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Vocabulary in educational media for preschoolers: a content analysis of word selection and screen-based pedagogical supports

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ABSTRACT

Children are spending an increasing amount of time in front of screens. However, little is known about the content of educational media, particularly in relation to vocabulary instruction. Since vocabulary is an important predictor of later reading comprehension, it warrants a thorough investigation on how it is taught in educational media. This study presents a content analysis of vocabulary instruction in a weighted sample of all educational programs on the media marketplace for young children. We examine the time spent on vocabulary in educational media, the words selected, and the screen-based pedagogical supports (SBPS) that facilitate vocabulary learning in videos. We found that few sophisticated words were selected for instruction, and identified 11 SBPS used during vocabulary instruction in our weighted sample. These findings provide a more holistic understanding of the content of vocabulary instruction in educational media for young children.

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Children spend more than two hours a day in front of screens (Rideout, 2014), viewing media programs that capture their attention. Consequently, less time is devoted to rich social interactions with peers and adults, leading to fewer opportunities for language learning through responsive interactions (Beck, McKeown, & Kucan, 2002). Despite this potential setback in early language development, young children are exposed to media programs that promise to equip them with language-rich viewing experiences (Vaala et al., 2010). In fact, adults are increasingly turning to educational media programs as the preferred media for children to engage with (Common Sense Media, 2013). The specific content preschoolers view on screen plays a large role in determining whether or not children benefit from educational media (Piotrowski, Jennings, & Linebarger, 2013). Given the importance of content in educational media for preschoolers, surprisingly little is actually known about what young children are watching in this digital age. Without question, more focus is needed on the content of these programs to maximize their positive impact.

An important feature of educational content for young children is vocabulary. Extensive research indicates that children's vocabulary knowledge is directly related to their later reading achievement and literacy skills. Exposure to sophisticated words that

are not the most commonly used in the English language in preschool impacts later vocabulary knowledge (Rowe, 2012; Weizman & Snow, 2001). The size of a child's vocabulary in kindergarten is a significant predictor of comprehension in middle elementary school, and vocabulary size at the end of first grade is a significant predictor of high school literacy skills (Cunningham & Stanovich, 1997; Sénéchal, 2006).

Considering the accessibility of screen platforms (Rideout, 2014), educational media for preschoolers has the potential to provide young children with wide exposure and opportunities to learn new words (Wright et al., 2001). Moreover, vocabulary intervention research indicates that educational media may be particularly beneficial for vocabulary gains in the preschool years (Marulis & Neuman, 2013; Wright & Cervetti, 2016). Still, the body of knowledge on vocabulary instruction through educational media is small and typically focuses on the influence of one program or segment of a program. There is a dearth of knowledge about the vocabulary content and instruction in educational media as a whole.

To fill this gap, the current study thoroughly examines the vocabulary-related content of educational media available on DVD and streaming platforms. This study also adds to the literature on educational media by looking at the specific ways vocabulary is taught, offering scholars a clear understanding of the current landscape of preschool educational media.

Background

Vocabulary instruction

Specific factors hold much importance in vocabulary instruction: word selection, number of words to teach, and frequency and repetition of instruction (Beck & McKeown, 2007; Leung, Silverman, Nandakumar, Qian, & Hines, 2011; Nagy & Hiebert, 2010). The first consideration, word selection, can be based on a variety of factors (Beck & McKeown, 1985; Biemiller, 2015; Chall & Dale, 1995). Sophisticated words (e.g., *avoid* or *enormous*) rather than those that are familiar (e.g., *happy*) or only used in particular domains (e.g., *sedimentary*) are ideal for instruction (Beck & McKeown, 1985). Additionally, exposure to sophisticated words during preschool is related to vocabulary performance in elementary school (Rowe, 2012; Weizman & Snow, 2001). For example, children may use the word *purchase* in addition to *buy*, or *vehicle* when they are talking about *cars* and *trucks*.

In addition to the quality of words in educational media for preschoolers, quantity is also an important factor. Research demonstrates the number of words selected for instruction matters – teaching too many words in one sitting of about 15 minutes is not effective for young children (Coyne, Simmons, Kame'enui, & Stoolmiller, 2004). Providing too many novel words simultaneously to young children is cognitively demanding and does not encourage deeper processing of word meanings (Stahl & Nagy, 2006).

Lastly, the frequency and repetition of new vocabulary words may influence learning in young children. Preschool children benefit from repeated readings of text when learning new vocabulary words (Horst, 2013). These repeated exposures in early childhood should vary and provide examples of words in different contexts. For example, children benefit from vocabulary instruction that is first read during a read aloud and

then discussed during circle time in a new context (Coyne et al., 2004). Instruction should also include opportunities for preschool children to think critically about words and support a deep understanding of their meanings (Neuman, Newman, & Dwyer, 2011; Stahl & Nagy, 2006). Together, these features of vocabulary instruction provide a lens to examine the content of educational media.

