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The Effect of Digital Media on Emergent Literacy Skills: A Systematic Review

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THE EFFECT OF DIGITAL MEDIA ON EMERGENT LITERACY SKILLS: A SYSTEMATIC REVIEW

THESIS

A thesis submitted in partial fulfillment of the
requirements for the degree of Master of Science in the
College of Health Sciences
at the University of Kentucky

By

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Lexington, Kentucky

Director: Dr. Gilson J. Capilouto, Professor of Communication Sciences and Disorders

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ABSTRACT OF THESIS

THE EFFECT OF DIGITAL MEDIA ON EMERGENT LITERACY SKILLS: A SYSTEMATIC REVIEW

This review examines the effectiveness of digital media on emergent literacy skills, specifically alphabet knowledge, print awareness, and phonological awareness, on children birth to four. A systematic search of the literature identified 13 studies that met the pre-determined inclusion criteria. Two independent raters evaluated each study for methodological quality and assigned appropriate levels of evidence based on ASHA levels of evidence. Results found that specific features of digital media can lead to positive effects on emergent literacy skills. A checklist with the highlighted features was created to guide clinicians, parents, and others in making decisions about the true educational quality of various screen media.

KEY WORDS: digital media, screen media, emergent literacy skills, systematic review

Ciera Brianna Mills

04-04-2016

THE EFFECT OF DIGITAL MEDIA ON EMERGENT LITERACY SKILLS: A SYSTEMATIC REVIEW

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Proverbs 22:6 (New International Version) says, “Train up a child in the way they should go, and when they are old they will not depart from it.” In the same way, one might say if you train up a student in the best practices and knowledge available, when they go out into the world, they will not depart from it. I would like to acknowledge a few people who have contributed to my training and to the completion of this project.

My thesis chair, Dr. Capilouto, is a brilliant teacher and mentor. I have appreciated her patience as my writing and research skills have developed. Her forward-thinking and ingenious creativity has made me feel like my research truly has been written, “for such a time as this” Esther 4:14. Simply put, I could not have made this journey without her and I thank her for being brave enough to come along for the ride.

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To my family, especially my mom and grandma--who have given selflessly for me, worked for me and with me, and prayed for me every step of the way. I am fully aware I have accomplished nothing on my own, and I’m so thankful that God gave me both of them to “train me up in the way I should go” Proverbs 22:6. Last but not least, I give thanks to Jesus, our Lord and Savior, “who began a good work in me, and will finish it to completion” Philippians 1:6.

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CHAPTER ONE: INTRODUCTION

In 1999, the American Academy of Pediatrics issued a policy statement recommending parents limit screen time use in children younger than two years (Brown, 2011). The AAOP recognized that children of this age need direct interactions with their parents and urged families to carefully monitor media use for children, given the vast literature stating the negative effects of media (Okuma & Tanimura, 2009). Despite this recommendation, a recent study by Funk, Brouwer, Curtiss, and McBroom (2009), showed that the parents of 94 children under the age of five were given a questionnaire that addressed perceptions of their child's favorite television show, DVD, or computer game and the amount of time their child was exposed to screen media. Results indicated that preschoolers were exposed to approximately 12 hours of screen time over the course of a week (Funk et al., 2009). In a similar study, Christakis (2008) found that, on average, young children spend about 3-4 hours per day watching television, which indicates that many children under two years old are spending as much as 30-40% of their waking hours with screen media. It is clear that children are watching more screen media than is recommended by the AAOP.

Research has also reported that children from lower socio-economic backgrounds may experience disproportionately high rates of screen time (Duch, Fisher, Ensari, & Harrington, 2013). In a systematic review, Duch et al. (2013) found that on a typical weekday, 82% of one year-olds and 95% of two year-old children participating in the Women, Infants and Children (WIC) program in New York State watched television and videos. One year-olds watched an average of 10 hours per week, while two year-olds watched approximately 15 hours per week (Duch, Fisher, Ensari, & Harrington, 2013).

Although most media exposure revolves around watching television, Duch, Fisher, Ensari, Font, et al. (2013) found that about one-third of children also watch shows through YouTube on parents' cell phones. Rideout's online parent survey (as cited in Neumann & Neumann, 2014) found that over half of 0-8 year olds had access to touch screen tablets at home and used them for approximately 43 minutes per day. Furthermore, 10% of children, aged 0-1 year, 39% of children 2-4 years old, and 52% of children 5-8 years old use apps at home, according to Rideout (as cited in Neumann & Neumann, 2014). Linebarger and Vaala (2010) found that by the time the average American infant turns 6-months-old, they have at least four DVDs/videos, some of which include Baby Einstein, Brainy Baby and Baby Genius (Barr, Lally, Hillard, Andolina, & Ruskis, 2009), and over seven DVDs/videos by 18 months of age.

Taken together, these studies provide evidence that parents continue to allow children to engage with screen media despite the professional advice to limit exposure to technology and screen media (DeLoache et al., 2010). A possible reason for this overexposure was hypothesized in a study by DeLoache et al. (2010) which showed that many parents actually overestimate the positive effects of media on their child's development. One reason parents overestimate the value of these media may be the ways in which the industry advertises the programs/products targeting this age group. Research shows that the industry has a tendency to label the media content aimed at this group as 'educational' (Tomopoulos et al., 2010). For example, products such as 'Baby Einstein' and 'Brainy Baby' even have titles that are suggestive of beneficial effects for infants' cognitive development (Christakis, 2008). In a survey of 1,000 families, Christakis (2008) found that the most common reason reported for having their infants

watch television was that it was thought to be 'good for their brains.' Parents have reported to feel 'relieved' that their children are watching programming described as 'educational' and that such media is thought to be an important contributor to healthy development (Brown, 2011).

In a digital age, it is virtually impossible for parents to avoid all media use. From smart phone technology to built-in DVD players in minivans, children have access to more forms of electronic media than ever before (Brown, 2011). As early as infancy, children are exposed to touch screen devices, as they explore and play with their parents' smartphone (Neumann & Neumann, 2014). As they grow, children are introduced to a plethora of interactive toys, media, and educational devices to supplement their technological childhood.

Even though parents have been cautioned about the negative effects of passive media use, the findings are equivocal and can create confusion for families (NAEYC., 2012). Some research suggests that increased media use can result in negative effects, such as language delays for children under the age of two, which can also lead to attention deficits through age seven (Brown, 2011; Christakis et al., 2009; Okuma & Tanimura, 2009; Stasburger, 2007; Tanimura, 2007). Christakis et al. (2009) reported that having a television on within earshot of children can diminish the number of vocalizations and exposure to adult words. In addition, McCreery (2014) found that children who were exposed to more electronic media had fewer conversational turns than children with less exposure. In contrast, other researchers have reported a positive impact of screen media on language development. For example, Public Broadcasting's Ready to Learn initiative suggests that electronic sources can be effective tools for

teaching and learning in cases where the design incorporates aspects of emergent literacy skills (NAEYC., 2012). In fact, Hisrich and Blanchard (2009) suggest that every exposure to digital media presents a potential learning opportunity for many skills, including emergent literacy.

In summary, digital media has been found to have both positive and negative effects on children's language development. Regardless, children are fascinated with digital forms of media and are growing up in a technological age where they use digital devices to explore, read, and play, reported Edwards; Marsh (as cited in Neumann, 2014). Avoiding or eliminating screen time is not really a reasonable expectation so determining what features of media demonstrate a positive impact on language development, specifically, in the areas of emergent literacy, such as alphabet knowledge, print awareness, and phonological awareness, are critical. Emergent literacy skills (ELS), including alphabet knowledge, print awareness, and phonological awareness are crucial to successful academic performance (Pence-Turnbull & Justice, 2012). Therefore, *the purpose of this paper is to explore the effect of digital media on emergent literacy skills in children ages birth to four.*

This paper addresses the following research questions:

1. What are the features of media that promote alphabet knowledge in children ages birth to four?
2. What are the features of media that promote print awareness in children ages birth to four?
3. What are the features of media that promote phonological awareness in children ages birth to four?

The findings from these research questions will be used to construct a checklist (Table 1.1) to guide clinicians, parents, and others in making decisions about the true educational quality of various screen media.

