

Exploring word characteristics and evidence-based vocabulary teaching strategies used in children's television programs

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Abstract: Media has become a consistent part of children's learning environment with the potential to influence language development. Specifically, television provides exposure to authentic language input, pronunciation, prosody, and contextual use of words. While studies to date have informed the general effects of media on children's learning, information about the words targeted and the extent to which vocabulary teaching strategies are embedded in children's educational media is limited. Further, little is known about whether the lexical characteristics of the vocabulary used in educational media align with features described in the literature on child-directed speech (CDS). To address this paucity of evidence, the present study explored characteristics of target vocabulary including quantity, grammatical category, and age of acquisition, as well as the strategies employed to expose children to words in educational media. Specifically, we were interested in the use of repetition, definition, and elaboration, three evidence-based vocabulary teaching strategies. Eight episodes of six popular children's educational television programs were analyzed. Results indicated variability in the number of words targeted within and between programs and that the primary lexical category targeted consistently was nouns, with adjectives and verbs also occurring in some programs. The age of acquisition of the words being targeted varied within and between programs. Repetition was the most used vocabulary teaching strategy followed by definition and lastly, elaboration. Findings are interpreted in relation to lexical characteristics and strategies described in the CDS literature.

Keywords: television vocabulary; children's educational media; evidence-based vocabulary teaching strategies

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Citation: Dubasik, V. L., Kalhori Boroujerdi, S., & Greene, R. C. (2026). Exploring word characteristics and evidence-based vocabulary teaching strategies used in children's television programs. *Language Development Research*, 6(1), 125-160. <http://doi.org/10.34842/ldr2026-1008>

Introduction

One of the most influential factors in children's development is the environment in which they are exposed to language. In recent decades, media has become a consistent part of children's learning environment that offers a new source of language input. What differentiates language in media from language in children's everyday environments is that media, especially passive media, which traditionally presents information in a one-way manner, cannot create reciprocal interaction that is considered essential for language learning. Nevertheless, media still provides input related to events and experiences surrounding the child and exposure to novel words which make it like the speech directed to children in their daily interactions (Hoff, 2006; Rice & Haight, 1986). This in combination with the ever-growing presence of digital screens has prompted the examination of children's media content to inform the influence of aspects of media that may shape children's development (e.g., Alroqi et al., 2023; Lauricella et al., 2015; Vandewater et al., 2007).

Despite empirical support for language learning from environmental input, research on vocabulary learning from TV has reported varying and sometimes contradictory findings (e.g., Becker, 2013; Kirkorian et al., 2008; Rice & Woodsmall, 1988). Whereas some studies report negative effects of media on children's vocabulary (e.g., Martinot et al., 2021), others report positive effects. For instance, Becker (2013) found that screen exposure did not significantly affect novel word learning in 30- to 36-month-old children, however, it was associated with smaller expressive vocabulary sizes. In a later study, Taylor and colleagues (2018) examined the effects of screen media exposure on young children aged 6 to 36 months and found that exposure was not related to children's vocabulary size. Studies on incidental vocabulary learning indicate that children can acquire unfamiliar words simply by watching TV. Rice and Woodsmall (1988) conducted an experimental study to determine whether preschool aged children could acquire new vocabulary words through watching TV when the words were embedded in a meaningful narrative. Children in the sample learned object and attribute words more easily than affective state words, suggesting that visual reinforcement played a role in the learning process.

Since vocabulary acquisition is such a critical aspect of language development in early childhood and vocabulary knowledge and word-learning abilities are strong predictors of later language outcomes (Legacy et al., 2018), expanding our understanding of the language input children receive from screen media and the role it plays in language development is imperative. For that reason, we were interested in exploring the content of popular children's educational programs to better understand the language input children are receiving through watching media. Our goal was to provide a description of the vocabulary the program creators were targeting and the strategies used to expose children between the ages of 2-8 to words, since a great deal of lexical development occurs during this time.

In the following sections we provide a brief overview of related lines of inquiry that lay the foundation for the present study. In the first section, we present studies on characteristics of child-directed speech (CDS) that are shown to influence vocabulary and provide an interpretive lens for our work since effects of CDS on children's language are well known. Next, we discuss work on word learning via implicit and explicit exposure followed by studies that have explored characteristics of vocabulary in CDS and media to link the word learning contexts. Finally, we review studies examining vocabulary teaching strategies that align with CDS and are known to support word learning.

CDS and Vocabulary Development

A substantial body of research demonstrates that CDS differs systematically from adult-directed speech (ADS) and that these differences support early language development (Golinkoff et al., 2015; Soderstrom, 2007). Multiple CDS features—including prosody, lexical diversity, and structured repetition—have been linked to phonological development, word segmentation, and vocabulary growth (Huttenlocher et al., 2010; Jones et al., 2023; Snow, 1972; Soderstrom, 2007). Studies show that prosodic patterns typical of CDS promote word segmentation (Thiessen et al., 2005) and support early word learning (Ma et al., 2011), and that the vocabulary features of CDS that are linked to lexical development change systematically with children's age.

Caregivers' speech to infants contains a high proportion of concrete nouns, highly frequent words, and repetitive lexical items (Bornstein et al., 1992). In contrast, CDS directed to toddlers and preschoolers becomes more lexically diverse and includes greater use of verbs (Tubul-Lavy et al., 2020), relational terms, and less frequent vocabulary items (Huttenlocher et al., 2010). CDS also commonly contains diminutive and reduplicated forms (e.g., doggy, choochoo), which have been shown to facilitate segmentation and support vocabulary acquisition (Ota et al., 2018).

In a large corpus analysis, Jones et al. (2023) found that CDS differs from ADS in systematic lexical properties: CDS contains proportionally shorter, more frequent, higher density, and lower phonotactic probability words compared to ADS. These features closely resemble the structure of children's early vocabulary (Jones et al., 2023). Although children can form initial lexical hypotheses from minimal exposure (Carey & Bartlett, 1978), these early representations are often incomplete and benefit from repeated and enriched input. Thus, the distributional properties of CDS may align with children's developing lexical systems while repeated exposure helps stabilize and elaborate emerging word meanings.

A growing body of cross-linguistic research shows that CDS also frequently incorporates structured repetition, which may further support vocabulary learning (Lester et al., 2022). A prominent form of structured repetition is the use of variation sets, in

which caregivers produce clusters of successive utterances that reuse key lexical items while varying the syntactic or pragmatic frame (Küntay & Slobin, 1997). Küntay and Slobin (1997) reported that approximately 21% of maternal utterances occurred in such sets and that verbs were repeated in 81% of these cases, often with morphological variation but consistent semantic content. By providing multiple, contextually varied exemplars, variation sets may facilitate lexical mapping and promote semantic refinement. Although causal evidence varies across features and developmental stages, converging evidence indicates that CDS contains attributes that can differentially facilitate children's language learning.

Implicit and Explicit Word Learning

Research on word-learning and vocabulary has informed us of the types of exposure that influence children's vocabulary. The rich literature on the effectiveness of incidental word-learning, also known as fast-mapping, shows positive effects of incidental exposure to words (Carey & Bartlett, 1978). A considerable proportion of children's lexical development appears to rely on implicit learning and inference-based learning mechanisms. This is reflected in rapid vocabulary growth and children's ability to use categorical knowledge to infer meanings of novel words. Vocabulary learning could be enhanced through implicit vocabulary exposure that is complemented by explicit vocabulary teaching. While implicit exposure is essential for achieving the volume of vocabulary growth observed in development, explicit instruction has been shown to play a particularly vital role in supporting the learning of low-frequency words and in highlighting form-meaning mappings (Beck et al., 2002; Neuman et al., 2011).

Whereas incidental word learning can occur through social interactions with peers and adults and by overhearing speakers in the environment, explicit word learning happens through direct instruction such as by pointing to or labeling pictures representing objects and actions (Gillam et al., 2014; Reiser et al., 1984), providing definitions and elaborating on word meaning by using target words in context, and associating words (Becket al., 1982). Gillam et al. (2014) evaluated the effects of explicit vocabulary instruction with children ages 6;6 to 7;4 and found that instructions that included an introduction to target words and definitions yielded higher scores on vocabulary measures for children in the experimental group.

Although the benefits of these strategies are well established in controlled settings, the extent to which the strategies are being utilized and incorporated in naturalistic input such as children's television remains limited. Descriptive studies of CDS used in child-caregiver interactions also offer examples of direct labeling, meaning clarification, and scaffolding (e.g., Snow, 1972; Tomasello & Farrar, 1986) that are consistent with repletion, definition, and elaboration. Thus, explicit vocabulary teaching strategies may naturally occur during interactions and intentionally be used in edu-

cational media contexts. Additionally, understanding the input children receive via media is important as media exposure is not limited to children with typical language development, but rather includes children with diverse learning profiles and styles (e.g., those with language delay, developmental disorders, or differences in cognitive processing) whose reliance on implicit learning mechanisms alone may not be sufficient to support robust vocabulary growth. Research suggests that learners with language disorders often benefit from more structured and explicit instructional support (Lesaux et al., 2010; Snowling & Hulme, 2012). Taken together, this work highlights the need to explore whether children's television programs provide features of explicit vocabulary instruction that may complement, rather than replace, implicit word learning from media exposure.