Educational media content

Scholars often draw from two complementary theories to understand how screen content might support learning (Bus, Takacs, & Kegel, 2015; Neuman, Wong, Flynn, & Kaefer, 2019). These theories are dual-coding theory (Paivio, 1986) and a theory of synergy (Neuman, 1997, 2009), which collectively assert that multimedia provide multiple sources of information to support learning. Dual-coding theory proposes that when verbal and nonverbal (i.e., visual) information is simultaneously processed in the brain, the interconnections between the parallel systems create rich representations of words that facilitate learning. The theory of synergy posits that when children are exposed to multiple media presentations, there is a critical synergy among them that provides children with robust representations of content and deepens understanding. Together, these theories suggest that the media context is a palpable platform for vocabulary learning among preschoolers.

One approach to understand the vocabulary learning opportunities in educational media is through a content analysis. Several studies have examined content related to language and literacy, specifically in relation to educational media for young children (Larson & Rahn, 2015; Linebarger & Piotrowski, 2010; Moses & Duke, 2008; Neuman et al., 2019; Rice, 1984; Vaala et al., 2010; Wong & Neuman, 2019). An early content analysis conducted by Rice (1984) examined dialogue and non-verbal formal features (e.g., sound effects) that assist children's attention towards targeted content in children's television. Rice examined a 6.5 minute segment from six programs for three to five-year-olds. Rice found much of the media dialogue matches the language typically used in daily interactions with children. Although Rice's work addresses language in children's media, they used a limited program sample without investigating specific words taught on screen. Our study includes a much larger sample of educational media for preschoolers and specifically analyzes vocabulary included in programs.

Moses and Duke (2008) conducted a content analysis of the top ten programs viewed by children ages two to five, in terms of print literacy. They uncovered a paucity of print in television shows, indicating many missed opportunities for characters to engage in print activities such as reading and writing. While their study provides us with information about how print is used on television, the current study sought to examine a larger, representative sample of educational programs focused on vocabulary learning. In another study, Vaala et al. (2010) examined language-promoting strategies in 58 educational videos for children under age three. Unlike Vaala et al.'s study, which focused on infants and toddlers, the current study investigates vocabulary learning in educational media for preschool children who are ages three and four.

Focusing on vocabulary content in educational media, Linebarger and Piotrowski (2010) compared the words present in educational media for elementary children to Dolch words – words frequently used in children's books that should be recognized

quickly by young children (Dolch, 1948). In addition, they examined educational media characteristics that influence children's learning from specific programs. They found few explicit comprehension supports in the examined episodes as characters did not frequently provide background knowledge, plot summaries, or ask viewers related questions. While Linebarger and Piotrowski's findings are informative, they look at six programs for older children in elementary grades rather than preschool. The current study is more comprehensive and representative of what is currently available in the DVD and streaming media marketplace for preschool-aged children.

More recently, Larson and Rahn (2015) examined the preschool content of *Sesame Street's Word on the Street* initiative, and found that Word on the Street mostly included research-based vocabulary strategies and words appropriate for instruction according to the research of Beck et al. (2002). However, they examined only one specific portion of *Sesame Street* – Word on the Street – which is not a part of each episode. Moreover, the Word on the Street initiative was intentionally designed to utilize vocabulary instruction and may not reflect typical children's programming. While an increasing number of scholars are examining the educational content of media designed for young viewers, the present study offers a unique focus on vocabulary opportunities in educational media designed for preschool-aged children.

Addressing some of the concerns in previous studies, Neuman and colleagues (2019) examined a broader corpus of streamed educational media programs for 3–5 year olds, identifying two pedagogical supports that facilitated vocabulary learning: attention-directing cues and ostensive (definitional) cues. While attention-directing cues draw children's visual attention to novel words, ostensive cues provide explanations of words to young viewers. Media research has long examined how specific cues known as formal features might use production techniques to influence children's attention to screens (e.g., through zooming or panning) (Calvert, Huston, Watkins, & Wright, 1982). This, however, does not necessarily mean that these formal features will draw children's attention to specific learning experiences. Like Neuman and colleagues, the current study examines how screen-based pedagogical supports might serve as mechanisms that draw children's attention to word learning experiences on screen. Unlike Neuman and colleagues, it investigates vocabulary instruction in educational media at large available through DVDs and streaming services, and also offers a more fine-grained analysis of pedagogical supports for vocabulary learning on screen.