Table 1.1

Digital Media Checklist for Children Birth to Four ©

Mills, C. B., Capilouto, G. J., Maddy, K. M., Kleinert, J.O. & Morris, D.S. (2016)

TYPES OF MEDIA		"Must Have" Feature	Promotes	Present √
	Computer	Activity that correlates with the story		
		Targets same goals child is learning in treatment or intervention		
		Allows children to interact with letters on the keyboard	Alphabet Knowledge	
		Uses constant time delay		
		Targeting specific features such as: o Rhyme sensitivity o Syllable and phoneme-segmentation	Phonological Awareness	
		Colorful graphics		
		Game/or adventure theme		
		Progress bars after completion of each task		
		Auditory and visual feedback		
		Basic to more advanced activities		
	Electronic Book	Re-reading/re-listening to the text		
		Highlighting written phrases of the storybook		
		Built-in dictionary		
		Active engagement with print (i.e. child clicking on an error in the text of the story)	Print Awareness	
		Tasks that allow children to segment words into syllables	Phonological Awareness	
		Repeated readings		
	Tablet / Apps	Allowing children to trace letter shapes with finger	Print awareness	
		Write messages, using motivating features, such as: • Choosing clipart or photographs as illustrations • Choosing colored text • Choosing writing tools (i.e. paint brush, etc.)	Print awareness	
	Television	Characters speak to the child	Vocabulary/expressive language	
		Encourages participation		
		Labels objects	Vocabulary/expressive language	
		Provides opportunities for children to respond	Vocabulary/expressive language	

Note. 'Grade A' media contains all the features included on the checklist; 'Grade B' contains 85-75%; 'Grade C' contains 74-50%; Media containing less than 50% of these features is not considered to promote emergent literacy skills

CHAPTER TWO: LITERATURE REVIEW

The earliest period of learning about reading and writing is referred to as emergent literacy (Pence-Turnbull & Justice, 2012). Emergent literacy skills, such as alphabet and sound knowledge, print concepts, and phonological awareness are important precursors to children's development of reading and writing abilities (Neumann & Neumann, 2014). Alphabet knowledge, print awareness, and phonological awareness are three important achievements in emergent literacy for preschoolers (Pence-Turnbull & Justice, 2012). To answer the questions of interest, a review of the literature follows for emergent literacy skills of interest here, specifically alphabet knowledge, print awareness, and phonological awareness and the influence of digital media.

Alphabet Knowledge

Children's knowledge about the alphabet is referred to as alphabet knowledge (Pence-Turnbull & Justice, 2012). Letter knowledge, along with phonemic awareness, is considered one of the strongest contributing foundations to early literacy development (Castles et al., 2013). According to Chaney (as cited in Pence-Turnbull & Justice, 2012), preschoolers typically recognize some of the letters in their name, show interest in specific letters occurring on signs or labels in their environment, and begin to write some letters that are familiar. For the purpose of this study, alphabet knowledge has been selected as a media feature of interest since numerous studies have demonstrated that letter knowledge is a strong predictor of later reading skills (Gong & Levy, 2009). It has been reported that children who demonstrate poorer knowledge of letters also demonstrate reading problems when compared to their developing peers with adequate

knowledge of letters (Castles et al., 2013). In fact, Castles et al. (2013) reported that alphabet knowledge is a strong predictor of subsequent diagnosis of dyslexia for children at risk.

Print Awareness

Print awareness is defined as a child's understanding of the forms and functions of written language (Pence-Turnbull & Justice, 2012). According to Whitehurst & Lonigan (as cited in Gong & Levy, 2009), because of specific print conventions, printed language can be understood in the absence of being able to read. Such conventions include the difference between print and pictures, letter orientations, and the linear arrangement of writing (Gong & Levy, 2009). Goodman (1986) reported that children develop print awareness in connected discourse based on the types of written language they encounter, such as books, magazines, or letters (Beschorner & Hutchinson, 2013). Along with this, children know that print carries a message, often view themselves as writers while producing scribble forms, and use oral language to talk about written language by discussing letters, numbers and words (Beschorner & Hutchinson, 2013). Evidence suggests that children's oral language abilities and their interactions with print support development of print awareness, although, most children need prompting to attend to print, as they reportedly do not focus on print on their own (Pence-Turnbull & Justice, 2012).

Phonological Awareness

Phonological awareness refers to general awareness of the sound structures of speech, including awareness of syllables, phonemes, and rhyme (Chera & Wood, 2003). Phonological awareness emerges gradually starting at age 2 and moves from a shallow level, such as word awareness, to a deep level, such as phoneme manipulation (Pence-Turnbull & Justice, 2012). At the shallow level, preschool age children are beginning to segment sentences into words, and later multi-syllable words into syllables (Pence-Turnbull & Justice, 2012). As children approach kindergarten and school-age, they advance to more sophisticated skills, such deleting, adding, and rearranging phonemes in a word (Pence-Turnbull & Justice, 2012). Similar to alphabet knowledge, Gong and Levy (2009) found that phonological awareness is a significant predictor of successful reading development. Phonological awareness is considered a key component in developing phonic word-attack skills, such as segmenting words into syllables and smaller units of sounds for letter-sound association (Macaruso & Rodman, 2011). Other studies report that weaknesses in phonological awareness are significantly related to delayed reading skills (Chera & Wood, 2003). Taken together, these studies suggest that phonological awareness builds a solid foundation for emergent literacy skills.

Digital Media

Digital media is a class of media tools which includes, but is not limited to, television, DVDs, handheld touchscreen tablets, smartphones, computer software, computer games, and electronic books (NAEYC., 2012). Research supports positive

outcomes for language development, specifically literacy skills, from well-designed digital media (Hisrich & Blanchard, 2009).

Television has been found to have a positive impact on emergent literacy skills. For example, research has shown that infants, toddlers, and preschoolers from low-income families with a television in their bedrooms, obtained language and reading scores equivalent to peers who had more educational toys, books, and higher quality interactions with their caregivers (Courage & Howe, 2010). However, the nature of the television program is not specified in this study, therefore, this claim must be interpreted cautiously. Other studies have reported that young children who watched programs with explicit prompting routines (e.g. Dora the Explorer; Blue's Clues) were more likely to communicate during play and had larger vocabularies in contrast to infants who did not watch such programs (Linebarger & Vaala, 2010).

Researchers have also reported that touch screen tablets contain features that promote literacy skills. For example, researchers reported 2 and 3-year-olds use touch screen tablets to learn about numbers, letters, and vowel sounds, engage in storybook reading, and play memory games (Neumann, 2014). The features of many tablets provide platforms for children's emerging understanding of literacy; allowing children to read, write, or communicate in digital environments similar to those adults use (Beschorner & Hutchison, 2013).

Electronic books (e-books) also support children's emergent literacy skills (Neumann & Neumann, 2014). Research has shown that the use of e-books improved children's vocabulary (Korat & Shamir, 2007; Segers & Verhoeven, 2002), phonological awareness (Chera & Wood, 2003), story comprehension (De Jong & Bus, 2004; Korat &

Shamir, 2007), and word recognition (De Jong & Bus, 2002; Gong & Levy, 2009). Specific features of electronic books, such as text that brightens or changes in color, shape or size when the word is spoken, promotes vocabulary because it presents an opportunity for children to interact with text (Neumann & Neumann, 2014). In fact, one of the most common uses for e-books is in support of struggling readers, who can preview the story and vocabulary to improve their ability to keep pace with their peers during book discussion (Pearman & Ching - Wen, 2010). Korat and Shamir (2012) also reported similar results for children reading at their age level while using e-books.

Computers and electronic learning aids (ELAs) have been shown to build basic skills in multiple areas, including emerging literacy through the use of interactive platforms (Hisrich & Blanchard, 2009). Korat and Blau (2010) found that children as young as 3 years were motivated to use different types of software and approximately one-third of them (27%) spent time on the computer. They suggested that as educators and researchers search for methods to help young children from low socioeconomic status environments overcome the literacy gap, they may need to consider digital media options to broaden the opportunities for children from diverse communities to improve emergent literacy skills (Korat & Blau, 2010).

Summary

Collectively, these studies demonstrate the importance of emergent literacy skills, specifically alphabet knowledge, print awareness, and phonological awareness, for the development of language. Children's literacy skills depend heavily on the language skills they acquire in infancy and toddlerhood (Pence-Turnbull & Justice, 2012). The

relationship between language development and emergent literacy is significant; poor language development will inevitably cause a cascade effect on the development of emergent literacy skills. For this reason, it is said that preschoolers "build literacy on language" (Pence-Turnbull & Justice, 2012, p. 239). Of importance to the current review are those studies that demonstrate how digital media positively affects the emergent literacy skills of alphabet knowledge, print awareness, and phonological awareness. Therefore, the literature review central to this thesis focuses on the effect of digital media on alphabet knowledge, print awareness, and phonological awareness in children ages birth to four.

CHAPTER THREE: METHODS

A systematic search of the literature was conducted to identify studies that investigated the effects of digital media on children's emergent literacy skills, specifically alphabet knowledge, print awareness, and phonological awareness. A preliminary large scale search was conducted whereby the author manually recorded each result using a variety of search terms and databases. In the first search, seven electronic databases were used, between January 2015 and April 2015, which included: Academic Search Complete, CINAHL, Clinical Key, Cochrane, ERIC, PsycInfo, and PubMed. Results were not limited to publication date. Additional searches were performed through cross-referencing from other studies. A total of 22,251 citations were identified. Table 3.1 illustrates how the preliminary search was conducted for one database.