Educational Television Programs and Vocabulary

A small number of studies have investigated the characteristics of the words (e.g., Ismail & Salehuddin, 2025; Kolak et al, 2023) and evidence-based instructional support offered (e.g., Danielson et al., 2019; Linebarger & Piotrowski, 2010; Neuman et al., 2019) in educational television programs for children. In general, both vary across programs. Ismail & Salehuddin (2025) conducted a content analysis of Bing, a popular animated series, to examine lexical and syntactic structures in the program. They found that Bing consistently employed high-frequency, concrete vocabulary, short utterances, and frequent repetition, mirroring caregiver speech, while also occasionally introducing novel words and longer constructions. In a similar study Kolak et al. (2023) compared the linguistic input in educational applications for preschoolers with children's books and CDS. They analyzed grammatical constructions and psycholinguistic features linked to CDS including grammatical categories (nouns, verbs, adjectives, etc.) and age of acquisition (AoA). According to their findings, the educational applications used infrequent words, diverse vocabulary, and complex and varied sentences. Additionally, AoA did not differ significantly among CDS, applications and books suggesting that vocabulary used in the educational application was developmentally appropriate.

While some programs rely on incidental learning, others provide clear, structured explicit guidance to promote learning (Danielson et al., 2019; Neuman et al., 2019). Germane to the current study are findings from the limited number of studies examining use and nature of vocabulary teaching strategies. For instance, Danielson et al. (2019) conducted a content analysis of 200 episodes of preschools' educational programs to examine the quality and nature of vocabulary instruction. According to their study, most programs used familiar and easy words and rarely instructed on more sophisticated and high-level words. Vocabulary was explicitly taught in only two-thirds of the episodes, with an average of just 3 minutes (7.5%) of screen time dedicated to vocabulary. The study also identified 11 types of screen-based pedagogical support, such as visual aids, repetition, and explicit definitions, but noted that these

were often used in isolation rather than in combination, potentially limiting their effectiveness. In a similar study, Neuman et al. (2019) examined how educational media supports vocabulary learning in low-income preschoolers. By analyzing 200 streamed episodes, they found that while some programs included vocabulary content, most relied on attention-grabbing cues (e.g., visual/sound effects) rather than explicit vocabulary teaching (e.g., definitions). Eye-tracking results showed that explicit cues drew broader attention, while attention cues led to better word learning, especially in children with stronger language skills.

Despite conflicting findings regarding the impact of TV on speech, language, and cognitive development, television viewing continues to rise (Rideout, 2013; Rideout & Robb, 2021). In a recent study, Gowenlock and colleagues (2024) conducted a scoping review of 93 studies examining children's exposure to language via video media and found that high-quality well-designed media accompanied by explicit scaffolding or adult support, had potential to positively influence language learning. Although the effects were short term and no long-term effects were observed, the review offered insight into the role of content quality and interaction in media-based language outcomes.

Whereas many of the studies in this line of inquiry have mainly focused on environmental facilitators that can increase learning outcomes from watching educational programs such as co-viewing and different types of scaffolding (Karani et al., 2022; Mustonen et al., 2022; Sims & Colunga, 2013), a fewer number of studies have examined the language content quality of educational media applications in terms of the words targeted and specific vocabulary teaching strategies. Although educational applications differ from television in that they involve interactive as opposed to passive viewing, findings from this work offer insight into the effects of media input on language. Results showed that applications used a higher proportion of nouns and fewer verbs and function words than books and CDS, limiting syntactic diversity. Additionally, the vocabulary in applications had a lower average AoA, meaning that children typically learn target words earlier in development. In contrast, books and CDS provided more age-appropriate and linguistically rich input, reinforcing their value for early language learning, although these differences were not statistically significant.

In a related study, Linebarger and Piotrowski (2010) explored how different program formats—narrative vs. expository—and embedded instructional strategies influence children's vocabulary acquisition and comprehension. The researchers examined six educational TV programs and coded features such as literacy environment, comprehension aids, and vocabulary strategies. Of interest to the current study were the findings related to vocabulary strategies. Results highlighted that the strategies of repetition and elaboration were particularly effective at enhancing children's learning. Repetition of target words and key content improved vocabulary retention and comprehension, especially when embedded within familiar narrative structures. Simi-

larly, elaboration strategies, such as activating prior knowledge and encouraging predictions, helped children connect added information to existing knowledge, fostering deeper understanding. Narrative programs, which naturally incorporated these strategies in coherent and engaging ways, consistently led to better learning outcomes. The study concluded that educational content is most effective when structured to include frequent repetition and meaningful elaboration of vocabulary within a developmentally appropriate narrative framework. In addition to repetition and elaboration, which were highlighted by Linebarger and Piotrowski (2010) as effective teaching strategies, definition also emerged as an evidence-based strategy that facilitated comprehension and appropriate use of new vocabulary. Taken together, these findings support the notion that media has potential to serve as a valuable supplementary source of linguistic input, offering children scaffolded opportunities for vocabulary expansion and syntactic growth in line with principles of CDS.

The Present Study

The body of work related to children's vocabulary has paved the way for novel studies that examine characteristics of the language used in different contexts such as children's media. The present study aimed to add to the knowledge base by reporting characteristics of target vocabulary words that children are exposed to in popular children's educational television programs and the evidence-based teaching strategies children are experiencing in these programs. Target vocabulary words were specified by program creators/producers and identified using publicly sourced information as described below. Rich descriptions of vocabulary used in children's educational programs (e.g., number, type, AoA) are needed, not to ascertain the age appropriateness of language used in media, but rather to better understand the input children are receiving and inform the intentional selection of programs for individual children. Further, although several features of CDS align with strategies used in other contexts (i.e., repetition), less is known about the prevalence of explicit definition and elaboration. Such strategies may be more characteristic of instructional or media contexts, where lexical support is intentionally embedded. Accordingly, we sought to examine repetition as a strategy grounded in documented properties of CDS, while also investigating definitional and elaborative supports that may extend beyond spontaneous caregiver input.

To contextualize our results, we interpret our findings in relation to characteristics of vocabulary reported in the CDS literature. CDS was not analyzed as a comparison dataset in the present study; rather, it served as a conceptual framework for interpreting patterns observed in children's educational television programs. The research questions (RQs) that guided this study were:

RQ1. What are the number and types of words (grammatical categories) targeted in popular children's educational television programs?

RQ2. Are there differences in the age of acquisition of words targeted in popular children's educational programs?

RQ3. To what extent are children exposed to words via evidence-based vocabulary teaching strategies (repetition, elaboration, and definition) in popular children's educational television programs?

Method

Program and Episode Selection

Six children's educational television programs were selected for analysis based on the following criteria: (a) availability through the Public Broadcasting Service (PBS), (b) inclusion of explicit educational content, (c) explicitly stated emphasis on vocabulary, and (d) stated appropriateness for children aged 2 to 8 years. Although additional programs met these criteria, complete episodes were not consistently available. The final sample therefore included *Martha Speaks* (Greenwald et al., 2008–2014), *Sesame Street* (Ganzert & Kontra, 1969–present), *Sid the Science Kid* (Henson et al., 2008–2012), *Super Why!* (Santomero et al., 2007–2016), *WordGirl* (Fernandes & Knapp, 2007–2015), and *Word World* (Moody et al., 2007–2011).

Program descriptions and publicly available information were used to confirm alignment with the inclusion criteria. According to PBS Media, *Martha Speaks* (<https://nhpbs.org/schedule/series.aspx?progName=Martha+Speaks>) is an animated series designed to enrich the vocabularies of 4- to 7-year-old children through narrative and humor. *Sesame Street* is a long-standing educational program with strong empirical support for vocabulary growth particularly during the preschool years (Rice et al., 1990; <https://sesameworkshop.org/topics/language-literacy/>), when early language skills have the largest impact on later academic success. *Sid the Science Kid* is an animated sketch-comedy series that promotes science-readiness for 3- to 6-year-old children by encouraging curiosity and inquiry about the world (<https://www.henson.com/sid-the-science-kid-everybody-move-your-feet-celebrates-national-physical-fitness-and-sports-month/>). *SuperWhy!* is an animated adventure series that targets emergent literacy including vocabulary, through interactive story story-based problem solving for 4- to 8-year-old children (<https://9story.com/portfolio/super-why/>). *WordGirl* emphasizes vocabulary expansion for 6- to 8-year-old children through exposure to new words embedded in humorous narratives (<https://wgte.pbslearningmedia.org/collection/wordgirl/>). *Word World* is a series for children aged 3-6, that supports emergent literacy development including vocabulary, through visually explicit word-based problem solving (<https://www.wordworld.com/about/word-world>). Program name, brief description, number of words targeted, season and episode numbers, and original airdates are presented in Table 1.