Given the importance of vocabulary knowledge for later literacy success (Biemiller, 2006) and correlational data showing a relationship between educational media and child receptive vocabulary (Rice, Huston, Truglio, & Wright, 1990), vocabulary instruction is an opportune area to explore. The present study extends research on vocabulary learning opportunities in educational media for preschoolers in several ways. First, this study is designed to provide a holistic understanding of educational preschool programming. We therefore examine the media landscape available on television through DVDs and streamed platforms (e.g., Netflix), which includes a majority of programs that are available on television (e.g., Cartoon Network). This is important because although television represents half of the time that preschoolers are engaged with media each day, time spent on streamed platforms continues to escalate, rising from six minutes per day in 2013 to 21 minutes per day in 2017 (Rideout, 2017). In fact, children spend far more time watching educational programs on screen than other technological platforms (Guernsey, Levine, Chiong, & Stevens, 2012; Rideout, 2014). Second, previous

work has investigated how formal features of educational media might enhance children's comprehension (Calvert et al., 1982), but little research has documented specific screen-based pedagogical features that support preschool children's vocabulary acquisition. Lastly, streamed videos and DVDs have become increasingly accessible to families in the United States, with a recent nationally representative survey finding that 97% of preschool-aged children own or use mobile devices regardless of family income (Kabali et al., 2015).

The current study aims to better understand vocabulary instruction in educational media by addressing the following questions: To what extent does educational media for preschoolers focus on vocabulary development? Are the vocabulary words found in educational media familiar to preschool-aged viewers or do they represent more sophisticated words? To what extent are screen-based pedagogical supports used to accompany vocabulary instruction in educational media?

Method

Design

This study utilizes a content analysis design to precisely operationalize both when and how vocabulary learning experiences occur (Neuendorf, 2002). In this study, educational screen media are defined as programs that are designed and marketed to educate children in school readiness skills, such as language and early literacy (Cohen, 2012; Rideout, 2014). To gain a representative understanding of what children are watching, we collected educational media from sources where young children have the greatest exposure, experience and access (Rideout, 2014). These sources included online streamed videos from *Amazon Prime*, *HBO Now*, *Hulu*, and *Netflix*, as well as educational DVDs specifically marketed for preschoolers between the ages of three- and four-years old.

Sampling and selection criteria

Inclusion criteria

To examine the features of DVDs, we followed Fenstermacher et al.'s (2010) research method, conducting an Internet search for DVDs marketed for preschoolers using popular retail sites (e.g., Amazon) and search engines (e.g., Google). We used a relatively broad inclusion criterion to ensure a wide range of screen-based pedagogical supports (SBPS) were represented. We defined SBPS as cues on screen that elicited children's attention and conveyed pedagogical intent. Although SBPS are like formal features that capture children's attention, they are also intentionally linked to content. Programs in the sample met at least one of the following descriptions:

- (1) Title reflects a high degree of implied learning, such as suggested mastery, skill, or learning in a specific domain (e.g., *Leap Frog Phonics Farm*);
- (2) Product materials make explicit educational claims, defined as visual or verbal content suggesting that the program will assist children in learning important information, skills, values, and behaviors (i.e., Children's Television Act of 1990);

- (3) Company/producer provides supplemental educational materials (e.g., parent guide);
- (4) Endorsements from qualified educational groups (e.g., National Education Association).

From the exhaustive list of commercially available English language DVDs produced in the U.S., we created a sample of videos that targeted three- to four-year-old preschoolers.

To do so, we systematically surveyed children's programming from the following platforms: (1) all educational kids/family videos on Amazon Prime Video; (2) all educational kids/education videos on Netflix; (3) all educational kids/learning and education videos on Hulu; and (4) all educational family videos on HBO Now.

Exclusion criteria

Because we were interested in the screen-based features of educational media, DVDs containing explicit directions for "joint media engagement" (i.e., interactive co-viewing by adult) were excluded. Documentary videos (e.g. National Geographic) were also excluded because of length and comparability with those that engage preschoolers in a strong storyline. Using these criteria, we collected a total of 4,565 episodes from 182 different program titles.

Weighted sample

To operationalize our content analysis, we recognized the implausibility of coding this initial sample of 4,565 episodes. Thus, we created a weighted sample from each data source, selecting videos that represented the population in the media marketplace. We created two weighted samples with 100 episodes for streamed media, and another 100 episodes for DVDs. This would allow us to compare any differences that might emerge between the two media sources while maintaining a realistic sample that could be coded by the research team. Using streamed media as an example, we sorted episodes by program title (e.g. *Dora the Explorer*), and then counted the number of episodes per title. Because we wanted 100 videos in the final weighted sample, we determined that each program required at least 46 episodes (1% of 4,565; or 45.65 episodes) to be included in the sample. For example, *Blues Clues*, which had 141 episodes, took up three of the 100 episodes in the weighted sample ($141/45.65 = 3.09$). In other words, three *Blues Clues* episodes in the weighted sample represented the 141 *Blues Clues* episodes in the actual population. Alternatively, shows with less than 46 episodes were not included in the weighted sample. *Noddy in Toyland*, for example, was not represented because there were only 13 episodes ($13/45.65 = 0.28$). After calculating the number of episodes to include from each program title, there were eleven spaces left in the weighted sample. This was because many program titles did not have enough episodes to be included. These remaining spaces were randomly assigned to episodes from programs that were not yet included in the weighted sample.