Table 3.1

Preliminary search terms and databases used in systematic review

	PubMed[a]													
	Phonological Awareness[b]													
	Infant[c]		Toddlers		Birth to four		Children		Early childhood		Young children		Preschoolers	
Screen time[d]	0	0	0	0	0	0	4	0	0	0	0	0	2	0
Screen media	0	0	0	0	0	0	1	0	1	0	0	0	1	0
Tablets	2	0	0	0	0	0	0	0	0	0	1	0	0	0
Technology	0	0	0	0	0	0	18	0	0	0	0	0	10	0
Media use	0	0	0	0	0	0	6	0	3	0	0	0	4	0
Electronic media	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Television	0	0	0	0	0	0	2	0	0	0	0	0	2	0
Smart phones	0	0	0	0	0	0	4	0	0	0	0	0	0	0
Media products	0	0	0	0	0	0	0	0	0	0	2	0	0	0
Computers	0	0	0	0	0	0	5	0	0	0	0	0	4	0

Table 3.1 (continued)

Laptop	0	0	0	0	0	0	0	0	0	0	0	0	0	0
iPad	0	0	0	0	0	0	0	0	0	0	0	0	0	0
iPhone	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Android	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Digital Media	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note. [a] PubMed = database; [b] Phonological Awareness; [c] Infant = population search term; [d] Screen time = emergent literacy skill search term.

In an effort to reduce this exhaustive search, a second, more refined search was later conducted through the process of indexing, using subject headings in an electronic database thesaurus, such as MeSH headings. The purpose of the second search was to eliminate duplicate citations and to condense the substantial results found through the preliminary search. Tables 3.2 and 3.3 illustrate how the second search was conducted.

Table 3.2

Secondary search terms and databases used in systematic review

Database	Number of Search terms	Search options[c]	Results from search[d]	Reviewed by author[e]	Number of citations used in systematic review[f]	Number of studies used for appraisal[g]
PsycInfo	S41	S39 AND S40	11	No	0	0
	S40	S5 OR S35	12,765	No	0	0
	S39	MM "Phonological Awareness"	1,784	No	0	0
	S38	MM "Reading"	11,134	No	0	0
	S37	S25 AND S35	58	Yes	3	3
	S36	S9 AND S35	79	Yes	1	1
	S35	computer aided learning	12,765	No	0	0
	S34	infant media	58	Yes	1	0
	S33	S1 AND S6 AND S32	9	Yes	1	0
	S32	MM "Television Viewing"	3,336	No	0	0
	S31	MM "Learning"	38,307	No	0	0
	S30	S1 AND S6 AND S29	1	Yes	1	0
	S29	screen media	143	No	0	0
	S28	infant-directed television	3	No	0	0
	S27	S1 AND S6 AND S17	4	No	0	0
	S26	S2 AND S17 AND S25	0	No	0	0
	S25	preschoolers	14,498	No	0	0
	S24	S17 AND S22 AND S23	1	Yes	1	1
	S23	S6 OR S7	73,429	No	0	0
	S22	MM "Language"	25,264	No	0	0
	S21	childhood	164808	No	0	0
	S20	MM "Parents"	16,831	No	0	0
	S19	S1 AND S17 AND S18	5	Yes	1	1
	S18	S6 OR S7	73,429	No	0	0

Table 3.2 (continued)

S17	MM "Television" OR MM "Closed Circuit Television" OR MM "Educational Television" OR MM "Television Advertising"	6,229	No	0	0
S16	S3 AND S9	52	Yes	2	0
S15	S5 AND S9	79	No	0	0
S14	S11 AND S12 AND S13	18	Yes	1	1
S13	S6 OR S7 OR S8 OR S9 OR S10	133,204	No	0	0
S12	S3 OR S4 OR S5	24,260	No	0	0
S11	S1 OR S2	20,047	No	0	0
S10	young children	41,499	No	0	0
S9	early childhood	30,388	No	0	0
S8	MM "Preschool Students"	4,389	No	0	0
S7	toddlers	6,752	No	0	0
S6	infant	70,297	No	0	0
S5	MM "Computer Assisted Instruction"	12,718	No	0	0
S4	iPad apps	37	Yes	1	1
S3	MM "Mass Media" OR MM "Television"	11,540	No	0	0
S2	emergent literacy	826	No	0	0
S1	MM "Language Development"	19,330	No	0	0

Note. [a] Database used during search; [b] Number of search terms used; [c] Search term options; [d] Number of results found; [e] Study reviewed or not reviewed by author; [f] Number of studies used in systematic review from search results; [g] Number of studies used for appraisal from search results.

Table 3.2 (continued)

Database[a]	Search terms[b]	Search options[c]	Results from search[d]	Reviewed by author[e]	Number of citations used in systematic review[f]	Number of studies used for appraisal[g]
ERIC	S28	electronic storybook	18	Yes	2	2
	S27	S15 AND S26	17	No	0	0
	S26	S1 AND S25	241	No	0	0
	S25	S12 OR S24	6,329	No	0	0
	S24	print knowledge	311	No	0	0
	S23	S17 AND S19	12	Yes	1	1
	S22	DE "Young Children"	19,698	No	0	0
	S21	S12 AND S20	44	No	0	0
	S20	S13 OR S17 OR S19	15,955	No	0	0
	S19	DE "Computer Software"	15,411	No	0	0
	S18	S13 OR S17	581	No	0	0
	S17	talking books	404	No	0	0
	S16	S7 OR S13	201	No	0	0
	S15	DE "Children"	39,517	No	0	0
	S14	DE "Phonological Awareness"	1,159	No	0	0
	S13	computer aided learning	177	No	0	0
	S12	DE "Reading"	6,031	No	0	0
	S11	touch screen tablets	11	Yes	1	0
	S10	S3 AND S9	9	Yes	1	1
	S9	iPad	245	No	0	0
	S8	S1 AND S5	19	Yes	1	0
	S7	CD-ROM storybooks	25	Yes	2	1
	S6	S1 AND S3 AND S5	3	Yes	1	1
	S5	electronic books	507	No	0	0

Table 3.2 (continued)

S4	S1 AND S2 AND S3	3	Yes	1	0
S3	DE "Preschool Children"	18,030	No	0	0
S2	digital media	937	No	0	0
S1	DE "Emergent Literacy"	3,935	No	0	0

Note. [a] Database used during search; [b] Number of search terms used; [c] Search term options; [d] Number of results found; [e] Study reviewed or not reviewed by author; [f] Number of studies used in systematic review from search results; [g] Number of studies used for appraisal from search results.

Table 3.2 (continued)

Database[a]	Search terms[b]	Search options[c]	Results from search[d]	Reviewed by author[e]	Number of citations used in systematic review[f]	Number of studies used for appraisal[g]
CINAHL	S26	S2 AND S25	32	Yes	2	0
	S25	S1 OR S24	17,671	No	0	0
	S24	(MM "Communication")	14,687	No	0	0
	S23	S21 AND S22	1	Yes	1	0
	S22	S2 OR S18	2,854	No	0	0
	S21	"toddler development"	52	No	0	0
	S20	(MM "Infant Development")	2,265	No	0	0
	S19	S1 AND S18	1	No	0	0
	S18	"media exposure"	149	No	0	0
	S17	S15 AND S16	5	Yes	2	2
	S16	"computer"	48,227	No	0	0
	S15	"letter knowledge"	39	No	0	0
	S14	S8 AND S13	2	Yes	1	0
	S13	(MM "Parents")	9,930	No	0	0
	S12	S10 AND S11	24	Yes	1	0
	S11	"young children"	7,257	No	0	0
	S10	"television viewing"	384	No	0	0
	S9	"media"	26,617	No	0	0
	S8	"screen media"	24	No	0	0
	S7	S1 AND S6	3	Yes	2	0
	S6	"screen time"	246	No	0	0
	S5	(MM "Infant")	75	No	0	0
	S4	"preschool children"	1,988	No	0	0
	S3	(MM "Child")	278	No	0	0
	S2	(MM "Television")	2,726	No	0	0
	S1	(MM "Language Development")	3,048	No	0	0

Note. [a] Database used during search; [b] Number of search terms used; [c] Search term options; [d] Number of results found; [e] Study reviewed or not reviewed by author; [f] Number of studies used in systematic review from search results; [g] Number of studies used for appraisal from search results.

Table 3.2 (continued)

Database[a]	Search terms[b]	Search options[c]	Results from search[d]	Reviewed by author[e]	Number of citations used in systematic review[f]	Number of studies used for appraisal[g]
PubMed	46	Search **#45 AND #46** Filters: **Infant: birth-23 months**	127	Yes	2	0
	45	Search **((((((((((emergent literacy) OR "emergent literacy") OR language development) OR "language development") OR "LETTER KNOWLEDGE") OR LETTER KNOWLEDGE) OR "alphabet KNOWLEDGE") OR "alphabet KNOWLEDGE") OR "print awareness")) AND ((((((((((mass media) OR "Mass Media"[Mesh]) OR computers) OR "Computers"[Mesh]) OR advertising) OR "Advertising as Topic"[Mesh]) OR video games) OR "Video Games"[Mesh]) OR social media) OR (("Social Media"[Mesh]) OR "Internet"[Mesh]))** Filters: **Publication date from 1995/01/01 to 2015/12/31; English; Infant: 1-23 months; Preschool Child: 2-5 years**	211	No	0	0
	41	Search **((((((((((emergent literacy) OR "emergent literacy") OR language development) OR "language development") OR "LETTER KNOWLEDGE") OR LETTER KNOWLEDGE) OR "alphabet KNOWLEDGE") OR "alphabet KNOWLEDGE") OR "print awareness")) AND ((((((((((mass media) OR "Mass Media"[Mesh]) OR computers) OR "Computers"[Mesh]) OR advertising) OR "Advertising as Topic"[Mesh]) OR video games) OR "Video Games"[Mesh]) OR social media) OR (("Social Media"[Mesh]) OR "Internet"[Mesh]))**	1,254	No	0	0

