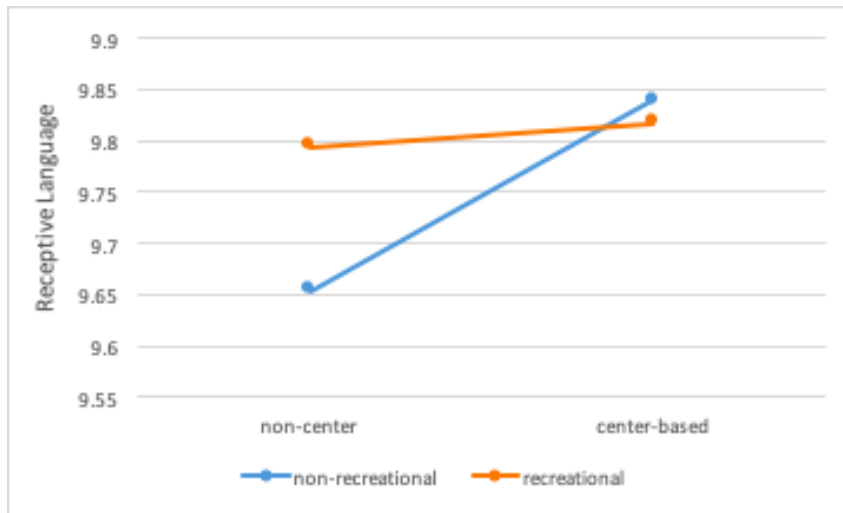
*Note:* A total of 7,432 Dual Language Learners with English as a second language were extracted from the public data of ECLS-K: 2011 study.

*pB* = significance of B

To test the sub-hypothesis that pre-K care arrangements moderate the association between Dual Language Learners' educational digital media content and their expressive language development, a hierarchical multiple regression was implemented. In the first step, educational digital media content and pre-K care arrangements were included in the analysis. Educational digital media content and pre-K care arrangements accounted for a significant amount of variance,  $R^2 = .001$ ,  $F(2, 7429) = 3.47$ ,  $p < .05$ , in DLLs' expressive language development (see Table 12). An interaction variable between educational digital media content and pre-K care arrangements was created. Next, the interaction term between educational digital media content and pre-K care arrangements was added to the regression model, which did not account for a significant proportion of the variance,  $R^2 = .001$ ,  $F(1, 7428) = 2.33$ ,  $p > .05$ , in DLLs' expressive language development (see Table 12). Hence, pre-K care arrangements did not moderate DLLs' educational digital media content's impact on their expressive language development.

To test the sub-hypothesis that pre-K care arrangements moderate the association between Dual Language Learners' recreational digital media content and their receptive English language development, a hierarchical multiple regression was implemented. In the first step, recreational digital media content and pre-K care arrangements were included in the analysis. Recreational digital media content and pre-K care arrangements accounted for a significant amount of variance,  $R^2 = .001$ ,  $F(2, 7429) = 4.19$ ,  $p < .05$ , in DLLs' receptive language development (see Table 12). An interaction variable between recreational digital media content and pre-K care arrangements was created. Next, the interaction term between recreational digital media content and pre-K care arrangements was added to the regression model, which accounted for a significant proportion of the

variance,  $R^2 = .002$ ,  $F(1, 7428) = 5.86$ ,  $p < .01$ , in DLLs' receptive language development (see Table 12).



*Figure 3.* Receptive language based on interaction of recreational digital media content and pre-K care arrangements

Examination of the interaction plot (see *Figure 3*) showed that center-based pre-K care arrangements and recreational digital media consumption led to higher receptive language development. DLLs who were in center-based pre-K care arrangements had higher receptive language development regardless of whether they engaged in recreational digital media or not. In addition, among DLLs in non-center based pre-K care arrangements, those who engaged in recreational media had better receptive language development than those who did not engage in recreational media.