A similar process was used for the weighted sample of DVDs. Unlike streamed videos, however, which provided full seasons of programs titles with a list of all episodes to choose from, DVDs were often limited with multiple episodes per disc. To select a final sample of 100 representative episodes, we first created a comprehensive list of each

episode from the 48 programs in the 356 DVDs. We then applied the same weighting strategy as the streamed media sample detailed above to choose representative episodes of DVDs for analysis.

Data analysis

Coding of learning situations

We coded for explicit vocabulary learning situations that facilitate vocabulary acquisition. Following Yu and Ballard (2007), learning situations were defined as explicit spoken utterances (e.g., “Beagles are a type of dog”) and relevant information that are based on the extra-linguistic context (e.g., dog, leash). Boundaries were drawn to include learning situations with factual and generalizable information (“Plants need sunlight to survive”), and to exclude vocabulary words presented with information that were inaccurate (“A plant grows in your stomach if you eat a seed”), non-extendable (“Jenny’s favorite color is green”), or purely descriptive (“The dog is running to see his friends”). While children might incidentally acquire the meaning of these words, these learning situations were not likely designed with the intention teaching explicit definitions of a new word.

Coding of screen-based pedagogical supports

SBPS for vocabulary acquisition were coded according to an iteratively-developed codebook. The research team watched a total of 20 episodes from 20 different programs in the weighted sample to identify pedagogical supports for vocabulary acquisition. Codes were then developed through an iterative process of meetings and discussion. Pedagogical supports were also informed by dual coding theory (Paivio, 1986) and the theory of synergy (Neuman, 1997, 2009) by accounting for both verbal and nonverbal content. After an initial round of coding by three research assistants, approximately 28 pedagogical supports were identified. These supports were brought to the research team, discussed, and piloted for additional coding. A final codebook was created with 11 SBPS for vocabulary acquisition after multiple rounds of discussion, refining, and piloting. These 11 codes were categorized as: (1) using *explicit definitions*, (2) using *visual effects*, and (3) using *attention-directing cues* (see Table 1). Moreover, these pedagogical supports were not mutually exclusive as a vocabulary word could be taught using multiple supports.

Explicit definitions occurred when characters used various SBPS to explicitly define the vocabulary word (“A conductor is someone who directs an orchestra or choir”). *Visual effects* included SBPS that provided visual definitions of words (e.g. A character says, “This is a pumpkin,” followed by an isolated image of a pumpkin on the screen). Visual effects did not require an explicitly stated definition, as preschoolers could learn words through effective visual supports and a vocabulary label (Paivio, 1986). *Attention-directing cues* included SBPS that draw children’s attention to particular objects or characters on screen. These were coded when something on screen commanded children’s attention, for example, a character saying, “Look at that!” or strategically-timed sound effects. Because *attention-directing cues* capture children’s attention, but do not necessarily provide them with an educational experience (e.g., a sound effect during a scene change), *attention-directing cues* were always coded in conjunction with *explicit definitions* or *visual effects* that did provide explicit support for vocabulary learning.



Table 1. Codebook of Screen-based Pedagogical Supports.

Screen-based Pedagogical Support	Example	Source
<i>I. Definitions</i>		
A. Do characters explicitly state the definition of the target word?	"A subway is an underground train."	Bubble Guppies
B. Do characters explicitly state the definition <i>and</i> discuss features of the target word?	A: "Which of these shapes matches the big piece with four sides?" [pause] B: "This one." A: "Right, the rectangle has two short and two long sides just like the picture." "A career is a job that you train for that you expect to have for a long time. That could be an architect, a teacher, a scientist..."	Bubble Guppies Sesame Street
C. Do characters explicitly state the definition <i>and</i> give examples or tell the category of the target word?	"There are a lot of tal... [pause]... [insert picture support in bubble]... buildings!" "This is a honeybear. Look at him, all the way from South America."	Bubble Guppies Sesame Street, Classics
<i>II. Picture Support</i>		
A. When the target word is said, is there an isolated picture of the target word or visual effects around the isolated target word?	"Elmo and I are gonna show you someone to take a nibble of this little cracker."	Sesame Street
B. When the target word is said, does the character have the object as a prop?		
C. To teach the target word, do characters demonstrate the function of the target word? (usually for verbs)		
<i>III. Viewer Attention and Interaction</i> (in conjunction with categories 1 or 2)		
A. Before the target word is said, do characters say something or point to something to get viewers' attention?	A: "Hey! The spikes moved!" [Daniel Tiger points to the lizard] B: "That's right! That's because the scary thing you saw was a lizard. See?"	Daniel Tiger's Neighborhood Dora the Explorer
B. When the target word is taught, are there sound effects to get viewers' attention?	"Is this box shaped like a square?" [digital clicking sound effect] "Right! The big square box!" A: "Where are you? Do you see any pigeons?" B: "Right there on your head!" A: "My head? [looks up] Ahhh pigeon!"	Bubble Guppies
C. When teaching the target word, do characters use humor to get viewer's attention?	"We have to get to the yellow subway. We need your help! Will the red subway take us to the yellow subway?"	Bubble Guppies
D. Do characters repeat the target word 3 or more times to get viewers' attention?	A: "How about a piece of fruit?" B: "Hmmm... a piece of fruit would be great! Which of these is a piece of fruit?"	Blue's Clues
E. Are viewers asked to select or guess the target word?		