Table 3.2 (continued)

44	Search **((((((((((emergent literacy) OR "emergent literacy") OR language development) OR "language development") OR "LETTER KNOWLEDGE") OR LETTER KNOWLEDGE) OR "alphabet KNOWLEDGE") OR "alphabet KNOWLEDGE") OR "print awareness")) AND ((((((((((mass media) OR "Mass Media"[Mesh]) OR computers) OR "Computers"[Mesh]) OR advertising) OR "Advertising as Topic"[Mesh]) OR video games) OR "Video Games"[Mesh]) OR social media) OR (("Social Media"[Mesh]) OR "Internet"[Mesh]))** Sort by: **PublicationDate** Filters: **English; Infant: 1-23 months; Preschool Child: 2-5 years**	289	No	0	0
43	Search **((((((((((emergent literacy) OR "emergent literacy") OR language development) OR "language development") OR "LETTER KNOWLEDGE") OR LETTER KNOWLEDGE) OR "alphabet KNOWLEDGE") OR "alphabet KNOWLEDGE") OR "print awareness")) AND ((((((((((mass media) OR "Mass Media"[Mesh]) OR computers) OR "Computers"[Mesh]) OR advertising) OR "Advertising as Topic"[Mesh]) OR video games) OR "Video Games"[Mesh]) OR social media) OR (("Social Media"[Mesh]) OR "Internet"[Mesh]))** Sort by: **PublicationDate** Filters: **Infant: 1-23 months; Preschool Child: 2-5 years**	303	No	0	0

Table 3.2 (continued)

42	Search **((((((((((emergent literacy) OR "emergent literacy") OR language development) OR "language development") OR "LETTER KNOWLEDGE") OR LETTER KNOWLEDGE) OR "alphabet KNOWLEDGE") OR "alphabet KNOWLEDGE") OR "print awareness")) AND ((((((((((mass media) OR "Mass Media"[Mesh]) OR computers) OR "Computers"[Mesh]) OR advertising) OR "Advertising as Topic"[Mesh]) OR video games) OR "Video Games"[Mesh]) OR social media) OR (("Social Media"[Mesh]) OR "Internet"[Mesh]))** Sort by: **PublicationDate** Filters: **Infant: 1-23 months**	169	No	0	0
40	Search **(((((((emergent literacy) OR "emergent literacy") OR language development) OR "language development") OR "LETTER KNOWLEDGE") OR LETTER KNOWLEDGE) OR "alphabet KNOWLEDGE") OR "alphabet KNOWLEDGE") OR "print awareness"** Sort by: **PublicationDate**	37,440	No	0	0
39	Search **"print awareness"** Sort by: **PublicationDate**	12	No	0	0
38	Search **"alphabet KNOWLEDGE"** Sort by: **PublicationDate**	29	No	0	0
37	Search **"alphabet KNOWLEDGE"**	29	No	0	0
35	Search **LETTER KNOWLEDGE**	4,767	No	0	0
33	Search **"LETTER KNOWLEDGE"** Sort by: **PublicationDate**	120	No	0	0
32	Search **"Language Development"[Mesh]** Sort by: **PublicationDate**	12,455	No	0	0
29	Search **"language development"** Sort by: **PublicationDate**	14,382	No	0	0
28	Search **language development** Sort by: **PublicationDate**	32,710	No	0	0

Table 3.2 (continued)

27	Search **"emergent literacy"** Sort by: **PublicationDate**	127	No	0	0
24	Search **emergent literacy**	167	No	0	0
19	Search **(((((((((mass media) OR "Mass Media"[Mesh]) OR computers) OR "Computers"[Mesh]) OR advertising) OR "Advertising as Topic"[Mesh]) OR video games) OR "Video Games"[Mesh]) OR social media) OR (("Social Media"[Mesh]) OR "Internet"[Mesh])** Sort by: **PublicationDate**	208,517	No	0	0
18	Search **("Social Media"[Mesh]) OR "Internet"[Mesh]** Sort by: **PublicationDate**	54,046	No	0	0
15	Search **social media** Sort by: **PublicationDate**	10,980	No	0	0
14	Search **"Video Games"[Mesh]** Sort by: **PublicationDate**	2,539	No	0	0
12	Search **video games** Sort by: **PublicationDate**	3,336	No	0	0
11	Search **"Advertising as Topic"[Mesh]** Sort by: **PublicationDate**	13,076	No	0	0
9	Search **advertising** Sort by: **PublicationDate**	16,527	No	0	0
8	Search **"Computers"[Mesh]** Sort by: **PublicationDate**	69504	No	0	0
5	Search **computers** Sort by: **PublicationDate**	80,649	No	0	0
4	Search **"Mass Media"[Mesh]** Sort by: **PublicationDate**	40,027	No	0	0
1	Search **mass media** Sort by: **PublicationDate**	59,473	No	0	0

Note. [a] Database used during search; [b] Number of search terms used; [c] Search term options; [d] Number of results found; [e] Study reviewed or not reviewed by author; [f] Number of studies used in systematic review from search results; [g] Number of studies used for appraisal from search results.

Table 3.3

Additional Search Terms and Databases Used In Systematic Review

Database[a]	Search terms[b]	Results from search[c]	In-depth review by author after brief title scan[d]	Number of citations used in systematic review[e]	Number of studies used for appraisal[f]
Journal of Speech, Language, and Hearing Research	Digital media AND emergent literacy AND preschoolers	18	No	0	0
American Journal of Speech-Language Pathology	Digital media AND emergent literacy AND preschoolers	13	No	0	0
Language, Speech, and Hearing Services in Schools	Digital media AND emergent literacy AND preschoolers	11	No	0	0
SIG 12 Perspectives on Augmentative and Alternative Communication	Digital media AND emergent literacy AND preschoolers	3	No	0	0
SIG 14 Perspectives on Communication Disorders and Sciences in Culturally and Linguistically Diverse (CLD) Populations	Digital media AND emergent literacy AND preschoolers	3	No	0	0
SIG 1 Perspectives on Language Learning and Education	Digital media AND emergent literacy AND preschoolers	2	No	0	0
SIG 16 Perspectives on School-Based Issues	Digital media AND emergent literacy AND preschoolers	2	No	0	0

Table 3.3 (continued)

American Journal of Audiology	Digital media AND emergent literacy AND preschoolers	1	No	0	0
SIG 18 Perspectives on Telepractice	Digital media AND emergent literacy AND preschoolers	1	No	0	0
Google Scholar	Digital media AND emergent literacy AND preschoolers	10	Yes	1	1

Note. [a] Database used during search; [b] Search term options; [c] Number of results found; [d] Study reviewed or not reviewed by author after brief title scan; [e] Number of studies used in systematic review from search results; [f] Number of studies used for appraisal from search results.

For the second search, four electronic databases were used and included: PubMed, CINAHL, ERIC, PsycInfo and PubMed. Additional searches were conducted for all American Speech Language and Hearing Association (ASHA) journals and Google Scholar. Inclusion criteria included: peer-reviewed journals, population 0-4 years, some form of media, and how forms and features of media impacted emergent literacy, specifically alphabet knowledge, print awareness, and phonological awareness. A total of 484 articles were identified. A brief scan of titles was completed and 450 were eliminated because they did not meet inclusion criteria. An in depth review of abstracts and articles resulted in 34 citations addressing some form or feature of media and emergent literacy. Of these, 21 were excluded because they were not experimental and/or they did not address features of media that promoted emergent literacy skills. The remaining 13 studies were selected for appraisal (Figure 3.1).