To test the sub-hypothesis that pre-K care arrangements moderate the association between Dual Language Learners' recreational media content and their expressive language development, a hierarchical multiple regression was implemented. In the first step, recreational media content and pre-K arrangements were included in the analysis. Recreational digital media content and pre-K arrangements did not account for a

Table 13

*Receptive and Expressive Language by interaction of Recreational Digital Media and Pre-K Care Arrangements (n = 7,432)*

Construct	Step	Variable	<i>B</i>	<i>SE B</i>	<i>pB</i>	<i>df1</i>	<i>df2</i>	<i>F</i>	<i>F</i> <i>change</i>	<i>R</i> <sup>2</sup> <i>p value</i>
Receptive Language	1	Recreational Media	.043	.026	.11					
		Pre-K Care Arrangements	.039	.016	.02	2	7429	4.19	.02	.001
	2	Recreational Media	.141	.042	.00					
		Pre-K Care Arrangements	.185	.051	.00					
		Recreational Media x Pre-K Care Arrangements	-.163	.054	.00	1	7428	5.86	.00	.002
Expressive Language	1	Recreational Media	.007	.026	.80					
		Pre-K Care Arrangements	.018	.016	.27	2	7429	.65	.52	.000
	2	Recreational Media	.023	.041	.58					
		Pre-K Care Arrangements	.041	.050	.40					
		Recreational Media x Pre-K Care Arrangements	-.026	.052	.61	1	7428	.52	.61	.000

*Note:* A total of 7,432 Dual Language Learners with English as a second language were extracted from the public data of ECLS-K: 2011 study.

*pB*= significance of B

significant amount of variance,  $R^2 = .000$ ,  $F(2, 7429) = .65$ ,  $p > .05$ , in DLLs' expressive language development (see Table 13). An interaction variable between recreational digital media content and pre-K care arrangements was created. Next, the interaction term



between recreational digital media content and pre-K care arrangements was added to the regression model, which did not account for a significant proportion of the variance,  $R^2 = .000$ ,  $F(1, 7428) = .52$ ,  $p > .05$ , in DLLs' expressive language development (see Table 13). Hence, pre-K care arrangements did not moderate DLLs' recreational digital media content's impact on their expressive language development.

### **Summary of Results**

In sum, the present study found that Dual Language Learners' (DLLs') expressive and receptive English language development varied based on their computer use frequency. In addition, DLLs' expressive and receptive English language development increased as their TV viewing frequency decreased. However, it did not vary based on the digital media content they consumed. Results showed that family digital media rules had no moderating effect on DLLs' receptive and expressive language development, but their pre-K care arrangements did moderate the impact of TV viewing frequency on their receptive and expressive English language development. Pre-K care arrangements also moderated the impact of DLLs' recreational digital media use on their receptive English language development, but not on their expressive English language development. Table 14 shows which hypotheses were rejected and which were approved.

Table 14

*Hypotheses Results*

Hypotheses	Contents	Test
H1-a	DLLs' receptive English language development in kindergarten varies based on their computer use frequency.	Accepted
H1-b	DLLs' expressive English language development in kindergarten varies based on their computer use frequency.	Accepted
H1-c	DLLs' receptive English language development in kindergarten varies based on their TV viewing frequency.	Accepted
H1-d	DLLs' expressive English language development in kindergarten varies based on their TV viewing frequency.	Accepted
H2-a	DLL's receptive English language development varies based on whether they consume educational digital media or not.	Rejected
H2-b	DLL's receptive English language development varies based on whether they consume recreational digital media or not.	Rejected
H2-c	DLL's expressive English language development varies based on whether they consume educational digital media or not.	Rejected
H2-d	DLL's expressive English language development varies based on whether they consume recreational digital media or not.	Rejected
H3	The number of family digital media use rules influences the way DLLs' digital media usage is associated with their English language development in kindergarten.	Rejected
H4-a	DLLs' pre-K care arrangement influences the way their computer use is associated with their English receptive language development in kindergarten.	Rejected
H4-b	DLLs' pre-K care arrangement influences the way their computer use is associated with their English expressive language development in kindergarten.	Rejected
H4-c	DLLs' pre-K care arrangement influences the way their TV viewing is associated with their English receptive language development in kindergarten.	Accepted
H4-d	DLLs' pre-K care arrangement influences the way their TV viewing is associated with their English expressive language development in kindergarten.	Accepted
H4-e	DLLs' pre-K care arrangement influences the way their educational digital media use is associated with their English receptive language development in kindergarten.	Rejected
H4-f	DLLs' pre-K care arrangement influences the way their educational digital media use is associated with their English expressive language development in kindergarten.	Rejected