Coding of word difficulty

We examined the types of words being taught in our program sample. Without a list in the literature of high-leverage words that three and four-year-old children should be taught, we used existing category systems that examined word sophistication since previous research (Rowe, 2012; Weizman & Snow, 2001) found type of word related to later child learning. The use of multiple lists follows previous research (Wright & Neuman, 2013) that triangulated three vocabulary lists. These lists included Biemiller's (2015) *Words Worth Teaching* list, the Dale-Chall word list (Chall & Dale, 1995), and the Beck and Beck and McKeown's (1985) framework for identifying appropriate vocabulary words for instruction. First, Biemiller (2015) notes that many words learned in early childhood have concrete meanings. He outlines lists of words - Easy, High Priority, and Difficult - that students should focus on in kindergarten through 2nd grade. Second, Dale-Chall lists familiar words that often have concrete meaning and are used frequently in the primary years. Third, Beck and McKeown (1985) offer a heuristic that establishes three tiers of words. Unlike Biemiller and Dale-Chall who present lists of words, Beck and Beck and McKeown's (1985) is a framework whereby subjective decisions are required to place words into one of three tiers. In addition, Beck and McKeown (1985) was created for vocabulary instruction in the elementary grades. However, without a similar framework for vocabulary instruction in early childhood education, we find it a useful measure when considering types of words. Together, the three lists allowed us to analyze words according to a leveling system and provided us with a nuanced understanding of word sophistication.

Inter-rater reliability

Learning situations were coded in real time by two trained research assistants. The research assistants were Master's degree candidates with experience in teaching literacy to preschoolers. In training, the research team engaged in discussion on inclusionary and exclusionary criteria for on screen vocabulary learning situations. A flow chart was used across randomly selected episodes from the sample to enhance coder reliability (see Figure 1). Assessing 10% of the weighted sample, each researcher submitted their codes, which were measured against the second author's codes. Averaging each researcher's percent agreement with the author, we calculated an inter-rater reliability of 87.3%. Disagreements were flagged and resolved through further discussion.

Pedagogical supports were added to the flowchart to strengthen inter-rater reliability among coders. Research assistants were trained with the flowchart (Figure 1), resulting in pedagogical support codes related to *explicit definitions* (i.e., 1A-1C), *visual supports* (i.e., 2A-2C), or *attention-directing cues* (i.e., 3A-3E). Then, five episodes were viewed by the three coders, two research assistants and the second author. Percent agreement with the second author was 82.1% for identifying SBPS. Disagreements and areas of uncertainty were flagged and resolved through discussion.

Word difficulty was measured according to Beck and Beck and McKeown's (1985) three tiered framework. Tier 1 includes words children typically know and use, such as *banana* and *dog*. Tier 2 words are used across a variety of domains and recommended for instruction, such as *observe* and *analyze*. Tier 3 words occur with low-frequency and are often used in a specific domain, such as *archeology* and *paleontologist*. Research assistants were trained to assign vocabulary words to one of the three tiers. After training, the two research assistants independently coded the same forty vocabulary words from the sample, and submitted their codes to the second author. Codes were calculated with percent agreement to

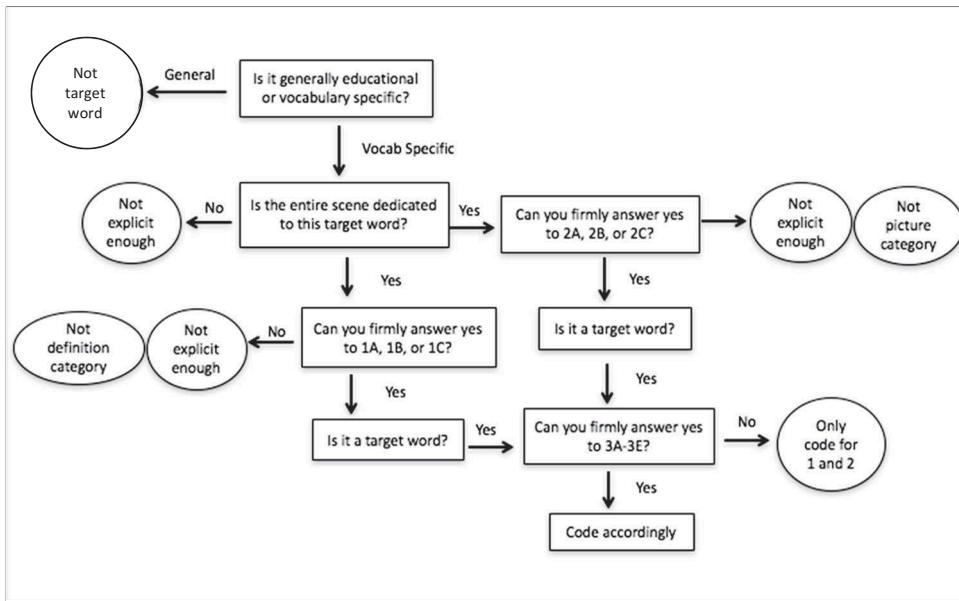


Figure 1. Flowchart identifying explicit vocabulary learning experiences and screen-based pedagogical supports.