Figure 3.1

Process for identifying studies to be included in systematic review

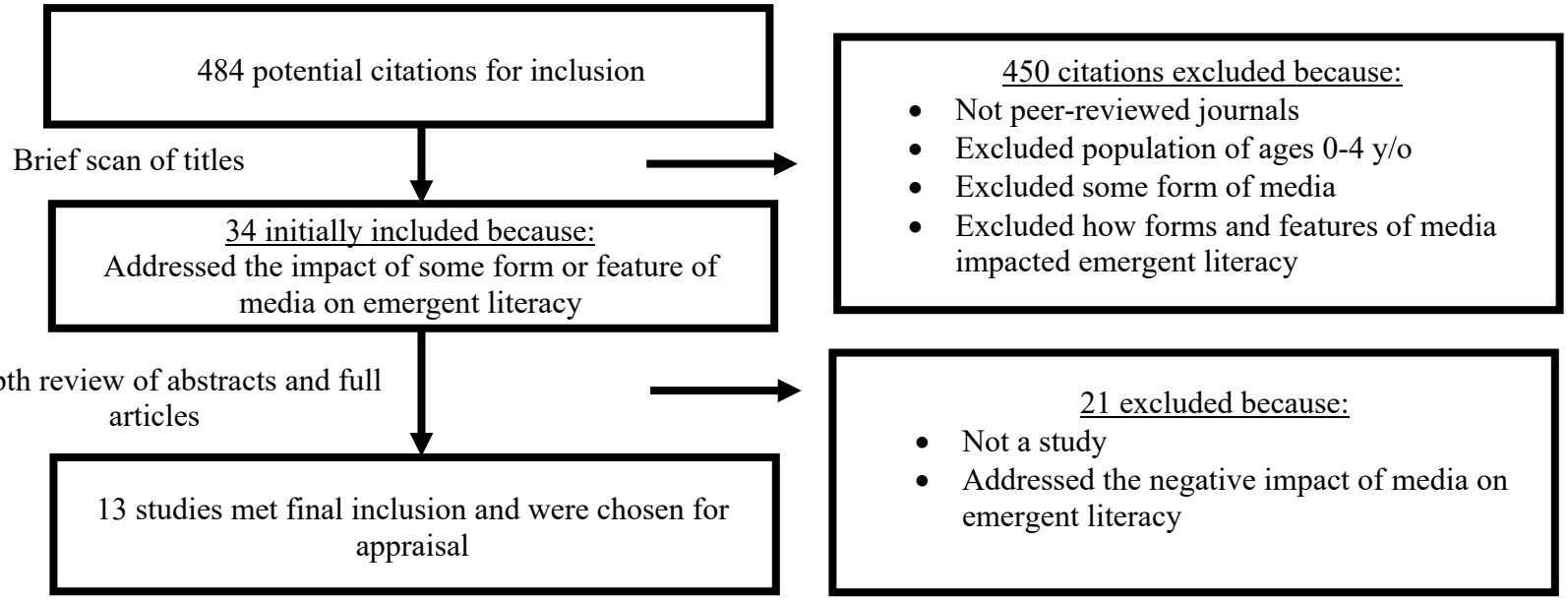

Figure displays the process for identifying articles to be included in systematic review, rationale for exclusion of remaining studies, and determination of final studies chosen for appraisal.

Non-randomized group studies were appraised using the TREND checklist. Two researchers independently appraised each study using the TREND checklist. The TREND checklist was developed to improve the accuracy and transparency of reporting standards of non-randomized designs (Fuller, Pearson, Peters, & Anderson, 2012). The checklist emphasizes description of the intervention, theoretical base, comparison condition, outcomes, and information related to the study design to assess possible biases in the reported outcomes (Des Jarlais, D.C., Lyles, C., Crepaz, N., & the TREND Group, 2004). It should be noted that the checklist does not serve as criterion for evaluating papers, but instead, a guideline for improving data reporting (Des Jarlais, et. al, 2004).

To appraise the single-subject design study, the Single Case Experimental Design (SCED) scale was used. The SCED is an 11-point scale used to evaluate the quality of single case experimental studies, with a perfectly designed study receiving a score of 11 (Tate et al., 2008). To appraise the survey research design study, the Critical Appraisal of a Survey was used. The Critical Appraisal of a Survey is a detailed checklist that addresses the fundamental concepts required to assess surveys (Harvey, 1994). The Critical Review Form–Qualitative Studies was used to evaluate the qualitative study included in this review. This review form assesses methodological quality of qualitative research, specifically sampling, data collection, and data analyses (Letts et al., 2007).

The author and a colleague independently appraised each study and then discussed them in detail. Checklists were used to appraise the literature and to discuss any disagreements in order to come to an agreement on whether each article specifically addressed the specified criteria. Appropriate levels of evidence were then assigned to the

studies using the American Speech-Language and Hearing Association's (ASHA) levels-of-evidence hierarchy (ASHA, 2010).

CHAPTER FOUR: RESULTS

The 13 studies included in this review used multiple research designs including randomized control trials (n=5), non-randomized control trials (n=6), qualitative research (n=1), and a single-subject research design (n=1). To critically appraise the literature, the author used the TREND for studies that were non-randomized group studies (Table 4.1), the SCED for a single-subject research design study (Table 4.2), the Critical Appraisal of a Survey for a survey study (Table 4.3), and the McMaster for the qualitative study (Table 4.4).

Table 4.1
Limitations Found While Using TREND

TREND Criterion	Studies									
	Chera & Wood (2003)	Gong & Levy (2009)	Korat & Blau (2010)	Korat (2009)	Linebarger & Walker (2005)	Lonigan et al. (2003)	Macaruso & Rodman (2011)	Neumann (2014)	Shute & Miksad (1997)	van Bysterveldt et al. (2010)
Method of recruitment (e.g. referral, self-selection), including the sampling method if a systematic sampling plan was implemented										
Setting: where was the intervention delivered?								X		
Deliverer: who delivered the intervention	X		X	X	X			X		
Exposure quantity and duration: how many sessions or episodes or events were intended to be delivered? How long were they intended to last?								X		
Activities to increase compliance or adherence (e.g. incentives)	X		X	X	X		X			
Methods used to collect data and any methods used to enhance the quality of measurements										X
Information on validated instruments such as psychometric and biometric properties	X	X	X	X						
How sample size was determined and, when applicable, explanation of any interim analyses and stopping rules	X	X	X	X			X	X	X	

Table 4.1 (continued)

Method used to assign units to study conditions, including details of any restriction (e.g. blocking, stratification, minimization)								X		
Inclusions of aspects employed to help minimized potential bias induced due to non-randomized (e.g. matching)			X	X				X		X
Whether or not participants, those administering the interventions, and those assessing the outcomes were blinded to study condition assignment; if so, statement regarding how the blinding was accomplished and how it was assessed.	X		X	X	X	X	X	X	X	X
Description of the smallest unit that is being analyzed to assess intervention effects (e.g., individual, group, or community)			X							
If the unit of analysis differs from the unit of assignment and the analytical methods used to account for this, (e.g., adjusting the standard error estimates by the design effect or using multilevel analysis)			X		X	X	X	X	X	X
Statistical methods used to compare study groups for primary methods outcome(s), including complex methods of correlated data	X									
Statistical methods used for additional analyses, such as a subgroup analyses and adjusted analysis	X									
Methods for imputing missing data, if used	X	X	X	X	X	X	X	X	X	X
Statistical software or programs used	X	X	X		X	X	X	X	X	X
Assignment: the numbers of participants assigned to a study condition								X		
Allocation and intervention exposure: the number of participants assigned to each study condition and the number of participants who received each intervention								X		

Table 4.1 (continued)

Follow-up: the number of participants who completed the follow-up or did not complete the follow-up (i.e., lost to follow-up), by study condition	X		X	X	X	X	X	X		X
Analysis: the number of participants included or excluded from the main study condition			X	X	X			X		
Description of protocol deviations from study as planned, along with reasons	X	X	X	X	X	X	X	X	X	X
Dates defining the periods of recruitment and follow-up	X	X	X	X	X	X	X	X	X	X
Baseline demographic and clinical characteristics of participants in each study condition					X			X		
Baseline characteristics for each study condition relevant to specific disease prevention research					X			X		X
Baseline comparisons of those lost to follow-up and those retained, overall and by study condition		X	X	X	X	X	X	X	X	X
Comparison between study population at baseline and target population of interest						X	X	X		X
Data on study group equivalence at baseline and statistical methods used to control for baseline differences	X				X			X		X
Indication of whether the analysis strategy was " intention to treat" or if not, description of how non-compliers were treated in the analyses	X	X	X	X	X	X	X	X	X	X
For each primary and secondary outcome, a summary of results for each estimation study condition, and the estimated effect size and a confidence interval to indicate the precision		X						X		
Inclusion of results from testing pre-specified causal pathways through which the intervention was intended to operate, if any	X	X	X	X	X	X	X	X	X	X
Summary of other analyses performed, including subgroup or restricted analyses, indicating which are pre-specified or exploratory	X							X		

Table 4.1 (continued)

Summary of all important adverse events or unintended effects in each study condition (including summary measures, effect size estimates, and confidence intervals)	X	X	X	X		X	X		X	X
Discussion of results taking into account the mechanism by which the intervention was intended to work (causal pathways) or alternative mechanisms or explanations					X	X	X	X	X	X
Discussion of the success of and barriers to implementing the intervention, fidelity of implementation	X	X	X	X						
Discussion of research, programmatic, or policy implications			X							

Note. The TREND statement is not intended to be grading standard with points, but rather a checklist to help guide authors to ensure they include all pertinent information.

Table 4.2

Limitations Found Using the SCED scale

Limitations Found Using the SCED scale	Study
Independence of Assessors	Hitchcock & Noonan (2000)
Statistical analysis	

Table 4.3

Limitations Found Using the McMaster scale

Limitations Found Using the McMaster scale	Study
Informed consent was not obtained	Beschorner & Hutchison (2013)
Role of researcher and relationship with participants and identification of assumptions and biases of researcher	
How decision trail was developed and process of analyzing the data that was described adequately	
Overall rigor, specifically in dependability and confirmability	

Table 4.4

Limitations Found Using the Critical Appraisal of a Survey

Limitations Found Using the Critical Appraisal of a Survey	Study
Was the sample size based on pre-study considerations of statistical power?	Castles et al. (2013)

Studies were also assigned levels of evidence based on ASHA's Level-of-Evidence hierarchy (Tables 4.5-4.6).