Hypotheses	Contents	Test
H4-g	DLLs' pre-K care arrangement influences the way their recreational digital media use is associated with their English receptive language development in kindergarten.	Accepted
H4-h	DLLs' pre-K care arrangement influences the way their recreational digital media use is associated with their English expressive language development in kindergarten.	Rejected

## CHAPTER 5

### Discussion

Despite the fact that the number of Dual Language Learners (DLLs) in the U.S. is increasing exponentially, there is a limited number of studies on Dual Language Learners' (DLLs') digital media usage and their English language development. (Hammer, et al., 2014; Weyer, 2018). Prior studies have resulted in mixed findings regarding the association between digital media and DLLs' language development. More research is needed in order to better understand DLLs' language development and its association to their digital media use. This could help parents, pediatricians and educators better support DLLs' language development. In addition, there is limited literature regarding other environmental factors, such as pre-K care arrangements, that may influence DLLs' digital media's potential impact on their English language development (Hu, et. al., 2020; Lieberman, et. al., 2009; Newman, 2018; Patterson, 2002)

The present study contributes to existing literature by looking at how DLLs' expressive and receptive English language development is influenced by both digital media frequency and digital media content. Prior studies examined how only one specific type digital media impacts DLLs' language development. In addition, prior studies have not examined DLLS' digital media's influence on both their expressive and receptive language development. In contrast, the present study examined how both digital media frequency and digital media content impact DLLs' expressive and receptive language development. It also takes other environmental factors, such as family digital media rules and pre-K care arrangements, into account. Using the nationally representative ECLS-K:2011 data strengthened this study by providing data from a large and diverse population.

The study's results indicated that daily computer use led to the lowest receptive English language development, whereas DLLs who used the computer three to six times a week, had the highest receptive English language development. Similarly, DLLs who used the computer every day, had lower expressive language development than those who used it three to six times a week. However, of all DLLs, those who never used the computer had the highest expressive English language development. These findings contradict the American Psychological Association's (2019) suggestion that having some computer use can have some advantages on expressive language development. They specifically suggest that having some digital media usage is not harmful (American Psychological Association, 2019). It is significant to note that the present study found that DLLs who had no computer use had the highest expressive language development. However, recommending that DLLs' have no digital media use seems unrealistic. One could argue that this result may have been due to other factors, such as digital media content, time spent reading, and parent/child interactions, that influence DLLs' expressive language development. Considering the finding that DLLs who used the computer three to six times a week had the highest receptive language development and one of the highest expressive language developments, it would be more realistic to suggest that DLLs' spend a moderate time using a computer.

Results also indicated that DLLs who spent more hours watching TV had lower receptive and expressive English language development than those who spent fewer hours watching TV. These results are in agreement with Dutch et. al's (2013) findings that young Dual Language Learners who watch more than two hours of television have lower English language development. Similarly, the American Academy of Pediatrics (AAP) has found that excessive TV viewing can lead to language delays, and recommends that parents limit

their digital media use to 1 hour or less per day (Council on Communications and Media, 2016; Ehmke, 2019). Based on the above results, it is conceivable that a small to moderate time spent on digital media could be the most beneficial.

In recent years there has been more emphasis on the content that children consume on digital media, rather than on the time they spend on it (Silverman & Hines, 2009; Uckikoshi, 2006). In contrast, the present study found that there were no significant differences in the expressive nor the receptive English language development of DLLs based on their educational and recreational digital media consumption. These results seem to be surprising since recent studies, such as Silverman and Hine's (2009) study, have found that educational digital media, such as multimedia-enhanced read-aloud vocabulary instruction, can lead to a decrease in the gap between non-DLLs' and DLLs' general vocabulary knowledge. Similarly, Uckikoshi (2006) found that viewing English educational TV programs was linked to higher expressive and receptive English language development among Dual Language kindergartners. In contrast to the present study, these findings suggest that it would be beneficial to DLLs to consume more educational digital content rather than recreational digital content. The present study's results may differ from what prior studies have found due to the way educational and recreational media were measured. The present study measured DLLs' educational and recreational digital media by simply asking if their children used the computer for learning skills, and if they used it to draw or use the internet. However, what programs are used to support learning skills can be very subjective. A clearer definition of educational and recreational digital media may have led to different results.