the second author, which established an inter-rater reliability of 95%. Disagreements and areas of uncertainty were flagged and resolved through discussion. In addition, coding words according to Biemiller (2015) and Dale-Chall (1995) did not require inter-rater reliability because they are objective lists of words.

Results

The following section reports the findings from our content analysis. Our weighted sample of 200 videos consisted of 112 different programs. The sample totaled 108.9 hours of educational media for preschool children, with an average of 32.7 minutes of coding per episode. We first examine the extent of vocabulary opportunities in the sample, focusing on the number of words addressed and the amount of time these words were taught. We then turn to a discussion of the vocabulary words selected, examining whether the words found in our sample are familiar or sophisticated.

Extent of learning situations

To examine the extent to which educational screen media focuses on vocabulary development, we reviewed the number of words taught and the amount of time spent teaching words per episode. Of the 200 episodes, 68 did not include any moments of vocabulary instruction. In the remaining 132 episodes that included vocabulary, only 3.13 minutes of each episode, 7.54%, was used to teach vocabulary. Even though we found vocabulary instruction was a small portion of the programming, an average of 9.89 words were taught per episode when vocabulary was included. Each vocabulary word had an average of 19 seconds of screen time.

Levels of words found

To explore the vocabulary taught in educational media for preschoolers, we used three measures to triangulate word choice: Dale-Chall (Chall & Dale, 1995), Biemiller (2015), and Beck and McKeown (1985). Overall, according to all measures, words included in educational media were considered easy and familiar to preschool-aged children (See Table 2). The sample of 1,306 words typically included words such as *apple*, *bird*, and *spoon*. Examining words in the sample, 56% were Tier 1 words (Beck & McKeown, 1985), 48.9% were Easy for children at the end of grade two (Biemiller, 2015), and 56.2% were considered concrete and common according to Chall and Dale (1995). In other words, vocabulary taught in educational media for preschoolers did not align with those that are considered high-leverage for children (Beck & McKeown, 1985).

Investigating Beck and McKeown's Tier 2 words, such as *observe* and *migration* that are sophisticated and helpful for preschool-aged children, we found they were only included 3.5% of the time. Tier 3 words, such as *bipedal* and *architect*, only made up 39.1% of the sample words. The majority of words in educational media for preschoolers thus appeared to be familiar.

Screen-based pedagogical supports

Our third research question investigated how words are being taught on the screen through the use of SBPS. Three categories of SBPS emerged (see Table 1). Overall, 2,277

Table 2. Word difficulty (N = 1,306).

Measure	Frequency	Frequency of Total Words (%)
Beck & McKeown		
Tier 1	741	56.0%
Tier 2	47	3.5%
Tier 3	518	39.1%
Dale-Chall		
Present	744	56.2%
Not Present		
Biemiller		
Easy	638	48.2%
High Priority	236	17.7%
Difficult	66	5.0%
Not Present	99	7.5%

Table 3. Screen-based pedagogical supports code applications (N = 2,277).

Strategy	Frequency	Frequency of Total Codes (%)
Definition:		
Explicit definition (1A)	209	9.2%
Discuss features (1B)	72	3.2%
Give examples/categories (1C)	36	1.6%
Picture Support:		
Visual effects (2A)	945	41.5%
Use props (2B)	144	6.3%
Give demonstration (2C)	81	3.6%
Attention-Directing:		
Verbal and pointing cues (3A)	149	6.5%
Sound effects (3B)	241	10.6%
Humor (3C)	45	2.0%
Repetition (3D)	277	12.2%
Guess Target word (3E)	78	3.4%

SBPS codes were identified in the sample. Examining the categories of SBPS, *visual attention* codes were applied the most (51.4%), followed by *attention directing* codes (34.4%), and lastly by *explicit definition* codes (13.7%) (See Table 3).

Explicit definition

Vocabulary learning is about making meaning. However, we found SBPS that provided *definitions* for children were only used 13.7% of the time. Characters explicitly stated the definition 9.2% of the time (209 code applications). An example of this is from *Caillou* with the target word, *illustrations*. Caillou looks at a book and says, “There aren’t any pictures!” The teacher responds, “Not yet! The pictures in books are called illustrations. Would you like to make some illustrations for your book?” In this exchange, the teacher clearly states the definition of illustrations.