Table 1. Program Characteristics and Episode Details

Program (Pro- duction Years)	Airdate	Age Range	Episode Length	Number Words Targeted	Description
Martha Speaks (2008 – 2014)					
S1E39	11-28-2008	4 – 7 yrs	26 - 27 mins	10 – 22	Main character solves a problem
S2E1	9-14-2009				
S2E12	1-3-2010				
S2E15	1-23-2010				
S3E2	1-30-2010				
S3E6	2-3-2010				
S4E5	4-4-2012				
S6E2	4-1-2014				
Sesame Street (1969 – Present)					
S38E16	9-18-2007	2 – 5 yrs	57 mins	1	Several short segments with different themes and characters
S40E4	11-13-2009				
S40E9	11-12-2009				
S41E23	12-28-2010				
S42E32	12-1-2011				
S45E7	10-8-2014				
S45E9	10-31-2014				
S45E14	1-12-2015				
Sid the Science Kid (2008 – 2015)					
S1E9	9-11-2008	3 – 6 yrs	25 mins	1 - 2	Main character attends school and learns a new science concept
S1E21	10-27-2008				
S1E26	2-14-2009				
S2E5	10-7-2010				
S2E9	11-11-2010				
S2E10	4-18-2011				
S2E13	4-21-2011				
S2E23	1-13-2012				
Super Why! (2007 – 2016)					
S1E21	2-16-2008	3 – 6 yrs	26 mins	1 - 3	Main characters work together to solve problems or answer questions
S1E47	6-3-2009				
S1E58	1-22-2010				
S1E62	7-12-2010				
S2E6	1-16-2012				
S2E10	6-12-2012				
S3E3	8-19-2015				
S3E12	1-12-2016				
WordGirl (2007 – 2015)					

S1E4	9-8-2007					
S1E20	8-1-2008					Main
S3E6	10-11-2010					character
S4E1	9-5-2011	4 – 8 yrs	24 - 26 mins	5		defeats a
S5E4	9-13-2012					villain or
S6E3	8-7-2013					solves a
S7E4	8-7-2014					problem
S8E2	6-12-2015					
Word World (2007 – 2011)						
S1E2	9-4-2007					
S1E3	9-5-2007					Characters
S1E16	4-7-2008					solve
S1E18	5-5-2008	3 – 5 yrs	25 mins	2 - 3		problems
S2E3	4-13-2009					relating to
S2E5	5-12-2009					target words
S3E2	10-5-2010					
S3E3	11-1-2010					

For each program, lists of aired episodes were obtained from PBS Kids program pages (pbskids.org) and cross-referenced with publicly available sources including, TVGuide (<https://www.tvguide.com>), YouTube (<https://www.youtube.com>), IMD (<https://www.imdb.com/>), Google search results (<https://www.google.com/search>), and the Internet Archive (<https://archive.org>), to confirm viewing availability. Episodes were assigned numerical identifiers based on airing order. Eight episodes per program were randomly selected using Random.org (<http://www.random.org>), a sample size chose to balance representativeness and feasibility. Episodes were sampled across seasons to capture potential changes in word-selection practices over-time. The sole exception was Sesame Street, for which only episodes from seasons 38-45 were eligible for selection (see details below).

Target Words

Target words included in the analyses were those explicitly designated by program creators or producers as main vocabulary within episodes. For most programs, target words were obtained from publicly available online sources and then confirmed during episode viewing. The sole exception was Sid the Science Kid, for which no public word lists were available; in this case, target words were identified during episode viewing.

Upon accessing the main source links provided below, individual episode pages were consulted to identify words labeled as target vocabulary (e.g., “Word of the Day,” “featured words,” or explicitly introduced by a speaker or on-screen text). During view-

ing, a word was confirmed as a target word if it was explicitly introduced, labeled or highlighted by the program as a focal vocabulary item (e.g., “Today’s word is___”). Across all programs, target words were therefore readily identifiable in episode transcripts and audiovisual cues. Although not all programs described explicit procedures for target vocabulary selection, each provided general descriptions of curricular goals and types of vocabulary targeted. See LDR_Data in the OSF repository for the full list of target vocabulary.

Martha Speaks. Vocabulary selection for Martha Speaks was based on literacy expert input as described by the program’s literacy consultant, in a recorded interview (Reading Rockets, 2014). Whereas earlier seasons of the program targeted more words per episode (up to 22), later episodes targeted a smaller set (approximately 10). Target vocabulary included both basic and advanced words: basic words were typically supported implicitly through context, while advanced words were explicitly defined for viewers. Target words for episodes of Martha Speaks were obtained from episode descriptions, publicly available at [https://marthaspeaks.fandom.com/wiki/Martha_Speaks_\(episode\)](https://marthaspeaks.fandom.com/wiki/Martha_Speaks_(episode)).

Sesame Street. According to Sesame Workshop, key vocabulary words for Sesame Street were selected by literacy consultants and included descriptive words (e.g., adjectives) as well as words supporting social-emotional language growth (https://sesameworkshop.org/wp-content/uploads/2023/02/wots_parent_eng2.pdf). Vocabulary words were featured in the “Word of the Day” or “Word on the Street” segments of each episode and linked to a broader developmental theme. The “Word of the Day” segment, later renamed “Topic of the Day,” was introduced at the start of episodes in seasons 38-45; accordingly, only episodes from these seasons were included. Target words were obtained from publicly available episode descriptions: https://muppet.fandom.com/wiki/The_Word_of_the_Day.

Sid the Science Kid. Content for Sid the Science Kid was developed by experts in education and child development to support science readiness in preschool-aged children. Vocabulary presented in the program was organized thematically and related to science and STEM concepts appropriate for preschool-age children. Target words included terms related to science tools, processes, inquiry and life, and earth science. In each episode, target words corresponded to responses to a question posed by the main character at the start of each episode and were identified during viewing.

Super Why!. Super Why! was developed by 9 Story Media Group (<https://9story.com>) in collaboration with a research and curriculum team comprising educators and literacy experts, with expertise in child development. The program curriculum, guided by the National Reading Panel, addresses multiple aspects of literacy, including vocabulary. In each episode, target words functioned as solutions to the “super story” problem. Target words were obtained from publicly available epi-

sode descriptions (https://superwhy.fandom.com/wiki/Super_Why!#Episodes) and easily identifiable during viewing through on-screen text.

WordGirl. WordGirl emphasizes vocabulary expansion and enrichment through implicit exposure, rather than explicit instruction, although strategies examined in the current study were present. Vocabulary targets were explicitly stated at the start of each of the two main episode segments (e.g., “Today’s featured words are ___ and ___” or “Listen for the words ___ and ___”). An additional fifth word was introduced between segments, during the “May I Have a Word” feature. Target words were obtained online from publicly available episode descriptions (<https://wordgirl.fandom.com/wiki/Episodes>).

Word World. Word World was designed to support emergent literacy skills, including vocabulary acquisition, in preschool-age children. As described on the program website (<https://www.wordworld.com/about/word-world>), the curriculum is grounded in empirical reading research and developed in consultation with literacy experts in child development, psychology, and education. Vocabulary targeted in each episode was related to the central problem being addressed and typically appeared across one or two segments as characters collaborated to reach a solution. Target words were obtained from publicly available episode descriptions on Word-World (<https://www.wordworld.com/about/episode-descriptions>).

Content Analysis and Coding Procedures

Content was analyzed to describe the vocabulary targeted in the programs including the number of target words per episode, grammatical categories (i.e., noun, verb, adjective, adverb) of target words and age of acquisition of each target word. Episodes were also analyzed for the three evidence-based vocabulary teaching strategies (repetition, definition, and elaboration) shown to positively influence vocabulary acquisition.

Once the final words for each program were confirmed, the grammatical category and age of acquisition of the words were determined. Grammatical categories were based on the definition provided in the episode and the AoA was based on Kuperman et al. (2012). For 98% of the target words, the form of the word throughout the episode was consistent with the definition, and the grammatical category originally assigned based on the definition. If an alternate form of a target word was used, it was coded if the grammatical category did not change. For instance, for the target word supreme (adjective), supremely was coded since it was also an adjective, however, for accomplish (verb), accomplishment (noun) was not coded since the definition given was for the verb.

Episodes were coded in their entirety for use of three evidence-based strategies. Strategy use was coded per word. Coding was based on operational definitions adapted from Linebarger and Piotrowski (2010) and Linebarger et al. (2017). Specifically, repetitions were coded for each occurrence when characters used a target word after its initial mention within the episode. There were no exceptions to this rule. Each repetition of a word was counted irrespective of the speaker or context (e.g., conversation, song). If the first mention of a target word occurred within a definition, it was not counted as a repetition. Definitions were coded when characters explicitly provided the meaning of a target word. Both simple, stand-alone definitions (e.g., The universe is everything) and more complex definitions containing advanced vocabulary (e.g., The universe is the totality of space, time, matter, and energy) were included. Elaborations were coded when characters extended a target word beyond its definition by providing contextualized examples, scenarios, or explanations. If no definition was provided for a target word, elaborations were not considered. When multiple strategies were used simultaneously, they were coded individually to capture all occurrences of each strategy. Additionally, when a repetition occurred within a definition or elaboration, it was noted as such. For instance, in the following example from *Sesame Street*, the target word *pumpernickel* had five repetitions (1 within definition, 4 independent), one definition and two instances of elaboration:

Murray: What's the word on the street?

