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Supporting Vocabulary Development in Children Who Use Augmentative and Alternative Communication

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Abstract

Background: Vocabulary development is a powerful driver of language development and is also an important predictor of early progress in reading. It is recommended that vocabulary interventions support rich word knowledge, incorporating phonological, semantic, morphological and orthographic information. Children who use AAC are at risk of vocabulary difficulties. For these children, acquiring vocabulary also involves knowledge of symbol representations and operational skills. Furthermore, they also frequently struggle to develop functional skills in reading and spelling.

Method: Four children who use AAC participated in a storybook-based intervention study targeting vocabulary instruction over a ten-week period. The program was structured to integrate communication, language and literacy dimensions of word learning, within a framework where multiple opportunities were provided to see, hear, analyze and use the target words. Results: All children demonstrated increased word knowledge post-intervention, although the areas and the extent of progress varied across participants. Two participants made greater gains in communicative use of target words while two made most progress in spelling.

Conclusion: Although small in scope, this study suggests that integrated intervention programs that target multiple aspects of word knowledge can support both communicative and literacy aspects of word learning. Implications for future developments are considered.

Keywords: Vocabulary instruction; Aided communication; Integrated intervention; Literacy

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Augmentative and alternative communication (AAC) interventions seek to ensure that the communication needs of children and adults are met, typically where attainment of functional speech is not a realistic or predictable outcome of intervention. This paper explores some of the challenges faced by young children acquiring vocabulary using aided communication, and describes a clinical intervention program targeting vocabulary learning through storybook reading. The first section of this paper focuses on the relationship between vocabulary and literacy development for speaking children, and the role of vocabulary instruction. Attention then turns to the challenges of establishing an initial lexicon for aided communicators, and factors to consider in determining vocabulary items to support communication and language learning needs. These topics set the scene for the description of a short, integrated vocabulary intervention program with four young aided communicators.

I. Vocabulary Development and Aided Communication

One of the highlights of early development for most parents is the emergence of young children's first words, somewhere around their first birthday. Over the following six months, vocabulary grows steadily (Ingram, 1989), triggering the emergence of word combinations, allowing new meanings to be expressed through the relationships between words (Bloom, 2000). While parents may actively choose to 'teach' their children certain lexical items (for example 'please' and 'thank you'), for the most part the first words produced by young children reflect their own choices and interests. Vocabulary growth accelerates rapidly once children's productive vocabulary reaches approximately 250 words (Ingram), with new words added to the lexicon on a daily basis. Lexical growth is one of the aspects of language development that continues across the school years and indeed the lifespan (Hockema & Smith, 2009). While growth in vocabulary is important in triggering and supporting the development of language structure, there may also be dividends for aspects of phonological development. As vocabulary store increases, the phonological specificity of representations becomes increasingly important. Increasing word stores create pressure to ensure that each word is distinguishable from neighbors, driving a process of refining and differentiation of phonological features (Metsala & Walley, 1998). There is now considerable research evidence indicating that skills in phonological awareness and phonological processing are powerful predictors of success in learning to read (National Early Literacy Panel, 2008; National Reading Panel, 2000), even for children learning to read morphologically-based orthographies (Huang & Hanley, 1997; Li, Shu, McBride-Chang, Liu, & Peng, 2010; Newman, Tardif, Huang, & Shu, 2011). Although vocabulary development may bootstrap these early aspects of literacy development, over time reading becomes increasingly important for vocabulary learning.

II. Supporting Vocabulary Growth through Effective Vocabulary Instruction

School is one of the key contexts of vocabulary learning for all children. As they progress

across the school years, children's vocabulary growth increasingly draws on their engagement with reading and writing (Nagy & Anderson, 1984; Vellutino, Fletcher, Snowling, & Scanlon, 2004). While early vocabulary knowledge supports progress in learning to read (National Early Literacy Panel, 2008), children encounter much of their later vocabulary learning through their reading (Nagy & Anderson; Paul & Norbury, 2012). Children who struggle to acquire vocabulary therefore are at risk of literacy difficulties at the outset, and unless those literacy difficulties resolve, they are at risk of further disadvantage in their opportunities to learn new vocabulary as they progress across the school years (National Reading Panel, 2000). For this reason, vocabulary instruction occupies a prominent position in most educational curricula and research to support effective vocabulary instruction has attracted considerable interest (Beck, McKeown, & Kucan, 2013; National Early Literacy Panel; National Reading Panel). Two key questions arise in relation to vocabulary instruction with all children: (1) what words should be the focus of instruction, and (2) what does effective instruction look like?