Furthermore, a study by Dixon (2011) investigated the role of home and school factors in predicting English vocabulary among 284 bilingual kindergartners and found

that Singaporean DLLs who only watched English TV programs demonstrated higher English language development than those who only watched non-English TV shows. Furthermore, Dixon also found that those who viewed English TV shows as frequently as they watched programs in another language had higher English language development than those who only watched non-English TV shows. Hence, it could be argued that the language used in the digital media may also impact the extent to which digital media frequency and content influences DLLs' language development. Perhaps the present study's results regarding digital media content and English language development would differ, if the language in which the content was consumed was taken into account.

In addition, the development and use of educational media applications have increase significantly in the last few years. There are now specific applications designed to support precise skills, such as vocabulary and phonological awareness. However, the data used for this study were collected in 2011, so it is conceivable that the educational media that was used then was not as advanced in terms of its contents, uses, and its availability as it is nowadays.

When the interaction between family digital media rules and digital media frequency was considered, it was found that it did not moderate the impact of digital media frequency on expressive and receptive English language. Furthermore, the interaction between family digital media rules and digital media content had no moderating effect on DLLs' expressive and receptive English language. Although there are no prior studies exploring DLLs' language development in regards to their family digital media rules, previous research suggests that the use of family digital media rules can limit the negative effects that frequent and inappropriate digital media can have on children's development (Council on Communications and Media, 2016). In contrast, the

present study found that the interaction between digital media rules and digital media frequency and content did not moderate digital media's impact on DLLs' language development. This could be due to the fact that the survey used to collect data for the present study specifically asked three questions about family rules on TV program contents and time spent on TV viewing. Results may have been different if the survey had asked more questions about family's digital media rules (e.g. rules concerning computer use).

Although family digital media rules did not have any moderating effect on DLLs' English language development, findings indicated that DLLs' pre-K care arrangements had a significant moderating effect on the association between their TV frequency and expressive and receptive language development. Findings showed that high TV viewing frequency and non-center-based pre-K care arrangements led to lower receptive language development. However, among DLLs with high TV viewing frequency, those in center-based pre-K arrangements had much higher receptive language development than those in non-center-based pre-K care arrangements. At low TV viewing, DLLs' receptive language development was very similar for those who had center-based pre-K arrangements or non-center-based pre-K arrangements. Based on these results, one could argue that center-based pre-K care arrangements can have significant benefits for DLLs' receptive language because it lessens the decrease in receptive English language development. This result is congruent with prior literature that suggests DLLs who enter early child care centers at an earlier age developed larger vocabularies and better receptive language (Kohl, et al., 2019; Yazejian, et al., 2015). Yazejian et al. (2015) also found that entering center-based care before kindergarten was especially beneficial to children whose parents did not speak the language. Parents of the



children in the present study had a non-English primary language, so based on Yazenjian et al.'s (2015) findings, their language development would be best supported by having center-based pre-K arrangements. Furthermore, Yazenjian (2015) found that DLLs' language improves in center-based pre-K because of their interactions with their teachers and peers. This may explain why DLLs' in non-center-based pre-K arrangements had much lower receptive language development than those in center-based arrangements.

From a Vygotskian perspective it could be argued that the parents of DLLs are not able to scaffold their children's English language development because they themselves have not fully achieved English proficiency. Hoff and her colleagues (2014) support this with their finding that among children exposed to two languages, the amount of interactions they have in English with native English speakers impacts DLLs' language development, whereas their interactions with non-native English speakers does not influence their English language development. Based on this finding, children in non-center-based pre-K arrangements may have had fewer interactions with native English-speakers, which could lead to lower English language development. In contrast, DLLs who were in center-based Pre-K arrangements may have received language scaffolding by their preschool teachers, which allowed them to reach their full potential. Similarly, Bronfenbrenner would argue that the effect of DLL's different pre-K care arrangements on their receptive English language development could be partially explained by the different environments in non-center-based vs. center-based pre-K arrangements as well as their ecological techno-subsystems (Johnson & Pupilampu, 2008). Although the present study did not provide information regarding the TV viewing in DLLs' pre-K care arrangements, existing literature suggests that children in center-based pre-K arrangements use educational digital media designed to support their language

development (Dore & Dynia, 2020; McGlynn-Stewart et al., 2018). It could be argued that the presence of this digital media in their environment enhances their English language development.