Child1: Pumpernickel (initial mention – not counted)

Murray: What does pumpernickel mean? (2nd mention – repetition)

Child1: Pumpernickel, that's a type of bread. (3rd mention – repetition / definition)

Child2: It's really brown and dark. (elaboration)

Child3: Tastes a little bit sour. (elaboration)

Child4: Pumpernickel. (4th mention – repetition)

Adult: Oh pumpernickel (5th mention – repetition)

Murray: Keep listening for the word pumpernickel on *Sesame Street* (6th mention – repetition)

Inter-Rater Reliability

Word characteristics and teaching strategies were coded independently in real time by the first and third authors. Coding reliability was based on 10% of the total number of episodes ($n = 4$ episodes) which contained 47 of the 228 total target words (20.6%). Percent agreement for grammatical category and AoA of the 47 target words was 100%. Percent agreement for number of words repeated (45/47) and number of repetitions (424/424) was 100%. Agreement regarding the number of words defined (26/47) was 100%. Agreement on the number of definitions for the 26 words (37/44) was calculated at 84.09% then 93% (41/44) following a review and modification of the coding rule. Initial discrepancies concerned simplicity and were resolved following discus-

sion and establishment of a more precise rule that included any definition that could stand alone, albeit simple. Across the 47 words in the four episodes, the percent agreement for number of words elaborated (25/47) was 100%, and agreement on number of elaborations per word was 90.4% (57/63) indicating strong reliability in all coding procedures.

Analyses

Descriptive and inferential analyses were conducted using SPSS to determine a) the number and types of words targeted within episodes and programs (RQ1), b) the mean age of acquisition (AoA) of targeted words (RQ2), and c) the frequency of use of vocabulary teaching strategies employed in eight episodes each of six popular children's educational programs (RQ3). RQ1 was developed to provide a description of the lexical items targeted in terms of number and grammatical categories of the words children are exposed to in each episode and program. RQ2 was designed to descriptively characterize the developmental level and internal consistency of lexical input across and within educational programs. AoA values were drawn from Kuperman et al. (2012), which provide adult-estimated AoA ratings reflecting the age at which a word is typically learned. AoA has been implicated in word-learning based on associations between children's word usage and comprehension and the frequency of and exposures to words used in CDS (Chang & Deák, 2020; Childers & Tomasello, 2002). We used AoA to operationalize developmental accessibility of lexical representations, which is directly relevant to our research question. Words with earlier AoA are more likely to be supported by existing lexical and semantic networks, whereas later-acquired words place greater demands on learning mechanisms (Elsherif et al., 2023; Juhasz, 2005). AoA values were assigned at the individual word level and then aggregated to episode and program level means. Because the programs differed in both the number and lexical composition of target words, direct statistical comparisons of mean AoA across programs were not conducted, as such comparisons would be difficult to interpret and statistically infeasible. Within-program analyses were conducted to assess episode-level variability in lexical difficulty, independent of assumptions about intentional instructional design. This variability provides an empirical measure of how consistent the lexical demands of a program are across viewing episodes, which is relevant for evaluating children's moment-to-moment language input. Finally, RQ3 was structured to quantify the explicit teaching strategies used to expose the children to the target words. Results of the analyses are based on 228 words and three strategies used in 48 episodes of the six programs (8 episodes each). Results in the following section are organized by research question.

Results

RQ1. What are the number and types (grammatical categories) of words targeted in popular children's educational television programs?

To answer RQ1, the number and types (grammatical categories) of words targeted was determined for each program. The number of words targeted in the programs varied. A Kruskal-Wallis test, a nonparametric test, was conducted to determine differences between the total number of words used across the programs. This test was most appropriate since the program level data failed to meet the assumption of normality that is required by parametric tests. The Kruskal-Wallis test, which was corrected for tied ranks, indicated a significant difference in number of words targeted in the six programs, $\chi^2(5, N = 48) = 41.33, p < .001$. The average number of words targeted was 20.00 in Martha Speaks, 1.00 in Sesame Street, 1.00 in Sid the Science Kid, 1.50 in Super Why!, 5.0 in WordGirl and 2.0 in Word World.

Post-hoc comparisons using Bonferroni correction for multiple tests indicated that the mean total number of words targeted in Martha Speaks was significantly higher than that of Sesame Street, $p < .001$, Sid the Science Kid, $p < .001$, and Super Why!, $p = .001$. Additionally, the mean number of words targeted in WordGirl was significantly higher than that of Sesame Street, $p = .001$, and Sid the Science Kid, $p = .009$. However, there was no significant difference between the total number of words targeted in the other program pairs, $p > .05$.

Nouns and verbs were most frequent category of words in all programs. All six programs targeted nouns ($n = 130$), four targeted adjectives ($n = 43$), four targeted verbs ($n = 54$), and one program targeted a single adverb. Martha Speaks was the only program that targeted words from all four grammatical categories. Martha Speaks consistently used the highest number of each type. In eight episodes of Martha Speaks there were a total of 78 nouns, 34 verbs, 28 adjectives, and one adverb. Super Why! targeted the lowest number of verbs (3) and adjectives (2). The programs that targeted three types of words were Super Why! and WordGirl and the programs that targeted two types of words were Sid the Science Kid and Sesame Street. The number of target words in each category are shown by program and episode in Table 2.

RQ2. Are there differences in the mean age of acquisition of words targeted in popular children's educational programs?

To answer RQ2, the mean age of acquisition of words in each program was determined based on established norms (Kuperman et al., 2012) for each word. The episode-level data for each program and overall program averages across episodes are shown in Table 3. It should be noted that higher mean values indicate vocabulary acquired by older children, while lower values reflect earlier-acquired, simpler words typically acquired by younger children. Among the six programs, WordGirl had the highest overall mean AoA ($M = 9.81, SD = 1.81$), with acquisition ages ranging from 6.50 to 13.34, indicating the use of more advanced vocabulary.

Table 2. Number of Words in each Grammatical Category by Episode and Program

Episode	Martha Speaks				Sesame Street			Sid the Science Kid			Super Why!			WordGirl			Word World		
	N	V	Adj	Adv	N	V	A	N	V	A	N	V	A	N	V	A	N	V	A
1	7	10	3	--	--	--	1	1	1	--	--	1	--	1	2	2	2	--	--
2	12	4	5	--	1	--	--	1	--	--	--	--	1	4	1	--	2	--	--
3	17	1	2	--	--	--	1	--	1	--	1	--	--	2	3	--	2	--	--
4	9	4	7	--	1	--	--	1	--	--	1	--	--	2	2	1	2	--	--
5	6	4	9	1	1	--	--	1	--	--	3	--	--	1	2	2	2	--	--
6	19	1	--	--	1	--	--	1	--	--	2	--	--	1	3	1	2	--	--
7	5	4	1	--	--	--	1	1	--	--	1	1	--	2	1	2	2	--	--
8	3	6	1	--	--	--	1	2	--	--	--	1	1	2	2	1	3	--	--
Total	78	34	28	1	4	0	4	8	2	0	8	3	2	15	16	9	16	0	0

Note. N = noun; V = verb; A = adjective; Adv = adverb. Total words analyzed per program: Martha Speaks ($N = 141$), Sesame Street ($N = 8$), Sid the Science Kid ($N = 10$), Super Why! ($N = 13$), WordGirl ($N = 40$), and Word World ($N = 16$). Words per episode by program: WordGirl ($n = 5$), Martha Speaks ($n = 10-22$), Sesame Street ($n = 1$), Sid the Science Kid ($n = 1-2$), Super Why! ($n = 1-2$), and Word World ($n = 2-3$). Double dashes (--) indicate that no target words of that type occurred.

In contrast, Word World had a lower overall mean AoA ($M = 4.69$, $SD = 1.40$), with AoA word values ranging from 2.89 to 7.94.

To further examine whether the observed episode-level variations in AoA were statistically meaningful, separate one-way analyses of variance (ANOVA) were conducted for each program. These tests assessed whether the mean AoA significantly differed in the eight episodes of each program. Within-program analyses were conducted to complement cross-program descriptions by assessing internal consistency of AoA across episodes—whether a program consistently targeted vocabulary with similar acquisition ages, or whether the AoA of the target words fluctuated between episodes. Equality of variances was assessed using Levene's test. For programs that met the assumption of homogeneity of variances ($p > .05$), a standard one-way ANOVA was conducted. When the assumption was violated ($p < .05$), Welch's correction was applied to provide a more robust test under unequal variances. There was a statistically significant difference in AoA across episodes of Martha Speaks, $F(24, 203) = 2.15$, $p = .002$, indicating meaningful fluctuations in the AoA of the targeted vocabulary. No statistically significant variation was observed for WordGirl $F(5, 11.68) = 0.52$, $p = .75$, Sid the Science Kid, $F(6, 3) = 1.46$, $p = .41$ or Word World, $F(4, 3.24) = 3.31$, $p = .16$. For Super Why!, Levene's test indicated unequal variances, $F(3, 5) = 17.12$, $p = .005$. However, due to extremely small group sizes, robust tests could not be completed. A one-way ANOVA showed no statistically significant difference in AoA across episodes, $F(7, 5) = 1.09$, $p = .478$. Additionally, Sesame Street was excluded from the analysis because only one AoA value was available per episode, preventing variance estimation.

RQ3. To what extent are children exposed to words via evidence-based vocabulary teaching strategies (repetition, elaboration, and definition) in popular educational TV programs for children?

To address RQ3, the frequency with which three evidence-based vocabulary teaching strategies—defining, elaborating, and repeating—were used was analyzed by program, episode, and word. Table 4 presents the mean frequency and standard deviation for each strategy per word and episode for each program. Overall, repetition was the most used strategy in all programs, although frequency varied per word and episode relative to the number of words targeted.