Selecting target words for instruction. A number of different approaches to selecting words for instruction have been proposed (Graves et al., 2014). For example, words can be drawn from lists of commonly occurring words across grade levels, or on principles of organizational hierarchies, such as that outlined by Beck (e.g., Beck et al., 2013). Graves and colleagues (2014) propose a four-category hierarchy of words: *essential* words that are crucial for a child's understanding of a text; *valuable* words that are important in the text but are also for general language learning; *accessible* words -- common, high-frequency words that are likely to be known to most students, but may be a target for instruction for some; and *imported* words that may be important in allowing children to discuss the theme, meaning or implications of what has been read but that may not appear explicitly within the text. Graves and colleagues recommend that teachers review any text that children are expected to read, identify words that may require explicit instruction and categorize those words according to the above four groups, before finally selecting specific targets that represent each category of word. Identifying potential targets is one step in the process -- implementing effective instruction is then key.

Effective approaches to vocabulary instruction. Given its importance to reading and writing, it is reassuring that there is substantial research evidence that vocabulary instruction can be effective, and if implemented appropriately, can enhance children's vocabulary and literacy development (National Early Literacy Panel, 2008; National Reading Panel, 2000). The National Reading Panel (2000) concluded that instruction should be explicit and focused and promote active engagement in learning. It should be multi-faceted and embedded in rich instruction. Multiple opportunities for learning are important and they caution that reliance on a single vocabulary instruction method is unlikely to result in optimal learning. Graves (2006) suggests that effective instruction incorporates at least four dimensions: (1) providing rich and varied language experiences; (2) teaching individual words; (3) teaching word-learning strategies, and (4) fostering word consciousness.

Multi-dimensional approaches are essential because word learning is complex and involves abstracting, analyzing, retaining and storing many different kinds of information, often from a

fleeting exposure. "Quality" lexical representations (Perfetti, 2007) encode information about the phonological form and structure of the word, its semantic content and meaning in relation to other words already within the lexicon, its syntactic role and morphological features (i.e., whether it can take affixes or prefixes, how it can be transformed), as well as how it is represented orthographically. Effective word learning supports phonological and letter-based orthographic analysis, but also the gestalt skills related to meaning, function and word form. Many vocabulary instruction approaches have been criticized as superficial and brief (Blachowicz, Fisher, Ogle, & Watts-Taffe, 2006; Kucan, 2012), lacking appreciation of the complexity and inter-connectedness of effective word learning. In this view, effective instruction targets multi-layered networks of complementary knowledge rather than emphasizing 'word-islands' of bounded information. Finally, if word learning is to be motivating, it must be situated in authentic learning situations (Justice, Meier, & Walpole, 2005), where the end goal is not focused on word learning itself but on a higher level activity, such as enjoying a story, creating a poem or controlling aspects of the child's world.

III. Vocabulary and Aided Communication

For children with no functional speech, the first word often does not emerge spontaneously. Instead, first "words" are often the outcome of a specific intervention where another person (a clinician, a parent or a teacher) has selected a set of words that are potentially important or interesting to the child, and made them available as an external lexical set, usually simultaneously in some form of symbol format. This external lexicon may not align with a child's internal lexicon (Romski & Sevcik, 1993). Children may *know* many more words than are available to them externally, and equally there may be words displayed in their external lexicon that are not yet within their internal lexicon. They may "know" a speech-based lexical item, but not link that word to a symbol form within their communication system. Alternatively, they may know a vocabulary item and its symbol form, but not where that symbol is located, or they may lack the operational skills to access it. Even for children without disabilities, navigating aided communication systems is challenging (Robillard, Mayer-Crittenden, Roy-Charland, Minor-Corriveau, & Bélanger, 2013), creating demands on working memory (Oxley & Norris, 2000) and other aspects of executive functioning (J. Murray & Goldbart, 2011; Stadskleiv et al., 2014). Therefore even if children using aided communication (1) know the vocabulary; (2) know the symbols and (3) understand the navigation principles, they may still struggle to access the relevant lexical items, particularly if they are switch users (White, Carney, & Reichle, 2010). As motivation to access and use aided communication may be heavily influenced by the vocabulary available (Fallon, Light, & Paige, 2001), the importance of making good choices in selecting vocabulary cannot be over-stated.