The amount of scaffolding DLLs received and the different environments of their pre-K arrangements could also explain the moderating effect that pre-K care arrangements had on the association between DLLs' TV frequency and their expressive English language development. This study found that high TV viewing frequency and non-center-based pre-K care arrangements led to lower expressive language development. However, at low TV viewing, DLLs' expressive language development was higher for those who had non-center based pre-K care arrangements than for those in non-center based pre-K care arrangements. For those in non-center based pre-K arrangements, expressive language seemed to decrease as TV viewing increased, whereas for those in center-based pre-K arrangements, expressive seemed to reach a plateau as their TV viewing frequency increased. Overall, findings suggested that center-based pre-K arrangements can limit the negative effects of extreme TV viewing. This is congruent with Uchikoshi's (2006) finding that kindergarteners who had attended preschool or Head Start had a higher expressive language development than children who had stayed at home.

As previously mentioned, the moderating effect that pre-K care arrangements had on the association between DLLs' TV frequency and their expressive English language development could be explained by the different experiences and environments of DLLs in center-based and non-center-based pre-K arrangements. For example, prior literature suggests that children in center-based pre-K arrangements are exposed to multiple adult-child and peer interactions which have been found to increase expressive

English language development (Gómez, 2015; Gómez, Griskell, Sobrevilla, & Vazquez, 2019). In contrast, DLLs in non-center-based pre-K care arrangements may spend more time with non-native English speakers and less with English-proficient peers and adults, which may limit their exposure to the English language and in turn their expressive language development (Hoff, et al., 2014). This study's findings indicated that as TV viewing increased, though, the expressive language of DLLs in center-based pre-K care arrangements seemed to reach a plateau and thus, the difference between the expressive language development of DLLs in center-based pre-K care arrangements vs. those in non-center based pre-K arrangements stabilized. This may be because when DLLs have a very high TV viewing frequency they may not engage in certain other activities that have been found to promote expressive language development. For example, the American Pediatric Association suggests that TV viewing should not replace play, reading aloud, and social interactions which have been shown to promote language development (Council on Communications and Media, 2016; Uchikoshi, 2006).

As previously noted, the expressive language of DLLs in center-based pre-K care arrangements seemed to reach a plateau as their TV viewing increased, whereas the difference between the receptive language development of DLLs in center-based pre-K care arrangements vs. those in non-center based Pre-K arrangements seemed to increase as TV viewing increased. This may be because DLLs need more English language exposure and more opportunities to speak the language in order to achieve better expressive language development. This is supported by Gómez et al. (2019) who found that peer interactions of DLLs in center-based pre-K care arrangements led to an increase in their receptive vocabulary, an increase in their sentence comprehension and an

increase in some areas of expressive language, but there was no increase in children's mean length of utterance in words.

Results also indicated that the interaction between DLLs' educational digital media consumption and their pre-K care arrangements did not have a moderating effect on their expressive or receptive language development, but the interaction between DLLs' recreational digital media consumption and their pre-K care arrangements did have a moderating effect on their receptive language. Findings suggest that center-based pre-K care arrangements and recreational digital media consumption led to higher receptive language development. DLLs who were in center-based pre-K arrangements had higher receptive language development regardless of whether they engaged in recreational digital media or not. This is in agreement with previous studies that showed that children that attend preschool have better receptive language development because of their social and verbal interactions with their teachers and peers (Kohl, Willard, Agache, Bihler, & Leyendecker, 2019; Yazejian, Bryant, Freel, & Burchinal, 2015). In addition, among DLLs in non-center based pre-K care arrangements, those who engaged in recreational digital media had better receptive language development than those who did not engage in recreational digital media. The positive impact of the interaction of recreational media and center-based pre-K arrangements may be because recreational media exposes DLLs to the English language. Vygotsky would argue that DLLs' interaction with the English language through engagement in recreational media supports their development of the English language. Perhaps this is not the case with expressive language because, as Gámez et al. (2019) suggested, DLLs need more English language exposure and more opportunities to speak the language in order to achieve better expressive language development.