The second code, when characters explicitly stated the *definition and discussed features* of the target word, occurred 3.2% of the time (72 code applications). For example, in *Dinosaur Train* a paleontologist notes:

An *Allosaurs* is part of a famous group of dinosaurs called *theropods*. Let’s take a look at some of its features: three toed feet, large claws on its hands, lots of sharp teeth for eating meat, and a long tail to help this predator stay balanced.

In addition to noting an *Allosaurs* is a type of *theropod*, the paleontologist supports children in understanding why that is the case by noting features of the target word.

The SBPS used the least, only 1.6% of the time, was when a character explicitly stated the definition and then *gave examples or provided the category* of the target word. For example, in *Bubble Guppies*, Guppy says, “buildings.” Then Adult Guppy says, “That’s right! Building! And the really tall buildings are called *skyscrapers!*”, which provides a definition. Guppy then gives an example saying, “The Big Bubble Building is a *skyscraper!*” and Adult Guppy says “That’s right.” This type of exchange between characters around the meaning of the vocabulary word was seen the least in our sample.

Visual effects

The SBPS used the most (41.5%) was *visual effects*. For example, in an episode of *Word World*, as a character says /St/-/age/, the letters morph into a stage on screen. The second visual effects code, included the character having only the target word object as a *prop* when the word was said. For example, when talking about a *lei* in *Justin Time*, the character is holding a *lei*. This SBPS occurred 6.3% of the time.

The visual effects SBPS used the least was when characters *demonstrated the function* of a target word when it was being taught. This code was only used 3.6% of the time. An example of this is from *Sesame Street* when talking about the word *nibble*:

Halle: That’s a tiger!

Elmo: Well, Tiger says he’s a good nibbler.

Halle: (stuttering) Yea, but he’s got teeth...are you sure he knows what a nibble is?

Tiger: Yes, I do. A nibble is a tiny bite.

Elmo: He seems to, Miss Halle.

Halle: Well ok, uhhh, alright, let’s give it a go. (Halle feeds tiger, who takes a nibble.) Hey, he took a tiny bite! The tiger took a nibble.

This segment is an example of a *picture support* that helps students understand the meaning of the word. It is not just a picture of a *nibble*; as the characters are talking about the word, children see someone *nibble*. This code was used mostly with verbs.

Attention directing

The third SBPS category we found included *viewer attention and interaction* supports. As noted in the method section, these codes were never used in isolation. The attention directing support used the most was *repetition* (12.2%). A vocabulary episode was coded for *repetition* if the target word was said three or more times. For example, in *Bubble Guppies*, when talking about *subways*, the character says, "We have to get to the yellow subway. We need your help! Will the red subway take us to the yellow subway? What about the blue subway? Will the blue subway take us to the yellow subway?" The word *subway* is repeated six times in this segment.

Sound effects was the next attention directing support used the most at 10.6%. In *Telo & Tula: The Apple Pie Adventure*, Tula notes, "Today we're going to make an *apple pie*!" and then the sound of an organ plays as a picture of an *apple pie* appears on the screen. *Verbal and pointing cues* were used 6.5% of the time. As another example, both *verbal and pointing cues* are used in *Bubble Guppies* while discussing the word *subway*:

Guppy Girl: Gill, look! (verbal cue: the word look) (pointing cue: Guppy Girl points to the subway on the map) It's a lost city *subway*!

Guppy Boy: (Popping out from behind a pillar) A *subway* is an underground train.

Asking children to *guess the target word* and using *humor* were the two least used attention directing supports at 3.4% and 2.0%, respectively. An example of asking viewers to select or guess a target word comes from *Blue's Clues*. The characters are sitting down at breakfast and someone asks, "How about a piece of *fruit*?" Four objects appear together on the screen: a bottle of maple syrup, an apple, a carrot, and a muffin. The character says, "Hmmm... a piece of *fruit* would be great! Which of these is a piece of *fruit*?"

An example of humor as an attention directing cue comes from *Bubble Guppies* when teaching the word *pigeon*:

A: "Where are you? Do you see any *pigeons*?"

B: "Right there on your head!"

A: "My head? (looks up) Ahhh *pigeon*!"

In this moment children would laugh at the character with the *pigeon* on his head. Overall, *attention directing supports* were not used frequently.

Relationships among screen-based pedagogical supports

Given our framing of dual coding theory, we sought to understand the relationships between the pedagogical supports. The *definition* code category is a verbal message, where someone or something is sharing the meaning of a word. There is an image on the screen, but the SBPS is a verbal one. The *picture support* codes and attention and

interaction codes include a combination of verbal and nonverbal cues. We analyzed the codes in relation to one another to see if patterns or trends emerged among verbal and nonverbal codes.

Strategies were typically used in isolation 46.8% of the time. Two SBPS were used 36.6% of the time and even fewer adopted three SBPS together (13.9%). Four SBPS were used 2.4% of the time, five were used 0.46% of the time and six were used 0.08% of the time. These results indicate that educational media typically used one or two SBPS simultaneously for target vocabulary instruction. It is not evident that SBPS were paired with one another in an intentional way to impact children's experience.