Considerations in choosing an initial lexicon for aided communicators. A number of principles in vocabulary selection for aided communicators have both theoretical plausibility and empirical support. One is that multiple sources and multiple informants should be consulted

(Fallon et al., 2001; Morrow, Mirenda, Beukelman, & Yorkston, 1993). Sources of data can include ecological inventories, (von Tetzchner & Martinsen, 2000); communication diaries (Beukelman & Mirenda, 1998; von Tetzchner & Martinsen); standard word lists drawn from sampling speaking children across different age groups (Balandin & Iacono, 1998; Marvin, Beukelman, & Bilyeu, 1994; Marvin, Beukelman, Brockhaus, & Kast, 1994); 'blank sheet approaches' where key communication partners suggest target vocabulary (Fallon et al.); and core vocabulary lists. Synthesizing information from a range of sources is both time-consuming and challenging (Fallon et al.), but is essential to ensure that vocabulary items available to young aided communicators are relevant, functional, motivating and necessary.

A second principle is that the vocabulary selected must support language and communication development (Beukelman et al., 2013). Vocabulary growth is a driver for language learning (e.g., Hohenberger & Peltzer-Karpf, 2009), but functional use is grounded in meaningful interactions (Bloom, 2000; Tomasello, 2003) and lack of access to relevant vocabulary may lead to rejection of aided communication (McCall, Marková, Murphy, Moodie, & Collins, 1997). The priorities motivating early vocabulary selection and instruction may therefore differ from those that become important as language skills develop. In the early stages, words of personal relevance that have an immediate impact (e.g., *more*, *stop*, *out*) may be essential to harness motivation, especially if access is difficult and selecting each lexical item takes time and effort. However, as children increase their vocabulary store, vocabulary must also support the development of language structure, to ensure that a shift towards hierarchical syntactic organization is possible (Nelson, 1992; Paul, 1997). In other words, effective vocabulary selection involves exploring what is necessary immediately, but also what is important to support future development, keeping an eye both on present and future needs (Beukelman et al.).

A third principle is that the vocabulary should have the potential for frequent and regular use, with multiple opportunities for reinforcement. However, words that occur with high frequency may not always be motivating. Core vocabulary words occur frequently in spoken language samples, accounting for a high proportion of words within any interaction (Banajee, DiCarlo, & Stricklin, 2003). They are consistent across situations, partners and topics. If a relatively small number of words accounts for a significant proportion of all the words used in a conversation, it seems logical to focus on ensuring that aided communicators have access to this set of words, so that they have multiple opportunities to learn to use them. What core vocabulary words offer in terms of frequency, must be balanced against the fact that many of these words serve important syntactic functions but may carry little semantic 'weight'. For example in English, *with*, *for*, *by* and *to* all fit the criteria for core vocabulary, but their meanings are determined by their role within a syntactic structure. They therefore may be less motivating for children to use, at least in the early stages when communicative demands are high. Balancing the needs of immediate communication and longer-term language development implies that core and fringe vocabulary are equally essential (Beukelman et al., 2013).