## **Implications**

First, this study demonstrated the significant impact that digital media frequency can have on Dual Language Learners' receptive and expressive English language development in kindergarten. Most prior research has focused on digital media's impact on the language development of native English speakers, but results remain mixed. Pediatricians have used this research to make recommendations regarding the safest and most efficient use of digital media use. However, there is limited literature that could be used to make recommendations directed specifically towards DLLs' digital media use. The present study's findings that low TV viewing had the most benefits on DLLs' English language development, and that moderate computer use was found to be beneficial to their receptive language could be used to help pediatricians recommend that DLLs' limit their TV viewing, and instead of watching TV, they should spend their digital media time on the computer.

Second, the finding that the digital media content (educational vs. recreational) did not have a significant impact on DLLs' English language can be used to encourage parents to limit their children's digital media use. Many parents allow their children to use digital media a lot because they think it is educational and believe it supports their development (Rideout, 2017; Rideout, & Robb, 2020). This finding contradicts this belief. Many parents may have this belief because it has been found that only one in five parents have talked to a pediatrician regarding their children's digital media use, and this was mostly White, well-educated and upper-class parents (Rideout, 2017).

Finally, a key finding of the present study was that the interactions between some aspects of DLLs' digital media use and center based pre-K care arrangements led to significantly better English language development. Based on this result, early childhood

educators and policymakers should advocate for the importance of preschool attendance and its impact on young DLLs' language development.

### **Limitations and Future Research**

Although this study has several important implications, its results should be considered cautiously because there were several limitations. First, as previously discussed, some results may have differed if other factors, such as parental scaffolding, parent-child interactions, and other activities (e.g. time spent reading) were taken into account. Previous studies have shown that parental scaffolding, positive parent-child interactions, and other activities (e.g. time spent reading) and home factors improve kindergarteners' language development (Dixon, 2010; Uckikoshi, 2006). In addition, children's different demographic backgrounds, such as their household income, race, and their parents' employment, education level, and marital status, may also influence their language development. For example, Rideout (2017) reported that children from lower income households tend to have less access to digital media. The present study addressed this by controlling for DLLs' access to digital media by only including those who reported owning a TV and computer. Due to the fact that present study focused on the association between digital media use and English language development, it did not consider how demographic background may impact language. However, controlling for these factors may have limited the effect of digital media on DLLs' language development. In addition, DLLs' language development may differ based on potential language impairments or participation in non-English language instruction. Hence, children's low or high language development may be due to language impairments or due to participation in non-English language instruction rather than due to their digital media use. In order to accurately understand the impact of digital media on DLLs' language development, it would be

worthy to consider these factors in understanding the impact of digital media on DLLs' language development.

Second, a limitation of this study was that most of the children in the ECLS-K:2011 scored highly or near perfect on the preLAS subtests, because most of them spoke English, even if it was not their primary home language. This raises the question of how findings may have differed if the sample population of DLLs were less proficient in English. Future research should examine this with a population with more diverse English language development. In addition, the preLAS screener, which was used to assess DLLs' expressive and receptive language development, has a limited number of items included in its subtests. This may lead to scores that may not represent a complete measure of children's English language development. Further assessments could be used to achieve a more comprehensive and accurate measurement of their English language development.

The last limitation to consider is the kind of digital media this study included in its measurement of DLLs' digital media use. Due to the year during which the ECLS-K:2011 data were collected, this study was limited in regards to the kinds of digital media it used to measure DLLs' digital media use. This study only examined the more traditional digital media outlets; TV and computer. However, in recent years, young children have increasingly used other newer digital media outlets such as tablets and smartphones. According to the most recent Zero to Eight study (Rideout, & Robb, 2020), the majority of young children's screen time now consists of watching videos online on websites like YouTube. Furthermore, approximately 46% of two to four year-olds and 67% of five to eight year-olds have their own tablet or smartphone (Rideout, & Robb, 2020). The increasing use of tablets and smartphones has also led to an increase in different types of educational applications. However, the present study did not examine how different kinds

of educational applications may influence DLLs' language development. To achieve a more accurate understanding of DLLs' current digital media use in regards to their language development, future research should use all of these modern digital media outlets to measure their digital media frequency and the content in which they engaged. This would allow for a more holistic understanding and help make more accurate recommendations to parents, early-childhood educators, and policymakers.