While most words targeted in each program were repeated at least once, the number of repetitions per word varied and ranged from 0–54 in Martha Speaks, 13–83 in Sesame Street, 5–106 in Sid the Science Kid, 6–16 in Super Why!, 2–35 in WordGirl and 4–50 in Word World. Sid the Science Kid made the most use of repetition per episode ($M = 50.90$, $SD = 43.85$), followed by Sesame Street ($M = 28.75$, $SD = 24.73$). In contrast, Word World and Super Why! used repetition less frequently per episode with Word World averaging 21.71 ($SD = 14.71$) repetitions and Super Why! averaging 9.67 ($SD = 2.42$) repetitions.

Table 3. Means (Standard Deviations) for Age of Acquisition of Words by Program and Episode

Episode	Martha Speaks	Sesame Street	Sid the Sci- ence Kid	Super Why!	WordGirl	Word World
	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>
1	6.82 (1.93)	7.72 (0.0)	6.42 (1.53)	4.82 (0.0)	8.63 (1.05)	5.14 (1.15)
2	7.49 (2.01)	6.18 (0.0)	4.40 (0.0)	10.65 (0.0)	9.78 (1.69)	4.58 (1.49)
3	7.03 (2.00)	6.32 (0.0)	6.57 (0.0)	6.40 (0.0)	10.21 (2.51)	4.69 (1.57)
4	8.33 (1.91)	7.28 (0.0)	6.00 (0.0)	5.47 (0.0)	10.32 (2.57)	6.55 (1.97)
5	7.06 (1.73)	10.89 (0.0)	4.26 (0.0)	7.15 (1.22)	9.43 (1.59)	4.58 (0.30)
6	8.37 (2.09)	8.72 (0.0)	2.37 (0.0)	7.60 (2.83)	9.05 (3.23)	3.13 (0.34)
7	7.80 (1.18)	10.17 (0.0)	9.44 (0.0)	7.17 (2.20)	10.06 (1.89)	4.60 (0.02)
8	9.03 (1.02)	6.65 (0.0)	5.47 (1.42)	8.44 (0.40)	9.66 (0.87)	4.43 (2.08)
Program	7.64 (1.94)	7.99 (1.78)	5.68 (2.03)	7.32 (1.83)	9.72 (1.90)	4.69 (1.40)

Note: Values represent the mean Age of Acquisition (AoA) of words for each program and episode. AoA for each word based on Kuperman et al. (2012). Episode and program means, and standard deviations are based on the total number of words included in the analyses, which may differ from the total number of words targeted due to missing AoA in cited research. Number of words analyzed for each program (in alphabetical order): Martha Speaks ($N = 141$), Sesame Street ($N = 8$), Sid the Science Kid ($N = 10$), Super Why! ($N = 13$), WordGirl ($N = 40$), and Word World ($N = 16$).

Table 4. Mean Number (Standard Deviation) of Teaching Strategies per Word by Program and Episode

Episode	Martha Speaks			Sesame Street			Sid the Science Kid		
	D	E	R	D	E	R	D	E	R
1	1.90 (0.99)	1.00 (0.00)	7.25 (3.88)	5.00 (0.0)	--	25.00 (0.0)	1.00 (0.0)	1.00 (0.0)	17 (21.21)
2	1.18 (0.41)	0.09 (0.29)	5.77 (2.96)	3.00 (0.0)	--	19.00 (0.0)	3.00 (0.0)	8.00 (0.0)	135.00 (0.0)
3	1.44 (0.52)	--	6.95 (6.05)	10.00 (0.0)	--	87.00 (0.0)	1.00 (0.0)	--	9.00 (0.0)
4	1.50 (0.70)	--	6.20 (3.22)	3.00 (0.0)	--	5.00 (0.0)	2.00 (0.0)	13.00 (0.0)	67.00 (0.0)
5	1.33 (0.70)	--	6.25 (3.92)	7.00 (0.0)	--	29.00 (0.0)	5.00 (0.0)	10.00 (0.0)	99.00 (0.0)
6	1.40 (0.51)	--	5.74 (2.73)	2.00 (0.0)	--	28.00 (0.0)	1.00 (0.0)	2.00 (0.0)	81.00 (0.0)
7	2.00 (1.41)	1.00 (0.00)	15.10 (14.03)	3.00 (0.0)	--	20.00 (0.0)	2.00 (0.0)	2.00 (0.0)	41.00 (0.0)
8	1.30 (0.48)	--	7.70 (3.02)	2.00 (0.0)	--	17.00 (0.0)	1.00 (0.0)	--	21.50 (20.51)
Total	1.50 (0.79)	1.00 (0.00)	7.07 (5.58)	4.38 (2.83)	--	28.75 (24.73)	2.00 (1.41)	6.00 (5.01)	50.90 (43.85)

Episode	Super Why!			WordGirl			Word World		
	D	E	R	D	E	R	D	E	R
1	--	2.00 (0.0)	8.00 (0.0)	1.60 (1.34)	--	10.60 (7.13)	--	1.00 (0.0)	19.00 (2.83)
2	2.00 (0.0)	3.00 (0.0)	12.00 (0.0)	1.00 (0.00)	1.00 (0.0)	9.20 (4.76)	--	1.00 (0.0)	21.00 (5.66)
3	1.00 (0.0)	--	9.00 (0.0)	1.20 (0.45)	1.00 (0.0)	16.80 (9.09)	--	--	30.00 (26.87)
4	1.00 (0.0)	--	14.00 (0.0)	1.20 (0.45)	1.00 (0.0)	13.20 (9.20)	--	--	5.00 (0.00)
5	1.00 (0.00)	1.00 (0.0)	10.00 (2.83)	1.20 (0.45)	--	9.60 (3.78)	--	--	31.00 (18.38)
6	1.00 (0.00)	1.00 (0.0)	10.00 (2.83)	1.00 (0.00)	--	13.60 (8.02)	--	--	27.50 (23.33)
7	1.00 (0.0)	--	9.50 (2.12)	1.50 (0.58)	--	13.25 (6.70)	--	--	15.00 (12.73)
8	1.00 (0.00)	--	7.00 (1.41)	1.20 (0.45)	--	9.60 (3.05)	1.00 (0.0)	--	24.00 (17.32)
Total	1.10 (0.31)	1.75 (0.95)	9.67 (2.42)	1.23 (0.58)	1.00 (0.00)	11.93 (6.60)	1.00 (0.00)	1.00 (0.33)	21.71 (14.71)

Note. D = Definition; E = Elaboration; R = Repetition. An SD value of 0.0 indicates no variability since only one observation was available for that cell. An SD value of 0.00 for cells with multiple observations indicates that all values were identical. Total number of words analyzed per program: Martha Speaks ($N = 141$), Sesame Street ($N = 8$), Sid the Science Kid ($N = 10$), Super Why! ($N = 13$), WordGirl ($N = 40$), and Word World ($N = 16$).

Repetitions were also analyzed according to their contextual function: repetitions in isolation, repetitions within definitions, and repetitions within elaborations. In *Martha Speaks*, repetitions in isolation ranged from 0–34 per word, repetitions within definitions ranged from 0–6, and repetitions within elaborations ranged from 0–16. Seventy-five percent of the 141 target words were repeated 0–6 times in isolation. Repetitions within definitions occurred 0–2 times for 95% of words, and repetitions within elaborations occurred 0 times for 59% of words.

In *Sesame Street*, repetitions in isolation ranged from 13–77, repetitions within definitions ranged from 0–3, and repetitions within elaborations ranged from 0–4 per word. Of the eight target words, 50% were repeated twice in isolation. Repetitions within definitions occurred twice for 50% of words, and repetitions within elaborations occurred once for 50% of words.

In *Sid the Science Kid*, repetitions in isolation ranged from 2–72, repetitions within definitions ranged from 0–4, and repetitions within elaborations ranged from 1–41. Each of the ten target words occurred once in isolation. Repetitions within definitions occurred once for 40% of words, and repetitions within elaborations occurred twice for 20% and 12 times for an additional 20% of words.

In *Super Why!*, repetitions in isolation ranged from 2–12 per word, repetitions within definitions ranged from 0–3, and repetitions within elaborations ranged from 1–5. Of the thirteen target words, 31% were repeated four times in isolation. Repetitions within definitions occurred one or two times for 77% of words, and repetitions within elaborations occurred three or four times for 62% of words.

In *WordGirl*, the repetitions in isolation ranged from 1–32, repetitions within definitions ranged from 1–3, and repetitions within elaborations ranged from 1–8. Thirteen percent of the 40 target words were repeated three times in isolation. Repetitions within definitions occurred once for 80% of words, and repetitions within elaborations occurred twice for 40% of words.

In *Word World*, repetitions in isolation ranged from 3–50 per word, repetitions within definitions ranged from 0–1, and repetitions within elaborations ranged from 0–14 across the 16 target words. Two words were repeated five times in isolation, and two were repeated 20 times. No repetitions occurred within definitions for 63% of words and within elaborations for 69% of words.

The second most used strategy was defining. Definitions were provided at least once for the 8 (100%) words in *Sesame Street*, 10 (100%) words in *Sid the Science Kid*, 13 (100%) words in *Super Why!*, 40 (100%) words in *WordGirl*, 76 of 141 (54%) target words in *Martha Speaks* and 8 of 16 (50%) target words in *Word World*.