The impact of speech impairments on vocabulary learning. Choices about aided vocabulary selection are not the only relevant consideration. Research suggests that many aided communicators

may have deficits in their understanding of spoken vocabulary knowledge also (Berninger & Gans, 1986; Dahlgren Sandberg, 2006; Lund & Light, 2007; Solomon-Rice & Soto, 2014), and that these deficits often are unidentified. Almost all aspects of word learning have been identified as potentially problematic: phonological, morphological and orthographic. Aided communicators also frequently present with significant difficulties in learning to read and to write (Berninger & Gans), with as many as ninety percent experiencing significant difficulties in achieving functional reading and spelling skills (Koppenhaver & Yoder, 1992; Light, McNaughton, Weyer, & Karg, 2008). Severe speech difficulties do not prevent children from developing the phonological awareness skills that support early literacy development (Bishop, Byers Brown, & Robson, 1990; Dahlgren Sandberg, Smith, & Larsson, 2010), but these skills seem particularly vulnerable in this group (Smith, Dahlgren Sandberg, & Larsson, 2010). Lack of access to speech production may affect the quality of phonological specificity of lexical representations (Smith, 2001) as well as the development of effective processing skills. Specific deficits have also been identified in aspects of syntactic and morphological knowledge, both receptively and expressively (Binger & Light, 2008) so that the quality of syntactic (Sutton & Gallagher, 1993) and morphological aspects (Blockberger & Johnston, 2003) of word knowledge may also be vulnerable.

In sum, as a consequence of their vocabulary limitations (potentially receptive and expressive) and literacy difficulties, children using aided communication often find themselves in interactions where they do not have access to the vocabulary they require, and have few resources to generate words that have not been included within the vocabulary set provided to them. Ironically, research also indicates that one of the key factors influencing the extent to which aided communication systems are used is the relevance of the vocabulary available (Light, 1997; McCall et al., 1997). For these reasons, devising effective vocabulary intervention approaches for this group is particularly important for building communicative competence, promoting language development and for supporting written language skills.

Vocabulary intervention in aided communication. As reviewed above, research with speaking children suggests that effective vocabulary interventions are characterized by an explicit focus, exploitation of authentic learning opportunities and a multi-layered approach to building word knowledge (e.g., Graves, 2006). Evidence to date suggests that with appropriate instruction, children using aided communication can gain skills in word analysis (Johnston, Davenport, Kanarowski, Rhodehouse, & McDonnell, 2009; Light et al., 2008) supporting learning of the sound structure of words and how those are represented in print, as well as word meanings (Dada & Alant, 2009; Solomon-Rice & Soto, 2014; Soto & Dukhovny, 2008). However, few studies have addressed the multiple levels of knowledge that must be acquired if new vocabulary items are to become quality lexical representations, accessible for communication, for language building, for word reading and for spelling. Hanser and Erickson (2007) report one such study. In their integrated vocabulary approach, intervention focused on analysis of target words to support word identification and spelling, as well as communicative use, incorporating an emphasis on the navigational and operational knowledge and skills required to access the target lexical items. Over the course of a six-

week intervention with three participants aged thirteen years, all made measurable gains in word identification, spelling and communication tasks, although rate of progress was variable across participants and domains. This small-scale study suggests that approaching word learning from a multi-faceted approach supports many aspects of word learning for aided communicators, in much the same way as is documented for speaking children.

The aim of the intervention study reported here was to develop, implement and evaluate a vocabulary instruction programme for children using AAC. Building on the substantial evidence of the need for multi-faceted instruction, the goal was to apply an integrated intervention addressing five aspects of word learning: (1) receptive knowledge of target words; (2) recognition of associated symbol representations; (3) sight-word recognition of orthographic representations of the target vocabulary; (4) knowledge of spelling; and (5) communicative use of the target vocabulary in structured and spontaneous interaction. The research question addressed was whether integrating communication and literacy dimensions of word knowledge would support vocabulary learning for communicative purposes as well as reading and spelling.

IV. Method

i. Instructional Program Description

Instruction context. Shared storybook reading was chosen as the intervention context for vocabulary instruction, based on its demonstrated efficacy for building vocabulary knowledge and supporting many aspects of literacy development (Justice et al., 2005; National Early Literacy Panel, 2008; National Reading Panel, 2000). It represents an authentic context for focusing on words, spoken and written, and is enjoyable and motivating. Storybooks also offer a useful starting point for vocabulary selection, presenting a pre-defined set of words that can be evaluated in many different ways, including the four levels described by Graves (Graves et al., 2014).