Table 4.5

Studies Determined ASHA Levels of Evidence

Author	Study Design	Level of Evidence
Chera & Wood (2003)	Pre-test post-test treatment design	IIa
Hitchcock & Noonan (2000)	Adapted Alternating Treatments Design (AATD)	IIb
Gong & Levy (2009)	A pretest-posttest experimental design	IIa
Korat & Blau (2010)	A pretest-posttest experimental design	IIa
Castles et al. (2013)	Survey research design	III
Linebarger & Walker (2005)	Longitudinal study	IIa
Lonigan et al. (2003)	A pretest-posttest experimental design	IIa
Macaruso & Rodman (2011)	A pretest-posttest experimental design	IIa
Shute & Miksad (1997)	A pretest-posttest experimental design	IIa
van Bysterveldt et al. (2010)	Single-subject design	IIb
Korat (2009)	A pretest-posttest experimental design	IIa
Neumann (2014)	Cross-sectional research design	III
Beschorner & Hutchison (2013)	Qualitative Case Study	III

Table 4.6
ASHA Levels of Evidence

ASHA Levels of Evidence	Description
Ia	Well-designed meta-analysis of >1 randomized controlled trial
Ib	Well-designed randomized controlled study
IIa	Well-designed controlled study without randomization
IIb	Well-designed quasi-experimental study
III	Well-designed non-experimental studies, i.e., correlational and case studies
IV	Expert committee report, consensus conference, clinical experience of respected authorities

Descriptive Review

Chera & Wood (2003)

Chera & Wood (2003) examined the effect of computer-aided learning (CAL) software to promote phonological awareness in children beginning to read. Participants included 15 children, ranging from three to six years old, in both the control and intervention groups. Treatment consisted of ten, 10-minute sessions with the software over four weeks, while a matched control group completed normal classroom activities. The assessment battery consisted of a standardized word reading test and five non-standardized phonological tasks. The phonological tasks included visual and auditory letter sound awareness, auditory onset awareness, verbal onset awareness, visual onset awareness, and rhyme awareness. Data were calculated by using the difference in scores between pre-test and the post-test, and between the post-test and follow up testing two weeks later.

Results indicated that the intervention group achieved significantly higher increases in phonological awareness than the control group, specifically awareness of letter sounds and word onsets. Authors suggest these results could be due to the onset-rime activity pages found within each story. Authors concluded that CAL software can promote phonological awareness in beginning readers.

Korat & Blau (2010)

Korat & Blau (2010) explored the effect of repeated readings of an e-book on phonological awareness in pre-kindergarten and kindergarten children from low and middle socioeconomic groups. Only the results from the pre-kindergarten children are discussed here.

Participants included 247 children, ages four to six years old, from six pre-kindergarten and six kindergarten classes. Six classes were from low socioeconomic status (SES) and the other six were from middle SES. Participants were randomly assigned within each group to receive the experimental treatment using one of three options: reading an electronic book in five sessions, reading an electronic book in three sessions, or receiving the regular kindergarten program (control). Each session lasted approximately 20-25 minutes each. Participants' early literacy level was assessed using phonological awareness tasks, word reading tasks, and vocabulary tasks both before and after an activity with an electronic book. It was not clear whether these were standardized or non-standardized instruments.

Results indicated that pre-kindergarten children from both low and middle SES groups had higher mean phonological awareness scores as compared to the control group for both the three or five reading conditions; however these results were not statistically significant, most likely due to a small sample size. Authors suggested specific features such as re-reading/re-listening to the text and highlighting written phrases of the storybook help improve literacy skills. They concluded that repeated readings with e-books that utilize such specific features supports language and literacy development especially when aimed at a specific developmental level.

van Bysterveldt et al. (2010)

van Bysterveldt et al. (2010) examined the effectiveness of an integrated intervention approach on speech, alphabet knowledge, and phonological awareness in children with Down syndrome. Participants included 10 preschool children with Down syndrome between the ages

of four and five. Participants' speech, expressive and receptive language, and hearing were measured pre- and post-intervention using standardized tests. Phonological awareness and alphabet knowledge were assessed using non-standardized measures. Speech and phonological targets for the intervention were selected based on results of the pre- and post-intervention measures. Intervention consisted of three components: a parent-implemented home program, center-based speech-language therapy sessions, and 'learning through computer' sessions with a total intervention time of 20 hours over 18 weeks. The parent-implemented home program used print referencing techniques during joint story book reading. The speech-language therapy sessions integrated speech production, alphabet knowledge, and phonological awareness. 'Learning through computer' sessions integrated the same goals used in the speech-language therapy sessions via computer. Effectiveness was determined by comparing baseline and intervention measures for speech and pre- and post-intervention measures for alphabet knowledge and phonological awareness.

Results indicated that participants showed no improvement in letter-sound knowledge. Videotaped sessions revealed some participants were able to identify one or two targeted letter-sounds in a session, but were not able to generalize that skill. Participants showed improvement in alphabet knowledge and phonological awareness skills, but these results were not statistically significant, suggesting the intervention only stimulated this skill. The authors suggested that the results might have been due to the fact that both the speech therapy and computer sessions targeted the same phonological awareness and alphabet knowledge goals. The authors concluded that an intervention approach utilizing speech, alphabet knowledge, and phonological awareness tasks was effective in remediating speech error patterns at the single-word level in

children with Down syndrome. Phonological awareness and alphabet knowledge also appeared to be stimulated through the intervention.

Shute & Miksad (1997)

Shute & Miksad (1997) compared the effectiveness of computer assisted instruction (CAI) software on specific cognitive skills (i.e. counting and word knowledge) to traditional resources (i.e. books). Participants included 51 children between the ages of two and five. Standardized cognitive pretest measures included the McCarthy Short Form, which included 6 subscales, and the Boehm Test of Basic Concepts. The software content was designed to target word knowledge and counting--2 subscales included in the McCarthy Short Form. Children were randomly assigned to one of three groups based on level of computer-provided scaffolding: substantial, minimal, or none (control). For example, software with substantial levels of scaffolding included verbal encouragement and verbal assistance via the program as the child progressed through varying levels of difficulty. The control group received minimal teacher-provided scaffolding. Treatment consisted of individuals in each group receiving one 20 minute session per week, for eight weeks. Data were calculated using a pretest-posttest design to compare cognitive changes over eight weeks.

Results indicated that participants who received substantial computer assisted instruction had significantly higher word knowledge scores as compared to the control group. No other comparisons were significant. Authors concluded that computer assisted instruction software was effective in increasing specific cognitive skills, such as word knowledge, when substantial levels of scaffolding were present.

Korat (2009)

The effectiveness of repeated readings of a CD-ROM storybook on children's early literacy skills--vocabulary, word recognition, and phonological awareness--using a CD-ROM storybook, was examined by Korat (2009). Participants consisted of 214 children; 108 pre-kindergarten children, ages four to five years, and 106 kindergarten children, ages five to six years. Participants were randomly assigned to one of three groups: Treatment group A received three CD-ROM storybook reading sessions; Treatment group B received five CD-ROM reading sessions; and the control group received the regular kindergarten instruction. Each session lasted approximately 20-25 minutes. A pre- and post-design was used to measure effects. The assessment battery included measures of vocabulary, word recognition, and phonological awareness; however, it was not clear whether these measures were standardized or non-standardized.

Results indicated both pre-kindergarten and kindergarten participants in group B improved significantly in phonological awareness as compared to children in the control group. Authors suggested results may have been influenced by the fact that phonological awareness tasks and word reading are more cognitively demanding skills and so may require more training and/or exposure. Specific software features that may have contributed to the results included a dictionary built in to the CD-ROM story and a 'read and play mode' which allowed children to segment words into syllables. The authors concluded that children as young as four benefit from CD-ROM storybooks but cautioned that they may need repeated readings to reap those benefits.

Castles et al. (2013)

Castles et al. (2013) examined the effects of preschool children's general home computer use on alphabet knowledge. Participants consisted of 1,539 four-year-old children in an observational study. Children were informally asked to name the letters of the alphabet and researchers collected the raw scores of accurate responses. Standardized measures were administered and included measures of non-verbal intelligence, oral language, articulation and phonological awareness. Performance on these measures were analyzed in relation to parent-questionnaire responses investigating time spent on the computer or watching television and the home literacy environment, including formal and informal literacy experiences.

Results revealed a significant correlation between alphabet knowledge and computer use such that as computer use increased so did alphabet knowledge. In contrast, alphabet knowledge was significantly negatively correlated with television watching; as television watching increased, alphabet knowledge decreased. Authors suggested that computer activities that allow children to interact with letters on the keyboard stimulate alphabet knowledge positively influencing emerging literacy development.

Hitchcock & Noonan (2000)

Hitchcock & Noonan (2000) compared the effectiveness of computer-assisted instruction (CAI) and teacher-assisted instruction (TAI) on matching shapes, colors, numbers, and letters of the alphabet, in preschool children with disabilities. Five preschool children with disabilities, aged three to four years, participated in a single-subject research design study. Participants were taught the primary skills of matching shapes, colors, numbers or letters via direct instruction (DI)

from the teacher, prior to the study. This was followed by guided practice using constant time delay under two conditions: CAI or TAI. Constant time delay involved presenting a target, pausing for a delay, and then giving a prompt for the desired response. Standardized measures were used to assess cognitive skills, expressive/receptive language, basic school skills (i.e. able to follow school routines), and adaptive behavior pre- and post- intervention.