Elaboration was the least frequently used strategy overall and varied by program. In *Martha Speaks*, 73 of 141 words (52%) were not elaborated. The number of elaborations for the remaining 68 words ranged from 1–22 per word. In *Sesame Street*, elaboration was used for all target words, and the number of elaborations per word ranged from 1–10. All words targeted in *Sid the Science Kid* and *Super Why!* were elaborated and elaborations per word ranged from 5–47 and 2–11, respectively. In *WordGirl*, 38 of 40 words were elaborated, and the number of elaborations per elaborated word ranged from 1–5. Finally, in *Word World*, 8 of 16 words were elaborated, and the number of elaborations per word ranged from 1–20.

A series of Pearson correlation analyses were conducted to examine the relationships between the number of target words and the use of vocabulary teaching strategies across episodes within each program. A significance level of $p < .05$ was used for all analyses. Detailed results for repetition, definition, and elaboration strategies are presented in Table 5. For total use of vocabulary teaching strategies (i.e., the sum of repetition, definition, and elaboration frequencies) across episodes within each program, no statistically significant associations were found between the total number of words targeted and combined teaching strategies for *Martha Speaks*, $r(6) = -.15$, $p = .722$, *Sid the Science Kid*, $r(6) = -.13$, $p = .756$, or *Super Why!*, $r(6) = .32$, $p = .447$. Correlation analyses could not be conducted for *Sesame Street*, *WordGirl*, or *Word World* because one of the variables was constant across episodes, resulting in insufficient variability for calculation of Pearson correlation coefficients.

Table 5. Pearson Correlations between Number of Target Words and Vocabulary Teaching Strategies across Programs ($N = 8$).

Program	Repetition	Definition	Elaboration	Total Strategies
Martha Speaks	.22	.07	-.74*	-.15
Sid the Science Kid	-.36	.75*	.22	-.13
Super Why	.90*	.56	.35	.32
Sesame Street	—	—	—	—
WordGirl	—	—	—	—
Word World	—	—	—	—

Note. * $p < .05$. Eight episodes per program were analyzed. Correlations between number of target words and individual strategies across episodes of *Sesame Street*, *WordGirl*, and *Word World* could not be computed due to constant values.

Discussion

The current study explored characteristics of vocabulary, and teaching strategies used in popular children's educational television programs. We used descriptive and

inferential analyses to gain an understanding of the number, types, and AoA of creator selected target words, and to determine the frequency with which evidence-based vocabulary teaching strategies were used to expose children to the target words. There are several key findings that expand upon work in child language and add to the existing knowledge base on this topic.

Target words were identified using publicly available sources rather than a standardized researcher-generated system, thus differences between programs should be interpreted conservatively. Some variability may reflect differences in how program creators selected or documented target vocabulary rather than intentional differences in instructional emphasis. With this consideration in mind, we believe our findings still provide useful information particularly for parents and educators interested in understanding the number and types of words children are exposed to in specific programs.

First, our findings indicate that the number of words targeted in the six programs was highly variable and the types (grammatical categories) of words were consistent. For example, whereas *Sesame Street* targeted a single word in each episode, none of which were verbs, *Martha Speaks* targeted more than ten and up to twenty-two words, of which were a combination of nouns, verbs, and adjectives. As the number of words children acquire daily fluctuates during development, it would be misleading to suggest that fluctuation in number of words targeted in educational programs is problematic in any way. That said, this information could inform program selection for children in initial stages of vocabulary development. Whereas educational programs with more target words might appeal to educators or parents with children in advanced stages of development, programs with fewer target words may be preferred for children of different ages in the earliest stages of development.

The target vocabulary words in the educational programs we included in our analyses shared a main characteristic of words used in CDS as reported in previous studies in that both disproportionately target nouns but also evidence a smaller number of words in other grammatical categories. While it is known that in the initial stages of vocabulary development children show a preference for nouns and early vocabularies are proportionally biased toward nouns, children at various stages of vocabulary development may reap greater benefits from programs with greater lexical diversity than those that target nouns exclusively.

Second, the age of acquisition of target words in episodes of the included programs was inconsistent, which is not surprising given existing work on vocabulary from other sources of language input. While the average age of acquisition of target words for each program aligned with the age of the intended audience, the average age for words targeted in individual episodes did not. This finding is informative because several episodes of the programs were targeting words typically acquired by children

outside of the intended 2- to 8-year age range. A portion of the programs in this study included vocabulary typically acquired later in development, while others primarily targeted earlier-learned words. While this may not hinder children's vocabulary development, it is an important consideration since there also may not be any clear advantages. It may be the case that unlike applications that are designed with age-uniformity in mind as described in Kolak et al. (2023), television programs are intended to cater to broader or more varied developmental levels. We recognize that including words that are acquired by children of many ages at various stages of development appeals to a larger audience. That said, it is possible that introducing children to words that are not typically acquired by children their age may offer limited opportunities for exposures beyond those in the program and could negatively influence the slow-mapping process.

We were interested in examining within-program variation in AoA as this might inform the consistency of lexical difficulty that children encounter across episodes. Programs with stable AoA profiles may offer more developmentally predictable input, whereas greater episode-level variability might reflect fluctuating lexical demands that may differentially shape children's learning experiences. The extent to which such variability influences learning may also depend on individual differences in children's existing vocabulary knowledge and processing abilities. Conversely, exposing children to words that are not sufficiently advanced may limit potential benefits of vocabulary experiences in media and discourage their interest in some programs. These differences highlight considerations for purposefully aligning media content with children's language learning needs. Future studies to confirm or refute this are needed.

Finally, we were interested in exploring the use of three evidence-based vocabulary teaching strategies (repetition, definition, elaboration) to better understand the number and types of explicit exposures to words children are receiving via educational media. Our analyses indicated that all three strategies were used, but the extent to which each was used with the target words differed between programs. Whereas repetition, the dominant strategy was used in all episodes of all programs, defining and elaboration were not. The consistent use of repetition is also discussed in the CDS literature (e.g., labeling) as a characteristic that has been associated with vocabulary development.

Since repetition was the most consistently used strategy within and between programs, we were interested in more closely considering the contexts in which repetitions occurred. Specifically, we wanted to know if the number of repetitions was a function of the total number of words targeted in each program. Although there was no association between the total number of words and the number of repetitions per word, we found that repetition occurred in three different contexts: isolation, within definitions, and within elaborations. While the largest number of repetitions oc-

curred in isolation, words were also repeated within definitions and elaborations. Differentiating among these repetition contexts is important because isolated repetitions may facilitate word retention and promote general word knowledge, whereas repetitions accompanied by definitions or elaborations may lead to deeper semantic understanding. This distinction may be particularly relevant for children at the upper end of the age range, as different contexts may differentially support the development of more complex and semantically rich lexical representations.

Most of the programs in our sample employed one or two strategies in isolation per word, however, there were instances when all strategies were integrated. Beck et al. (1982) argued that vocabulary learning happens effectively when different vocabulary teaching strategies such as repetition, contextual elaboration, and definition are combined. Integrating multiple strategies may provide richer semantic representations and stronger memory traces for newly introduced words. Our results suggest that this combination does not happen most of the time, at least in the programs we examined. Although no significant association was observed between total number of target words and repetition frequency, some programs targeting fewer words per episode (e.g., *Sesame Street*) appeared to use a greater number of teaching strategies in isolation or combined than programs targeting more words per episode. One plausible explanation for this finding is that the more target words, the less actual time there is to utilize all strategies with every word, as this might result in the omission of other important content or necessitate longer episodes which are not likely feasible. This is especially relevant when it comes to selecting educational television programs for children at various stages of vocabulary development and with different language abilities.

Our results concerning vocabulary teaching strategies align with findings of Linebarger and Piotrowski (2010), in that the educational television programs in our analyses utilized repeating, elaborating, and defining, to explicitly teach vocabulary to children. This finding also aligns with Danielson et al. (2019) who found that while vocabulary teaching strategies were utilized in many children's programs, they often differed in terms of type, frequency, and integration.

There are important implications for this work. First, for parents and caregivers, our results offer insight into the vocabulary used in the educational programs we included and highlight considerations for educational program selection for their children. As described previously, children's educational program characteristics vary in terms of content and characteristics. As such, understanding the aspects of programs that have the potential to enhance children's language, specifically vocabulary, may facilitate selection of the most appropriate programs for individual children. For educators and clinicians, our findings indicate that while repetition is the dominant strategy as also reported in studies of CDS, use of definitions and particularly elaboration is limited and inconsistent in children's programs. This should be considered when

providing parents and caregivers with recommendations for programs that support vocabulary learning. Finally, the findings of the current study may inform digital media design in that intentional and purposeful inclusion of evidence-based strategies in educational television programs should be considered if programs intend to enhance children's opportunities to gain experience with vocabulary. These findings may also inform future guidelines for the design and evaluation of educational media aimed at supporting early language development.

Limitations and Future Directions

The current study is not without limitations. Our procedures and analyses were appropriate for our purposes of describing characteristics of vocabulary used in popular children's educational television programs, and the extent to which evidence-based vocabulary teaching strategies were employed to expose children to the target words in those programs; however, they are based on a limited sample. An additional limitation is that target vocabulary words were identified using publicly available program-specific sources rather than a standardized researcher-generated system. As such, some variability observed across programs may reflect differences in how programs selected or documented target vocabulary words. Future work should compare findings from educational television programs with other sources of language input such as other types of educational or non-educational media or CDS as in Kolak et al. (2023). Further, exploring the language context that target words have been introduced may offer insight into additional factors influencing vocabulary learning. Finally, the programs included in the present study had a target audience age range of 2- to 8-years. We acknowledge that children of different ages and at various stages of development may benefit differently from individual explicit teaching strategies. This could partially explain the observed differences between and within programs. Future studies should consider narrowing the program audience age due to the significant amount of vocabulary acquisition that occurs during this time and differences in children's ages and stages of development.