Intervention strategies. The program was designed to build on storybook reading to target word learning at multiple levels. The intervention approach was loosely based on a vocabulary instruction program described by Blachowicz and Obrochta (Blachowicz et al., 2005, 2006). This program comprised a four-pronged focus on vocabulary, based on systematically creating opportunities to *See*, *Hear*, *Analyze*, and *Use* target words. In the intervention described here, focused stimulation and augmented input techniques were core intervention strategies, as both these techniques have demonstrated efficacy with speaking children with language difficulties (Fey, Cleave, Long, & Hughes, 1993) and aided communicators (Binger, Berens, Kent-Walsh, & Taylor, 2008; Binger & Light, 2007; Solomon-Rice & Soto, 2014). Clinicians modeled use of target words using the participants' own communication systems as well as additional copies of symbol forms. Multiple models were provided of spoken and written forms of the target word, with an emphasis on the whole word and the individual sound elements, through labeling each letter as a target word was

written out, using "thinkalouds" in planning spelling of words and comparing written forms with the spelling of words under symbols on communication displays. Attention to vocalizing the analysis of target words was emphasized to support word consciousness and the use of analogies as a basis for spelling and reading, as possible word-learning strategies (Graves, 2006). Given the additional learning challenges typically faced by all children using aided communication, multiple opportunities for repetition (*Repeat*) were incorporated into the program. *SHAURing Up Vocabulary* as the program came to be known, was structured around weekly hour-long group sessions that started with reading a story.

Intervention structure. Target words (selected as described below from two key storybooks) were addressed in learning cycles across sessions focused on communicative use and literacy aspects of learning for each target word. Each session started with reading the key story or a related story, and discussing aspects of it, re-telling it or predicting parts of the story, creating the rich language environment recommended by Graves (2006). Multiple re-readings of the story allowed participants to become highly familiar with the language and the structure of the story itself, making it possible to extend the learning focus to more abstract aspects of language learning and to focus on constructing narratives related to the story.

Part of each session focused on gestalt, word-level skills involving communicative use of target words in written and symbol forms, and part focused on analytic skills involving sound- and grapheme-focused activities. Within each session, activities were structured to ensure multiple opportunities to *see* the written word (in the storybook, on word cards, on a word wall and written down as part of activities), to *hear* the word in natural speech and through use of single-message voice output devices, to *analyze* the word in terms of sound structure, rhyming patterns, initial onset and component letters, and to *use* the word in structured but authentic communication tasks (for an example of activities included, see Table 1).

Key principles of the intervention program were that instruction should integrate language, communication and literacy goals for all the target vocabulary, addressing analytic and holistic skills and incorporating rich instruction, with multiple opportunities to see, hear, analyze and use each target word. Ten hour-long intervention sessions were offered over a twelve-week period. The first author led sessions, supported by two speech language pathology (SLP) students. Carryover activities were developed for the classroom to consolidate vocabulary introduced. All sessions were video recorded and opportunities to *see*, *hear*, *analyze* and *use* target words were tabulated. Ethical approval for the project was received from the Research Ethics Committee of the university and of the service provider.

ii. Participants

Inclusion criteria for participation were an identified need to use aided communication, concerns relating to vocabulary and literacy development, and consent from parents and teachers. Four children aged between seven and ten years participated. All attended a service for children with physical disabilities and used aided communication as a primary mode of communication (see Table

Table 1

Sample of Activities and Sample Session Plan

"Gestalt skills": Word level and communication focused activities	Analytic skills: Deconstructing words into sounds and letters
Retelling the story	Rhyming activities
Identifying missing elements from the story	Word sorts (Bear, Invernizzi, Templeton, & Johnston, 2000), for spelling patterns
Interactive discussions using target forms such as "have you seen...?" (a range of films, animals, people), or "where is...?"	Word games giving clues to each other across barriers to support word identification
Generative narratives based on the story structure, editing and re-telling	Generating sound sequences using letters and sorting into real and nonsense words
Concept development (e.g., lazy, fed up)	Visual sorting of spelling patterns
Question forms (how, where, have you...)	Building word walls based on initial sound and rhyme patterns