Results showed CAI with constant time delay generated equal or greater improvement in the targeted skills as compared to TAI. However, these results did not reach statistical significance, possibly due to the small sample size. Authors suggested that CAI, using constant time delay, is an effective means of promoting pre-academic skills, such as alphabet knowledge, in preschool children with disabilities despite the fact that results did not reach statistical significance.

Beschorner & Hutchinson (2013)

The effects of improving preschooler's emergent literacy skills using a tablet in a qualitative case study design was the focus of a study by Beschorner & Hutchinson (2013). Participants consisted of thirty-five children from two preschool classrooms, ages three to five years. Data were collected twice a week for seven weeks through observations, children's digital work samples, semi-structured interviews with teachers, parent emails, and an informal survey of parents. New computer applications (apps) were introduced to the children bi-weekly to provide different opportunities to increase literacy and language skills. During the first two weeks, writing and speaking apps were introduced. During the third and fourth weeks, listening and

print awareness apps were used. During the last three weeks, apps that allowed students to write, speak and listen were selected. Standardized measures were not used.

Findings suggested that a tablet can be used in multiple ways to promote print awareness and phonological awareness. Print awareness was facilitated using two specific apps: the Doodle Buddy and Drawing Pad. These apps allowed students to write their name using letters formed on the screen with their finger, type text using the keyboard, choose text from digital stickers or stamps, and/or choose photographs taken with the tablet. Motivating features include choosing different colored text and writing tools, such as: a paint brush, a marker, or spray paint. For example, one child wrote her name using her fingers on the touch screen to write the letters of her name with the writing tool and print color of choice: purple, glitter spray paint. Children learned phonological awareness through an app, Magnetic ABC's; children initially manipulated letters to write their own name, and later began using the letters to write their peers' names. Authors concluded that preschool children can develop emerging literacy skills, specifically print awareness and phonological awareness, using a tablet. However, it's difficult to determine the actual level of improvement since no standardized assessments were used; therefore, one could argue that the observed improvement was a natural artifact of time.

Lonigan et al. (2003)

The effects of computer-assisted instruction (CAI) on phonological awareness in preschoolers at-risk for reading problems were examined by Lonigan (2003). Participants included forty-five children ages three to five. Participants were randomly assigned to a CAI group or a control group. The CAI group used two software programs, DaisyQuest and Daisy's

Castle, which both assessed phonological awareness, using colorful graphics and an adventure game context. The control group used the Head Start's program's traditional curriculum. Both groups engaged in 15- to 30-min sessions, twice a week, for three weeks. Pretest, posttest measures included standardized tests of oral language, cognition, and print knowledge. Non-standardized measures were used to assess phonological awareness.

Results indicated the CAI group had significantly higher mean scores for phonological skills as compared to the control group. No other posttest measures were statistically significant. Authors concluded the use of CAI training with colorful graphics and an adventure theme is effective to improve phonological awareness skills in preschool children at-risk for later reading difficulties.

Gong & Levy (2009)

The effects of an electronic storybook on print awareness were examined by Gong & Levy (2009). Participants included ninety-six four-year-olds who were randomly assigned to one of four groups: Story Control, Bouncing Ball, Violation condition, and Action condition. In the Story Control condition, children listened as the computer read stories via laptop. In the Bouncing Ball condition, a bouncing ball bounced above each word as the computer read stories via laptop. In the Violation condition, the condition was the same as the Bouncing Ball condition, except for the addition of errors added to the pages of the storybooks. When the computer read an error, the bouncing ball stopped and the computer voice said, "oh-oh" to indicate an error. The computer would correct the error and continue the story. In the Action condition, the condition was the same as the Violation condition; however, the computer would

only finish the story after the child 'clicked' on the error. Children participated in each condition for about 15 minutes, 2-3 times a week across four weeks. Pre- and posttest measures included a non-standardized assessment of print concept knowledge and a standardized reading test.

Results indicated that the Violation and Action groups had significantly higher mean scores for print awareness as compared to the Story Control and Bouncing Ball group. The authors concluded that focusing children's attention to the text did not improve knowledge about print; rather, children's active engagement with the text during shared story reading led to improved print awareness.

Neumann (2014)

Neumann (2014) examined the effect of home access to touch screen tablets on numeral identification, name writing, and emergent literacy skills. Participants included one hundred and nine Australian preschoolers ages three to five years. Assessment measures included letter name and sound knowledge, numeral identification, name writing, print concepts and word reading. It was not clear whether the measures used were standardized or non-standardized. Participants were tested for one session that lasted approximately 20 minutes. A home questionnaire was given to parents requesting participant and parental demographic information, child's home access to tablets, and time spent on tablets.

Results from the home questionnaire indicated 61% of families owned one or more touch screen tablets; children spent approximately 20 minutes per day using tablets. Questionnaire results included the report that participants had access to at least five tablet apps and the most commonly used were gaming apps. Assessment results indicated that children with greater

access to tablets had significantly higher means in name writing skills as compared to children with less access. Authors suggested that the tactile nature of tablets (i.e. the fact that information can be accessed and manipulated via touch) improved print awareness. Of specific mention was the feature of apps that allowed children to trace letter shapes with their finger while listening to the letter sounds was particularly beneficial. No significant relationships were found between time spent on tablets and emergent literacy skills. Authors speculated the greater time reportedly engaged with gaming apps rather than educational apps could explain the lack of association between time on tablets and emergent literacy skills. Results suggested further that the quality of experiences with tablets rather than time spent on tablets affected learning emergent literacy skills.

Linebarger & Walker (2005)

The relationship between television exposure, vocabulary and expressive language skills was examined by Linebarger & Walker (2005). Participants included 51 infants and toddlers, aged 6-36 months. Standardized pretest measures included assessments of cognitive and vocabulary development and non-standardized measures of expressive language development. An index of parental behavior was measured using the Home Observation for Measurement of the Environment Inventory (HOMEI) (Caldwell & Bradley, 1984) and a viewing log. In the viewing log, parents reported the names of the television programs their child viewed, along with the amount of time spent viewing each program. Experimenters used the HOMEI to measure the amount of stimulation and support available to a child in their home during a 45-90 minute observation. Parents used the viewing log to report the amount of time and the type of television

programs children viewed each day. Each program was classified based on its intended audience and program type. Specific programs were chosen for analysis if at least 25% of the sample reported viewing the program on at least two different occasions. These selected programs included: Arthur, Clifford, Blue's Clues, Dora the Explorer, Barney & Friends, Teletubbies, Dragon Tales, Sesame Street and Disney movies. Data was collected every three months between six months to thirty months.

Results from viewing logs indicated infants first showed interest in watching television at 9 months. At 30 months of age, vocabulary growth was greater after viewing Arthur, Clifford, Blue's Clues, and Dora the Explorer as compared to viewing Barney & Friends and Teletubbies; Dragon Tales, Sesame Street, and Disney movies were found to be unrelated to vocabulary development. At 30 months of age, expressive language production was shown to increase after viewing Arthur, Clifford, Blue's Clues, Dora the Explorer, Barney & Friends and Dragon Tales as compared to watching Sesame Street and Teletubbies. Disney movies were found to be unrelated to growth in expressive language production. Authors suggested certain strategies may promote or inhibit both vocabulary growth and expressive language. For example, programs such as Blue's Clues and Dora the Explorer use language-promoting strategies such as characters speaking directly to children, encouraging active participation, labeling, and providing opportunities for children to respond. In contrast, the authors suggested that programs such as Sesame Street and Teletubbies use language-inhibiting strategies including multiple forms of visual stimulation and music, poor language models and a loose narrative structure making it difficult for children to follow. While these results are clinically important they were not statistically significant, possibly due to a small sample size. Television programs that use

language-promoting strategies may increase toddlers' vocabulary and expressive language growth.

Macaruso & Rodman (2011)

Macaruso & Rodman (2011) examined the efficacy of using computer-assisted instruction (CAI) on phonological awareness in two studies. Only the results from the first study are discussed here as it met the inclusion criteria for this review. Preschoolers, ages four to five years, from fourteen preschool classes, served as participants. Seven of the 14 classes were randomly assigned to a treatment group while the remaining seven were assigned to the control group. Treatment classes used the Early Reading CAI software program for 10-15 minutes a day, two or three times a week for four months. Control classes engaged in free-choice or other center activities. The CAI software assessed phonological skills in level one and basic letter-sound mappings in level two. The Group Reading Assessment and Diagnostic Evaluation (GRADE) (Williams, 2001) was given as a pre- and posttest measure for both the treatment and control groups. GRADE assesses phonological awareness skills, visual skills, and verbal concepts which are summed to obtain a Total Test score. Pre- and posttest letter knowledge was informally assessed by asking children to identify letters of the alphabet presented on index cards, to supplement GRADE. There were no significant differences between groups on scores of the pretest measures.