Conclusion

This study addressed a gap in the literature and revealed highly variable total number and types of words and vocabulary teaching strategies used in popular educational television programs for young children. There was a wide range of words targeted in each episode suggesting inconsistent experiences for viewers. This was also the case with age of acquisition of target words that varied by episode and program. A common characteristic of all programs was the grammatical category of the target words which were primarily nouns. Verbs and adjectives were targeted in many but not all programs and adverbs in only one of them. We were interested in the extent to which evidence-based teaching strategies were employed to teach words and found that although repeating, defining, and elaborating were used, they were not used consist-

ently across programs, nor with all words. Also, by contextualizing the findings of the present study with published word characteristics of CDS, we found that the educational programs examined share similarities with CDS. Furthermore, only by examining word characteristics and strategies per word were we able to identify these program differences. There are still questions to answer concerning the television program content and effects of content presentation on children's language, specifically vocabulary development. Given that media programs have become one of the most influential and pervasive components of children's learning environments today, it is essential that educators and other professionals acknowledge this and that content developers and producers of children's visual media thoughtfully design content with pedagogical intention and care.

References

- Alroqi, H., Serratrice, L., & Cameron-Faulkner, T. (2023). The association between screen media quantity, content, and context and language development. *Journal of Child Language*, 50(5), 1155–1183. <https://doi.org/10.1017/S0305000922000265>
- Beck, I. L., Perfetti, C. A., & McKeown, M. G. (1982). Effects of long-term vocabulary instruction on lexical access and reading comprehension. *Journal of Educational Psychology*, 74(4), 506–521. <https://doi.org/10.1037/0022-0663.74.4.506>
- Beck, I. L., McKeown, M. G., & Kucan, L. (2002). *Bringing words to life: Robust vocabulary instruction*. Guilford Press.
- Becker, L. V. (2013). *The effects of screen media exposure on children's word learning* (Undergraduate honors thesis). University of Colorado Boulder.
- Bornstein, M. H., Tal, J., Rahn, C., Galperín, C. Z., Pêcheux, M.-G., Lamour, M., Toda, S., Azuma, H., Ogino, M., & Tamis-LeMonda, C. S. (1992). Functional analysis of the contents of maternal speech to infants of 5 and 13 months in four cultures: Argentina, France, Japan, and the United States. *Developmental Psychology*, 28(4), 593–603. <https://doi.org/10.1037/0012-1649.28.4.593>
- Carey, S., & Bartlett, E. (1978). Acquiring a single new word. *Papers and Reports on Child Language Development*, 15, 17–29.
- Chang, L. M. & Deák, G. O. (2020). Adjacent and non-adjacent word contexts both predict age of acquisition of English words: A distributional corpus analysis of child-directed speech. *Cognitive Science*, 44, 1–24. <https://doi.org/10.1111/cogs.12899>

Childers, J. B., & Tomasello, M. (2002). Two-year-olds learn novel nouns, verbs, and conventional actions from massed or distributed exposures. *Developmental Psychology*, 38(6), 967-978. <https://doi.org/10.1037/0012-1649.38.6.967>

Danielson, K., Wong, K. M., & Neuman, S. B. (2019). Vocabulary in educational media for preschoolers: A content analysis of word selection and screen-based pedagogical supports. *Journal of Children and Media*, 13(3), 345-362. <https://doi.org/10.1080/17482798.2019.1585892>

Elsherif, M. M., Preece, E., & Catling, J. C. (2023). Age-of-acquisition effects: A literature review. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 49(5), 812-847. <https://doi.org/10.1037/xlm0001215>

Fernandes, D., & Knapp, S. (2007-2015). *WordGirl* [TV series]. Scholastic Entertainment; Soup2Nuts.

Ganzert, C., & Kontra, L. (1969-present). *Sesame Street* [TV series]. Sesame Workshop.

Gillam, S. L., Olszewski, A., Fargo, J., & Gillam, R. B. (2014). Classroom-based narrative and vocabulary instruction: results of an early-stage, nonrandomized comparison study. *Language, Speech, and Hearing Services in Schools*, 45(3), 204-219. https://doi.org/10.1044/2014_LSHSS-13-0008

Golinkoff, R. M., Can, D.D., Soderstrom, M. & Hirsh-Pasek K. (2015). (Baby)talk to me: the social context of infant-directed speech and its effects on early language acquisition. *Current Directions in Psychological Science*, 24, 339-344. <https://doi.org/10.1177/0963721415595345>

Gowenlock, A. E., Norbury, C., & Rodd, J. M. (2024). Exposure to language in video and its impact on linguistic development in children aged 3-11: A scoping review. *Journal of Cognition*, 7(1), 57. <https://doi.org/10.5334/joc.385>

Greenwald, C., Bartleman, C., & Peters, B. (2008-2014). *Martha Speaks* [TV series]. WGBH Kids; DHX Media; Oasis Animation

Henson, B., Henson, L., Stanford, H., & Zweig, B. (Executive Producers). (2008-2012). *Sid the Science Kid* [TV series]. The Jim Henson Company; KCET.

Hoff, E. (2006). How social contexts support and shape language development. *Developmental Review*, 26(1), 55-88. <https://doi.org/10.1016/j.dr.2005.11.002>

- Huttenlocher, J., Waterfall, H., Vasilyeva, M., Vevea, J., & Hedges, L. V. (2010). Sources of variability in children's language growth. *Cognitive Psychology*, 61(4), 343–365. <https://doi.org/10.1016/j.cogpsych.2010.08.002>
- Ismail, U. S., & Salehuddin, K. (2025). Child-directed speech in children's media: A case study on Bing's lexical and syntactic structures. *GEMA Online Journal of Language Studies*, 25(2), 564. <https://doi.org/10.17576/gema-2025-2502-14>
- Jones, G., Cabiddu, F., Barrett, D. J. K., Castro, A., & Lee, B. (2023). How the characteristics of words in child-directed speech differ from adult-directed speech to influence children's productive vocabularies. *First Language*, 43(3), 253–282. <https://doi.org/10.1177/01427237221150070>
- Juhasz, B. J. (2005). Age-of-acquisition effects in word and picture identification. *Psychological Bulletin*, 131(5), 684–712. <https://doi.org/10.1037/0033-2909.131.5.684>
- Karani, N. F., Sher, J., & Mophosho, M. (2022). The influence of screen time on children's language development: A scoping review. *South African Journal of Communication Disorders*, 69(1), a825. <https://doi.org/10.4102/sajcd.v69i1.825>
- Kirkorian, H. L., Wartella, E. A., & Anderson, D. R. (2008). Media and young children's learning. *The Future of Children*, 18(1), 39–61. <https://doi.org/10.1353/foc.0.0002>
- Kolak, J., Monaghan, P., & Taylor, G. (2023). Language in educational apps for pre-schoolers. A comparison of grammatical constructions and psycholinguistic features in apps, books and child directed speech. *Journal of Child Language*, 50(4), 895–921. doi.org/10.1017/S0305000922000198
- Küntay, A., & Slobin, D. I. (1997). Listening to a Turkish mother: Some puzzles for acquisition 1. D. I. Slobin, J. Gerhardt, A. Kyratzis, & J. Guo (Eds.), *Social Interaction, Social Context, and Language* (pp. 265–286). Psychology Press. <https://doi.org/10.4324/9781315806525>
- Kuperman, V., Stadthagen-Gonzalez, H., & Brysbaert, M. (2012). Age-of-acquisition ratings for 30,000 English words. *Behavior Research Methods*, 44(4), 978–990. <https://doi.org/10.3758/s13428-012-0210-4>
- Lesaux, N. K., Kieffer, M. J., Faller, S. E., & Kelley, J. G. (2010). The effectiveness and ease of implementation of an academic vocabulary intervention for linguistically diverse students in urban middle schools. *Reading Research Quarterly*, 45(2), 196–228. <https://doi.org/10.1598/RRQ.45.2.3>

Lauricella, A. R., Wartella, E., & Rideout, V. J. (2015). Young children's screen time: The complex role of parent and child factors. *Journal of Applied Developmental Psychology*, 36, 11–17. <https://doi.org/10.1016/j.appdev.2014.12.001>

Legacy, J., Zesiger, P., Friend, M., & Poulin-Dubois, D. (2018). Vocabulary size and speed of word recognition in very young French–English bilinguals: A longitudinal study. *Bilingualism: Language and Cognition*, 21(1), 137–149. <https://doi.org/10.1017/S1366728916000833>

Lester, N. A., Moran, S., Küntay, A. C., Allen, S. E., Pfeiler, B., & Stoll, S. (2022). Detecting structured repetition in child-surrounding speech: Evidence from maximally diverse languages. *Cognition*, 221, 104986. <https://doi.org/10.1016/j.cognition.2021.104986>

Linebarger, D. L., & Piotrowski, J. T. (2010). Structure and strategies in children's educational television: The roles of program type and learning strategies in children's learning. *Child Development*, 81(5), 1582–1597. <https://doi.org/10.1111/j.1467-8624.2010.01493.x>

Linebarger, D. N., Brey, E., Fenstermacher, S., & Barr, R. (2017). What makes preschool educational television educational? In R. Barr & D. N. Linebarger (Eds.), *Media exposure during infancy and early childhood* (pp. 97–133). Springer. https://doi.org/10.1007/978-3-319-45102-2_7

Ma, W., Golinkoff, R. M., Houston, D. M., & Hirsh-Pasek, K. (2011). Word learning in infant- and adult-directed speech. *Language Learning and Development*, 7, 185–201. <https://doi.org/10.1080/15475441.2011.579839>

Martinot, P., Bernard, J.Y., Peyre, H., De Agostini, M., Forhan, A., Charles, M.-A., Plancoulaine, S., & Heude, B. (2021). Exposure to screens and children's language development in the EDEN mother–child cohort. *Scientific Reports* 11, Article number 11863. <https://doi.org/10.1038/s41598-021-90867-3>

Moody, D., Moody, J., Schneider, P., & Friedman, G. (2007–2011). *WordWorld* [TV series]. The Learning Box; WTTW Chicago.