• *Sample session plan:*

1. Read *Have You Seen Elvis?* (A. Murray, 2003).
2. Using symbol story-strips, re-create the story in the correct sequence.
3. Create "film portfolio" for each participant. Each participant takes turns to ask the other "have you seen (name of film or picture of film character)." Films that have been seen are displayed on a chart with the participant's name.
4. Word sort (3-way): Fight (right, might, light, sight); look (book, took, cook, hook); seen (keen, been, queen, green). Take turns to roll dice to select word and decide which group it belongs to. Spell the word and listen to the voice output.
5. Select one word from the word sort to spell using participant's own communication system.

2). Participants were seen in pairs for intervention. Pairing students supported natural interaction between participants, as well as offering opportunities for each participant to listen and observe a peer engaging in tasks offering explicit and incidental learning opportunities. Both Nessa[1] and Evan were in the same class and were familiar with each other. Kevin and Anna had prior experience of working together in groups.

iii. Materials

Two age-appropriate storybooks were selected to anchor the intervention, *Farmer Duck* (Waddell, 1995) for the younger participants and *Have You Seen Elvis?* (A. Murray, 2003) for Kevin and Anna. As recommended by Graves (2006), the first author reviewed each book for potential vocabulary targets and identified twenty possible targets in each book. These wordlists were then circulated to the teachers and speech language pathologists (SLP) working with the participants.

[1] Note: Pseudonyms are used throughout to protect confidentiality.

Table 2

Participant Characteristics

	Nessa	Evan	Anna	Kevin
Age	6;01	6;06	8;04	9;06
Diagnosis	Athetoid cerebral palsy	Choreoathetoid cerebral palsy, quadriplegia	Cerebral palsy, spastic quadriplegia	Dyskinetic cerebral palsy, kyphosis moderate intellectual disability
Gender	Female	Male	Female	Male
AAC device(s)	Communication board	Communication board and folder Dynavox VMax™	Communication board and folder Dynavox VMax™	Communication board MyTobii™
Access method(s)	Direct selection with index finger	Partner assisted scanning and eye-gaze; Jellybean switch™ at left temple	Partner assisted scanning and eye-gaze; joystick and headswitch	Partner assisted scanning and direct selection with fist; Eye-gaze
AAC device used in intervention	Communication board	Communication board and folder	Communication board and folder	Communication board
English as second language	Y	N	Y	N

Each teacher and SLP was asked to rank the target words in order of priority as a learning goal for each participant. The ranked score was then inverted to assign a score (i.e., the word ranked 1 was assigned a score of 20, while the word ranked 20 was assigned a score of one). The first author then rated each word target for communicative power, importance for language concepts or structure, spelling pattern, and frequency (see Table 3). Words were unlikely to score equally on all dimensions. For example, high frequency sight words in English tend to be irregular in spelling pattern, and so rated low on this dimension. Ten words were finally selected from each book as direct instruction targets, balancing words with high communicative value, key spelling patterns, high-frequency sight words and relevant language concepts. All met Grave's criteria as essential, valuable or accessible. The remaining words were included as incidental learning opportunities. The final list of target words for one book (*Farmer Duck*) and the relevant scoring criteria are outlined in Table 3. These words also formed the basis for the pre-intervention assessment, described further below.

In addition to the targeted storybooks, related storybooks were also identified, so that the themes presented in the core storybooks could be extended through further reading and discussion. Word cards incorporating a range of font sizes were developed for each target word, as well as single letters so that words could be constructed letter-by-letter in copying or in structured spelling activities.