Although, both treatment and control classes showed gains in skill, results showed the treatment group had significantly greater mean improvement in phonological awareness as compared to the control group. The treatment group showed improvements in all three

domains—phonological awareness, visual skills, and verbal concepts. The control group showed improvements in two domains—phonological awareness and verbal concepts. Motivating features of the program included progress bars as students successfully completed each task, immediate auditory and visual feedback to students after each response, and structured activities that built from basic to more advanced skills. Authors concluded that preschoolers can make accelerated progress in phonological awareness through the use of CAI.

Methodological Quality of Literature Reviewed

Findings from this critical appraisal of literature indicate limitations in methodological quality (Tables 4.1-4.4). The group studies reviewed failed to describe how authors determined an adequate sample size to detect significant changes in clinical parameters, treatment effects, or associations (Pourhoseingholi, Vahedi, & Rahimzadeh, 2013). Failure to calculate adequate sample sizes could lead to a misinterpretation of the results- in either direction, significant or nonsignificant (Pourhoseingholi, Vahedi, & Rahimzadeh, 2013). Although this is not uncommon in rehabilitative literature, the inclusion of a power analysis to determine an adequate sample size for statistically significant results would certainly strengthen findings and better guide treatment.

Other weaknesses included a lack of blinding and the consistent use of non-standardized measures. The fact that assessors were not blinded to group assessment introduces the possibility for bias. Consequently, insuring that assessors are blinded to group assignment would strengthen the validity of studies. For example, van Bysterveldt et al. (2010) used a certified speech-language pathologist to administer experimental tasks and two supervised students to

administer standardized assessments. Therefore, the results were strengthened clinically. Several studies include non-standardized measures for skills assessment and/or fail to specify whether the measures used were standardized or not. Standardized measures insure that the administration and scoring of the assessment is completed in a systematic way. The use of standardized measures also supports reliability and validity of the measures used.

Finally, a limitation of several studies was the lack of baseline data collection as well as maintenance data collection. Baseline data is vital to determining the effectiveness (or lack thereof) of a given treatment as it documents skill level prior to the initiation of treatment. In doing so, changes in performance following intervention are clearly identified. Additionally, maintenance data provides additional important information regarding how the treatment generalized to other contexts and whether the gains from treatment were maintained. Along with the limitations of the appraised studies, the current review is limited due to only including populations of children ages birth to four, as well as only including studies that emergent literacy skills.

Despite these limitations, clinical implications can be made from authors' findings. Clinicians and consumers can use this information to guide their decision-making of digital media that promotes emergent literacy skills. Further discussion of specific features that enhance children's literacy development are detailed in the following chapter.

CHAPTER FIVE: DISCUSSION

Media is pervasive in the lives of American infants and toddlers (Linebarger & Vaala, 2010). As the technologies available for parents evolve, families should be guided as to the positive and negative effects of media exposure in infancy and toddlerhood (Duch et al., 2013). In particular, parents should be informed of features of media that facilitate learning versus features that make it harder or interfere with learning. To facilitate that goal, a checklist (Table 1.1) was created from this review as a way of informing parents, educators, and clinicians of the features of media that have been found to promote emergent literacy skills, specifically alphabet knowledge, print awareness, and phonological awareness.

The purpose of this thesis was to explore the effect of digital media on emergent literacy skills in children ages birth to four years. Three research questions were addressed. The discussion that follows is organized according to those questions.

Research Question #1: What media features promote alphabet knowledge in children ages birth to four?

Based on this review, the following features were found to promote alphabet knowledge as taken from the work of Castles et al. (2013), van Bysterveldt et al. (2010), and Hitchocock & Noonan (2000). According to these studies, computer software that targets the same goals used in speech-language therapy and allows children to interact with letters on the keyboard promotes alphabet knowledge. Along with this, Hitchcock & Noonan (2000) concluded software that uses constant time delay, a strategy that pauses and gives children a prompt before responding, also

promoted alphabet knowledge. All of these features were found to be effective in promoting alphabet knowledge in populations of children with and without disabilities.

Research Question #2: What media features promote print awareness in children ages birth to four?

The following features were found to promote print awareness as taken from the work of Neumann (2014), Beschorner & Hutchinson (2013), and Gong & Levy (2009). According to these studies, tablets with apps that allow children to write messages using letters they formed on the screen using their fingers were found to promote print awareness. E-books that promoted active engagement with print, such as a child clicking on an error in the text of a story, were also found to promote awareness of print. These findings suggest that tablets and e-books can be designed to help preschoolers understand print. Research has shown that children gain print awareness by interacting with print in their environment, similar to the way adults interact with print in books, newspapers, and magazines. Therefore, features of media that allow children to interact and actively engage with print will promote print awareness.

Research Question #3: What media features promote phonological awareness in children ages birth to four?

The following features were found to promote phonological awareness, as taken from Beschorner & Hutchinson (2013), Macaruso & Rodman (2011), Korat & Blau (2010), van Bysterveldt et al. (2010), Korat (2009), Chera & Wood (2003), and Lonigan et al. (2003). According to these studies, computer software with structured activities that built from basic

knowledge to advanced skills (i.e. rhyme sensitivity to syllable and phoneme segmentation) promoted phonological awareness. In addition, software that provided immediate auditory and visual feedback and used motivating features such as progress bars and colorful/themed graphics promoted phonological awareness. Moreover, e-books that allowed children to have access to repeated readings of a story and highlight written phrases of the text improved phonological awareness. Lastly, the use of additional tools during reading (i.e. built in dictionary) and activity pages related to the story after reading promoted phonological improvement. Any app that allowed children to manipulate the phonemes to write their name and their peers' names was also found to promote phonological awareness. As discussed previously, when children actively engaged with media, versus passively received information, phonological awareness skills improved. It is well established that passive exposure or interaction with media can have harmful effects on a child's development (Okuma & Tanimura, 2009); however, when children actively process and retain information from viewing, well-designed media can promote many academic skills, including phonological awareness (Rice & Woodsmall, 1988).

Clinical Implications

The current review provides useful clinical information regarding the effects of digital media on emergent literacy skills. Findings from this review contribute to the growing body of literature about children's media use. This information is clinically relevant to the speech-language pathologist's role in implementing evidence-based practices with their clients and their families as well as professional colleagues. Clinicians must realize that media exposure is a reality in today's society. Clinicians should be informing families regarding screen time

exposure, and how to select media (Brown, 2011). Moreover, clinicians can play a valuable role in directing how media is used by alerting parents to the features of media that have been shown to be beneficial to children's language development and general learning.

One way to facilitate media selection is by using the checklist (Table 1.1) created from this review as a way of 'grading' potential media and/or software. For example, 'Grade A' media would be a product that contains all the features included on the checklist; 'Grade B' would contain 85-75%; 'Grade C' would contain 74-50%, and media containing less than 50% of these features would not be considered to promote emergent literacy skills.

Individuals in a variety of settings and roles could the use the checklist to guide their decision making. Clinicians and teachers may use the checklist to integrate computers into their practice and classrooms. For example, clinicians may use software to supplement skills targeted in therapy for further practice. Teachers may use computer activities to enhance academic skills, promote maintenance of skills, and reinforce learning through additional practice on a motivating medium (Hitchcock & Noonan, 2000). Findings from this review demonstrate how CAI or CAL can provide opportunities to engage in systematic and structured exercises that specifically address individual needs (Macaruso & Rodman, 2011). By using the features highlighted on the checklist, clinicians and teachers will find integrating media, such as computers, into their practice will serve as a promising accessory to their instruction (Lonigan et al., 2003).

Parents may use the checklist when deciding what media to invest in. The checklist serves as a tool to guide parents in decision-making about features of media, including television programs that promote literacy skills. For example, parents may choose programs where the characters speak directly to the child, label objects, and encourage the child to participate

because these are features that promote literacy skills. By using the features highlighted on the checklist, parents will find that appropriate, curriculum-based programs may have beneficial associations with expressive language production and vocabulary (Linebarger & Walker, 2005).

Another strategy is to encourage pediatricians to give the checklist to parents during a well-child visit, along with their own recommendations, to inform parents of media's influence on their child's development. By implementing evidence-based practices, clinicians play a major role in guiding others on the effects of digital media in an ever-changing technological era.

Future Directions

Future studies should consider the influence of important language development skills beyond emergent literacy. For example, Linebarger & Walker (2005) explored the features of media that increased vocabulary development—a related skill that stimulates phonological awareness, which is a variable of interest in this review. Although related skills, such as vocabulary and receptive/expressive language development, are not specifically emergent literacy skills, they are known to be strong predictors of later literacy development. Future studies should also expand participant demographics to include school-age and adolescent populations, as well as populations of children with disabilities. Media will play a different role in the lives of children older than four years. Instead of exploring media features that promote emergent literacy skills, future research might investigate features of media that promote language skills learned in school-age and beyond, such as figurative language, narrative development, and social skills. Older children will also have different guidelines concerning recommended amounts of screen time. Although a few studies in this review included atypical

children, examining features of media that promoted emergent literacy skills for this population, would benefit families and educators.

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