## APPENDICES

### APPENDIX A

#### Variable Names and Corresponding Measurements

Variable Name	What it measures
P2TVBF8H	Hours watching TV before 8AM
P2TVDAYH	Hours watching TV from 8AM-6PM
P2TVA6PH	Hours watching TV after 6PM
P2TVSATH	Hours watching TV on Saturday
P2TVSUNH	Hours watching TV on Sunday
TVFREQ	TV viewing frequency
P2TVRULE	Family rule about watch child watches
P2TVRULE2	Rule for hours child watches TV
P2TVRULE3	Rule for when child watches TV
X2PLSS	preLAS Simon Says score/ receptive vocabulary
X2PLART	preLAS Art Show Score/expressive vocabulary
X12LANGST	Home language of child
X12PRIMPK	Primary type of nonparental care pre-K
PREKCARE	Pre-K care arrangements
P2USECMP	Computer Use Frequency
P2LRNPRG	Educational Media Use
P2ARTPRG	Computer Use for Drawing/Art
P2INTRNT	Computer Use For Internet
COMP_RECREAT	Recreational Media Use

## APPENDIX B

### Survey Questions

#### DWQo8o

##### DISPLAY INSTRUCTIONS:

DISPLAY "in your home" AND "at home" IN UNDERLINED TEXT.

This is a pretty complicated item, if need be, we can send this to you in a Word file; I'm not sure what the best way is to present this in Specwriter.

##### QUESTION TEXT:

Now I'd like to ask some questions about {CHILD}'s television viewing. We are interested in {his/her} television viewing only in your home. We want you to include television shows, videotapes, and DVDs, but not games played on gaming systems like Playstation, Wii, or Xbox.

On any given weekday, how many hours of television, videotapes, or DVDs on average does {CHILD} watch at home? How about...

ENTER "77" IF FAMILY DOES NOT HAVE A TV.

- a. Before 8:00 a.m.?
- b. Between 8:00 a.m. and 6 p.m.?
- c. After 6 p.m.?

##### ENTER NUMBER

REFUSED

DON'T KNOW

##### PROGRAMMER INSTRUCTIONS:

2. DISPLAY THE FOLLOWING MATRIX IN THE RESPONSE FIELD:

	HOURS	MINUTES
Before 8:00 a.m.?		
Between 8:00 a.m. and 6 p.m.?		
After 6 p.m.?		

##### QUESTION TEXT:

How about on Saturday and Sunday? How many hours does {CHILD} watch television, videotapes, or DVDs at home on...

- a. Saturdays?
- B. Sundays?

##### ENTER NUMBER

REFUSED

DON'T KNOW

Please see CAPI Inst field below for range info

##### PROGRAMMER INSTRUCTIONS:

2. DISPLAY THE FOLLOWING MATRIX IN THE RESPONSE FIELD:

	HOURS	MINUTES
Saturdays?		
Sundays?		

**QUESTION TEXT:**

[Are there family rules for {CHILD} about any of the following...]

How many hours {CHILD} may watch television?

**CODES**

- |   |            |
|---|------------|
| 1 | YES        |
| 2 | NO         |
|   | REFUSED    |
|   | DON'T KNOW |

**QUESTION TEXT:**

[Are there family rules for {CHILD} about any of the following...]

How early or late {CHILD} may watch television?

**CODES**

- |   |            |
|---|------------|
| 1 | YES        |
| 2 | NO         |
|   | REFUSED    |
|   | DON'T KNOW |

**QUESTION TEXT:**

Are there family rules for {CHILD} about any of the following...

What programs {CHILD} can watch?

**CODES**

- |   |            |
|---|------------|
| 1 | YES        |
| 2 | NO         |
|   | REFUSED    |
|   | DON'T KNOW |

**QUESTION TEXT:**

In an average week, how often does {CHILD} use the computer?

Would you say ...

**CODES**

- |   |                         |
|---|-------------------------|
| 1 | Never,                  |
| 2 | Once or twice a week,   |
| 3 | 3 to 6 times a week, or |
| 4 | Every day?              |
|   | REFUSED                 |
|   | DON'T KNOW              |

**QUESTION TEXT:**

Does {CHILD} use the computer ... To play with programs that teach {him/her} something, like math or reading skills?