The SBPS used the most on its own was the category *picture support*, occurring 85.1% of the time. Breaking down the type of *picture supports*, a picture or *visual support* accompanied the target word 70.5% of the time, *props* were used 9% of the time, and 5.6% of the time characters *demonstrated the function* of the target word. On the other hand, a *definition* SBPS was used in isolation 14.9% of the time; within these code applications, characters *explicitly stated the definition* 12.3% of the time, 1.1% of the time characters stated the definition and *discussed features* of the target word, and 1.5% of the time the definition was stated and an *example* was given or the *category* of the word was shared.

Discussion

The purpose of this study was to examine the prevalence and characteristics of vocabulary instruction in educational media. Of the 200 videos we studied, only 132 included vocabulary learning situations. In those 132 episodes, vocabulary instruction appeared for an average of 3.3 minutes, or 7.54% of an episode, which was surprisingly infrequent considering the importance of vocabulary development and the claims of educational content in screen media for preschool-aged children. Familiar words were used for instruction 56% of the time, suggesting children may be learning words that they already know and indicating an opportunity lost when viewing educational media programs. What is promising, however, is that our content analysis revealed a fine-grained understanding of how educational media might be providing vocabulary instruction to young viewers. Specifically, we offer 11 SBPS that can be used by media producers and future researchers to further investigate their potential impact on vocabulary learning in young children.

In this study, we found educational media programming rarely includes sophisticated words. These findings are similar to Hiebert's (2005) results from an examination of word selection in vocabulary curriculum; most of the words were familiar and the second largest group included rare words. Beck and Beck and McKeown's (1985) framework was designed for elementary age children, yet the familiar words in Tier 1 align with non-sophisticated words used in studies on preschoolers' vocabulary (Rowe, 2012; Weizman & Snow, 2001). It appears that the majority of vocabulary in educational screen media for preschoolers are not sophisticated words that may benefit young children (Rowe, 2012; Weizman & Snow, 2001).

The three categories of SBPS: *definition*, *picture supports*, and *attention directing cues* are all types of strategies used in vocabulary instruction. However, the supports that are highest leverage (e.g., *repetition* and *providing a definition*) for in-person instruction are

used infrequently (3.5%), despite the theory of synergy that asserts multiple presentation of information might facilitate deeper learning (Neuman, 1997). More research is needed to know if proven classroom instructional strategies are also best practices in educational media. However, there is some research to show that practices such as repetition are beneficial across contexts. In our sample, the *repetition* SBPS was noted if a word was repeated three or more times. This support was used 12.2% of the time, which leaves room for improvement, considering research demonstrates that repetitions facilitate vocabulary learning from screen media for four- to six-year-old children (Skouteris & Kelly, 2006). *Repetitions* may be a useful technique for educational media to expand.

Research on the content of educational media is garnering more attention. Like the current study, Larson and Rahn (2015) addressed vocabulary instruction in educational media, but utilized a narrow lens of one program segment – *Word on the Street*. Our study uses a larger representative sample of programs to analyze the prevalence of vocabulary in all of educational media. In line with our differences in sample, Larson and Rahn found the majority of *Word on the Street's* target words were more sophisticated than what we found across diverse educational media programs. What is interesting in comparing our results with the content analysis of *Word on the Street* is there is some alignment in the strategies used. Specifically, both verbal and nonverbal supports are used to scaffold vocabulary learning according to dual-coding theory (Paivio, 1986). Methodologically, our study also approaches a content analysis with a weighted sample of educational media, which provides us with a clear snapshot of the media marketplace for preschoolers.

While this content analysis makes valuable contributions, it also has limitations. First, the criteria used to evaluate words was based on an older age group. To address this, we selected the best available measure that aligns with research on preschool vocabulary instruction. More research needs to be conducted to determine if these best practices are aligned. Additionally, while we sought an exhaustive sample of educational media for three and four-year-olds, new shows are always emerging. Still, the current study was based off of a representative sample of all programming in the current media marketplace. Despite these limitations, the study offers contributions to the growing body of research on educational media for young children.

There are many purposes for designing educational screen media for young children. For example, exposing children to science (*Peep and the Big Wide World*), socio-emotional scenarios (*Daniel Tiger's Neighborhood*), or professional careers (*Doc McStuffins*). Given the nature and impact of vocabulary knowledge on young children, future research may consider examining how vocabulary can be embedded in educational media across content areas. Currently, the vocabulary instruction in educational media is limited. This study illustrates the need for more sophisticated words in educational media for pre-school children and has uncovered 11 SBPS used in educational media to promote vocabulary learning, which is promising. Additional research needs to be conducted to explore the influence of specific SBPS on children's learning outcomes, which is now possible with identified and labeled pedagogical supports on screen. As children spend more and more time in front of screens, it is imperative that we better understand the content of educational media and its influence on learning.

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