Table 3

Scoring System and Ranked Direct Instruction Target Words

Target	Ranked by[†]	Ranking score[¥]	Dolch lists[#]	Spelling pattern[+]	Communication[!]	Language structure*	Total
1. he	2	29	4	0	2	3	40
2. goes	2	27	2	0	3	3	37
3. and	2	22	5	3	2	3	37
4. said	2	24	5	0	2	3	36
5. how	2	21	3	1	3	3	33
6. bed	2	24	0	3	1	1	31
7. but	2	16	4	2	2	3	29
8. they	2	16	4	0	2	3	27
9. lazy	2	21	0	0	0	3	26
10. hen	1	21	0	2	0	1	25
11. work	2	17	2	0	1	2	24
12. duck	1	18	0	3	0	1	23

[†] 2 = ranked by teacher and SLP in top10; 1 = ranked by one professional in top 10.
[¥] combined ranking score out of 20 from teacher and SLP (inverted value).
[#] Scored 5 ~ 1, depending on whether the word appears in Dolch pre-primer list (5), third grade list (1) or not in list (0).
[+] 3 = salient and frequent spelling pattern important for analogy; 2 = common spelling pattern; 1 = infrequent but patterned; 0 = irregular, minimal pattern potential.
[!] 3 = high communicative value to control discourse; 2 = important for specificity and frequently occurring; 1 = potential value in conversation control, frequently occurring; 0 = common nouns and infrequently occurring elements that have little value in controlling conversation.
* 3 = important for language structure or semantic concepts (e.g., tense marking, question formation, pronominal use) and high frequency irregular past tense words; 2 = regular past tense marking, words with potential language structure impact; 1 = common nouns or root forms of verbs.

iv. Pre-Intervention Assessment

Prior to intervention, each participant was assessed on knowledge of multiple aspects of each target word. Each participant's aided communication system was reviewed to determine whether or not the target words were already available and any gaps were addressed, through provision of a graphic symbol or a printed word.

An assessment protocol was developed to explore participants' ability to understand the spoken and symbol form of each target word, to expressively use the target word, to read and to spell each word. Assessment tasks were structured from most- to least difficult, to ensure that participants could complete the assessment efficiently and could end each section with success. Testing continued until sufficient prompts had been provided to ensure a successful response. To maintain motivation

and engagement, assessment focused initially only on the words selected for direct instruction. Assessment of remaining words proceeded only when a participant had successfully completed the initial set. Not all participants completed the full set of twenty words in either pre- or post-assessment and so comparison of learning of incidental and direct instruction words was not possible.

Scoring procedures for communicative use of target vocabulary. Scores were assigned on a scale of zero to four for both receptive and expressive dimensions of symbol knowledge, as outlined in Table 4. Later, these scores were combined to give an aggregate score of symbol knowledge, out of a maximum of eight.

Table 4

Assessment Hierarchy and Scoring System

	Score
Symbol comprehension	
1. Find the target symbol on own communication board e.g., *"can you find 'bed'"*	4
2. Find the target symbol from an array of six enlarged symbols presented on a single page	3
3. Find the target symbol from a choice of two enlarged symbols	2
4. Visually match the target symbol (*"can you find one the same as this"*)	1
Expressive use of symbol	
1. Uses symbol spontaneously in classroom or in clinical interaction	4
2. Uses symbol correctly in response to preceding utterance or as part of sentence completion (*"I was tired so I went to…"*)	3
3. Uses symbol when given verbal cue and location prompt (*"I sleep in a … It's one up in this part of your book/board"*	2
4. Uses symbol in forced choice alternative (*"do you sleep in a BED or CHAIR?"*), pointing to symbol choices	1
Word reading	
1. Identifies a word in response to a verbal question, where the target word is not explicitly named, from a choice of two similar targets (*"what do we sleep in?" Selects from* <u>bed bad dab</u>)	4
2. Identifies a word in response to a verbal question, where the target word is not explicitly named, from a choice of two dissimilar targets (*"what do we sleep in?" Selects from* <u>bed car sun</u>)	3
3. Identifies word in response to verbal cue from a choice of six similar (or dissimilar) words (*find "bed": bed, bad, get, dab, bell, bend*)	2.5/2
4. Identifies word in response to verbal cue from a choice of two similar (or dissimilar) words (*find "bed":* <u>bed, bad</u>*; or* <u>car bed</u>)	1.5/1

Table 4

Assessment Hierarchy and Scoring System (continued)