**CODES**

- |   |            |
|---|------------|
| 1 | YES        |
| 2 | NO         |
|   | REFUSED    |
|   | DON'T KNOW |

**QUESTION TEXT:**

[Does {CHILD} use the computer ... ] To play with drawing or art programs?

**CODES**

- |   |            |
|---|------------|
| 1 | YES        |
| 2 | NO         |
|   | REFUSED    |
|   | DON'T KNOW |

**QUESTION TEXT:**

[Does {CHILD} use the computer ... ] To get on the Internet?

**CODES**

- |   |            |
|---|------------|
| 1 | YES        |
| 2 | NO         |
|   | REFUSED    |
|   | DON'T KNOW |

**QUESTION TEXT:**

I'd like to talk to you about child care {CHILD} received on a regular basis from someone other than you or {his/her} parents or guardians the year before {he/she} started kindergarten. This does not include occasional baby-sitting or backup care providers. Did {CHILD} receive care from a relative on a regular basis the year before (he/she) started kindergarten? This may include grandparents, brothers and sisters, or any relatives other than you or {CHILD}'s parents or guardians.

THIS MEANS ANYTIME IN THE YEAR BEFORE CHILD ENTERED KINDERGARTEN.

**HELP TEXT:**

Care from a relative: Record care or programs provided by someone other than the child's parents in a private home. The private home may be the child's home, the caregiver's home, or another home. In all cases, do not include care provided by a parent, even if they do not live in the household. (Do not include visitation with a separated or divorced parent who does not have custody.)

If there is at least one parent in the household, any relative living in the household is eligible to be counted as a care arrangement, if the care is provided on a regularly scheduled basis. Relatives outside the household may also be regular care providers.

If neither parent lives in the household, do not include care provided by guardians who live with the child (they are similar to parents).

Relative care arrangements may or may not have a charge or fee.

Regular Basis: An arrangement or program occurring on a routine schedule (i.e., occurring at least weekly or on some other schedule). Do not include occasional babysitting or "back up" arrangements that are just used once in a while.

**CODES**

1	YES	
2	NO	SPQ020
	REFUSED	SPQ020
	DON'T KNOW	SPQ020

{Now I'd like to ask you about any care {CHILD} received from nonrelatives in a private home, not including child care centers.} Did {CHILD} receive care from a nonrelative on a regular basis the year before (he/she) started kindergarten? This includes home child care providers, regular sitters or neighbors. {It does not include child care centers.}

THIS MEANS ANYTIME IN THE YEAR BEFORE CHILD ENTERED KINDERGARTEN.

PROBE: This refers to care received from nonrelatives in a private home, including home child care providers, regular sitters, or neighbors. However, this does not include child care centers.

**HELP TEXT:**

Care from a non-relative: Non-relative care is provided by someone not related to the child and is located in a private home. The private home may be the child's home, the caregiver's home, or another home.

If there is at least one parent in the household, any nonrelative living in the household is eligible to be counted as a care arrangement, IF the care is given on a regularly scheduled basis.

If neither parent lives in the household, do not include care provided by guardians who live with the child (they are treated the same as parents).

Non-relative care arrangements or programs may or may not have a charge or fee.

Regular Basis: An arrangement or program occurring on a routine schedule (i.e., occurring at least weekly or on some other schedule). Do not include occasional babysitting or "back up" arrangements that are just used once in a while.

**CODES**

1	YES	
2	NO	SPQ040
	REFUSED	SPQ040
	DON'T KNOW	SPQ040

**QUESTION TEXT:**

Did {CHILD} attend a day care center, nursery school, preschool or prekindergarten program on a regular basis the year before {he/she} started kindergarten?

THIS MEANS ANYTIME IN THE YEAR BEFORE CHILD ENTERED KINDERGARTEN.

**HELP TEXT:**

Day Care Center: Includes any type of formal program that provides care and supervision. It may be in a child's school or in another location, such as a church or a free-standing building. Head Start programs and state-sponsored preschool or prekindergarten programs are also included.

Regular Basis: An arrangement or program occurring on a routine schedule (i.e., occurring at least weekly or on some other schedule). Do not include occasional babysitting or "back up" arrangements that are just used once in a while.

**CODES**

1	YES	
2	NO	SPQ060
	REFUSED	SPQ060
	DON'T KNOW	SPQ060

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