Mustonen, R., Torppa, R., & Stolt, S. (2022). Screen time of preschool-aged children and Their mothers, and children's language development. *Children*, 9(10), 1577. <https://doi.org/10.3390/children9101577>

Neuman, S. B., Newman, E. H., & Dwyer, J. (2011). Educational effects of a vocabulary intervention on preschoolers' word knowledge and conceptual development: A

cluster-randomized trial. *Reading Research Quarterly*, 46(3), 249-272.
<https://doi.org/10.1598/RRQ.46.3.3>

Neuman, S. B., Wong, K. M., Flynn, R., & Kaefer, T. (2019). Learning vocabulary from educational media: The role of pedagogical supports for low-income pre-schoolers. *Journal of Educational Psychology*, 111(1), 32.
<https://doi.org/10.1037/edu0000278>

Ota, M., Davies-Jenkins, N., & Skarabela, B. (2018). Why choo-choo is better than train: The role of register-specific words in early vocabulary growth. *Cognitive Science*, 42(6), 1974–1999. <https://doi.org/10.1111/cogs.12628>.

Reading Rockets. (2014, April 28). Learning vocabulary with Martha Speaks [Video]. YouTube. <https://www.youtube.com/watch?v=i6GP4RUB32U>

Reiser, R. A., Tessmer, M. A., & Phelps, P. C. (1984). Adult-child interaction in children's learning from "Sesame Street." *Educational Communication & Technology Journal*, 32(4), 217–223. <https://doi.org/10.1007/BF02768893>

Rice, M. L., & Haight, P. L. (1986). "Motherese" of Mr. Rogers: a description of the dialogue of educational television programs. *Journal of Speech and Hearing Disorders*, 51(3), 282–287. <https://doi.org/10.1044/jshd.5103.282>

Rice, M. L., Huston, A. C., Truglio, R., & Wright, J. (1990). Words from "Sesame Street": Learning vocabulary while viewing. *Developmental Psychology*, 26(3), 421-428.
<https://doi.org/10.1037/0012-1649.26.3.421>

Rice, M. L., & Woodsmall, L. (1988). Lessons from television: Children's word learning when viewing. *Child Development*, 59(2), 420–429. <https://doi.org/10.2307/1130321>

Rideout, V. (2013). *Zero to eight: Children's media use in America 2013*. Common Sense Media. <https://www.commonsensemedia.org/research/zero-to-eight-childrens-media-use-in-america-2013>

Rideout, V., & Robb, M. B. (2021). *The Common Sense Census: Media use by kids age zero to eight in America, a Common Sense Media research study* [United States, 2013, 2017] (ICPSR 37491; Version 2) [Data set]. Inter-university Consortium for Political and Social Research. <https://doi.org/10.3886/ICPSR37491.v2>

Santomero, A. C., Freeman Alpert, S., Harris, W., Johnson, T. P., Twomey, J., & Wilder, A. (Executive Producers) (2007–2016). *Super Why!* [TV series]. Out of the Blue Enterprises; Decode Entertainment; DHX Studios Halifax; Gallus Entertainment.

Sims, C. E., & Colunga, E. (2013). Parent-child screen media co-viewing: Influences on toddlers' word learning and retention. *Proceedings of the Annual Meeting of the Cognitive Science Society*, 35, 1323–1328. <https://escholarship.org/uc/item/1m4019fp>

Snow, C. E. (1972). Mothers' speech to children learning language. *Child Development*, 43(2), 549–565. <https://doi.org/10.2307/1127555>

Snowling, M. J., & Hulme, C. (2012). Interventions for children's language and literacy difficulties. *International Journal of Language & Communication Disorders*, 47(1), 27–34. <https://doi.org/10.1111/j.1460-6984.2011.00081.x>

Soderstrom, M. (2007). Beyond baby talk: Re-evaluating the nature and content of speech to preverbal infants. *Developmental Review*, 27, 501–532. <https://doi:10.1016/j.dr.2007.06.002>

Taylor, G., Monaghan, P., & Westermann, G. (2018). Investigating the association between children's screen media exposure and vocabulary size in the UK. *Journal of Children and Media*, 12(1), 51–65. <https://doi.org/10.1080/17482798.2017.1365737>

Thiessen, E. D., Hill, E. A., & Saffran, J. R. (2005). Infant-directed speech facilitates word segmentation. *Infancy*, 7(1), 53–71. https://doi.org/10.1207/s15327078in0701_5

Tomasello, M., & Farrar, M. J. (1986). Joint attention and early language. *Child Development*, 57(6), 1454–1463. <https://doi.org/10.2307/1130423>

Tubul-Lavy, G., Gatt, D., & Walters, J. (2020). Content words in child-directed speech of mothers toward children with autism spectrum disorder. *American Journal of Speech-Language Pathology*, 29(2), 815–829. https://doi.org/10.1044/2020_AJSLP-19-00170

Vandewater, E. A., Rideout, V. J., Wartella, E. A., Huang, X., Lee, J. H., & Shim, M. (2007). Digital childhood: Electronic media and technology use among infants, toddlers, and preschoolers. *Pediatrics*, 119(5), e1006–e1015. <https://doi.org/10.1542/peds.2006-1804>

Data, Code, Materials Availability Statement

Publicly broadcast programs were analyzed in this study. Episode lists and links, data files (SPSS, Excel), and analysis syntax can be found in our OSF repository: https://osf.io/y2zt8/overview?view_only=c2b48ae50a754972b2f55c680ae6c0f2.

Authorship and Contributions Statement

The authors participated in various aspects of this work from inception to final manuscript completion. Their knowledge of and experiences with the content varied as do their research, professional and clinical training. **Virginia L. Dubasik** co-designed this study and was responsible for project direction, data analysis, and manuscript preparation. **Sara Kalhori Boroujerdi** participated in data organization, analysis, and manuscript preparation. **Rebecca C. Greene** co-designed the study and was responsible for coding, data organization, and manuscript preparation.

Appendix

<i>Martha Speaks (N = 141)</i>							
escape	donate	solar system	creature	occupied	steep	adjective	stage
entrance	upholstery	orbit	contribution	companion	opera	define	props
flee	Profit	planet	fundraiser	lonesome	soprano	convince	orchestra
stuck	Valuable	star	salesman	disappointed	bass	dupe	guard
trapped	furniture	constellation	benefit	imaginary	percussion	ploy	hide
hurry	worth	sun	funds	bored	composition	prank	antique
closed	rich	moon	grand finale	lonely	trumpet	ruse	keep
inside	cost	earth	money	play/ed/ing	string	harass	sell
open	clean	space	owe	fun	maestro	intimidate	world
outside	worthless	spaceship	raise	twice	gong	pick/ing on	charity
avoid	rubbish	universe	complain	panic	usher	reluctant	cranky
capture	clutter	humane	disposition	reaction	noun	tease	cheerful
distract	salvage	invasion	cruel	terrify/ed/ing	remove	quartet	tall
exit	priceless	extraterrestrial	personality	phobia	term	accomplish	modify
intruder	perspective	astronomy	amiable	reassure/ing	insert	scene	weightless
catch	garbage	astronaut	grumpy	height/s	announce	rhyme	symphony
door	junk	asteroid	crabby	worry	oath	costume	conduct/ing
get away	collect	alien	lovable	dizzy			
<i>Sesame Street (N = 8)</i>							
windy	brilliant	celebration	amphibian	diagram	astounding	awful	nature
<i>Sid the Science Kid (N = 10)</i>							
irreversible-change	wheels heat/ed	animal-communication	rainbow force	habitats	pet/s	responsibility	water system

<i>Super Why! (N = 13)</i>							
ask questions	note	saddle	hero	quicksand	trail	distracted	concentrate
resourceful	rhyme	lasso	map	search			
<i>WordGirl (N = 40)</i>							
clumsy	morale	binocular	delay	woozy	rampage	adhesive	rival
supreme	scowl	frolic	captivated	bombard	sensitive	precious	boast
devour	compliment	procrastinate	divvy	emcee	doze	scamper	shatter
appetite	lair	precipitation	repetitive	fumble	juvenile	volunteer	brooch
expand	trophy	meteorologist	console	mistaken	lack	habitat	fib
<i>Word World (N = 16)</i>							
ant	bird	pool	balloon	fire	milk	kite	coat
pot	castle	sub	bike	bed	lake	rock	rocket

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