	Score
Spelling	
1. Spelling attempt with picture cue or sentence completion (no verbal cue)	See Table 5
2. Spelling attempt with verbal cue (*Spell "bed", I sleep in a bed*)	
3. Letter identification as word is sounded out (*"buh"-"eh"-"duh"*)	
4. Copies word with target word visible	

Scoring procedures for reading and spelling abilities. A graded scoring system was also developed to credit emerging reading abilities, again on a scale from zero to four. Spelling performance was further delineated, adapted from a developmental spelling rating approach suggested by Treiman and Bourassa (2000) to incorporate skills in copying skills and the ability to generate a target spelling from a picture cue, where the word was not labeled by the tester. This last element was included to explore the potential of participants to access an internal phonological representation for spelling, as this is the kind of task implicit in using spelling for communication, and has been reported as an area of particular difficulty for some children with severe speech impairments (e.g., Dahlgren-Sandberg & Hjelmquist, 1996; Smith, 2001). Spelling scores were assigned on a scale from zero to nine, as outlined in Table 5.

Table 5

Spelling Scoring Criteria (Target Word Example "Lap")

Points	Description	Example
0	(i) Does not include any letters; or (ii) Does not copy the word	2
1/1c	(i) Includes some letters that are not related to the sounds in the word and some other symbols; or (ii) Only includes first letter when copying word	4he
2/2c	(i) Includes only letters, but the letters are not related to the sounds in the word; or (ii) Does not conventionally copy whole word	x/yhiji
3/3c	(i) Begins with a letter that is related in sound to the initial phoneme of the word (e.g., "r" for /l/); (ii) Begins with a letter that conventionally represents a phoneme of the word other than the first phoneme; or (iii) Conventionally copies whole word	rv/pb

Table 5

Spelling Scoring Criteria (Target Word Example "Lap") (continued)

Points	Description	Example
4	Begins with conventional initial letter (which may be followed by other letters or symbols)	L
5	2/3 phonemes are represented with conventional letters, letters that represent related sounds, or letters that are highly visually confusable with the conventional letters. Intrusions are allowed.	lo/lvfael
6	All 3 phonemes are represented with conventional letters, letters that represent related sounds, or letters that are highly visually confusable with the conventional letters. Intrusions are allowed.	lanp
7	All 3 phonemes are represented and both consonants are spelled conventionally. No intrusions.	lop/lape
8	Conventional spelling produced	lap
9	Conventional spelling produced from a picture or auditory word cue alone	lap

v. Post-Intervention Assessment

Following ten weeks of intervention, the assessment was re-administered by students who were blind to the words that had been the target of direct instruction. Scoring was as outlined previously. All assessments were video-recorded.

V. Results

One of the unanticipated factors that impacted on the intervention was the frequent absence of most of the participants from school, due to illness, medical appointments or family matters. None of the participants attended more than 80% of sessions, and one participant attended only half of the sessions offered, making it difficult to adhere to the planned cycle of specific targets. In particular, absences meant that it was not possible to target each word with the same frequency for each participant, as a participant's absence from one session meant that the vocabulary covered that week had to be revised the following week. Such frequent absence from school was not considered unusual for any of the participants. As the baseline skills and rate of progress differed for each participant, key trends in terms of learning are discussed individually for each child.

i. Participant 1: Nessa

Nessa participated in five of the ten intervention sessions and her engagement in those sessions was variable, raising concerns among the educational team about her underlying medical condition. Furthermore, the intelligibility of her speech varied greatly, so that frequently there was no need for her to use aided communication in order to get her message across. There was little difference in her scores on pre- and post-assessment measures in terms of symbol identification or production

(mean score at pre-assessment was 3.55, and at post-assessment was 3.6). Similarly her reading scores remained variable, with the mean pre-assessment score of 54% and post-assessment of 60%. However, in spelling, the pattern of change was both more consistent and more evident. On initial assessment, she correctly spelled one target word from a verbal cue. For all other words, she could identify at most an initial letter and was unable to copy correctly the target word when presented for her. On post assessment she correctly spelled two words when presented with a picture cue only, and selected at least two correct letters for all other words, with some minor sequencing errors or letter intrusions (e.g., for "bed" she spelled bebd) (see Figure 1).

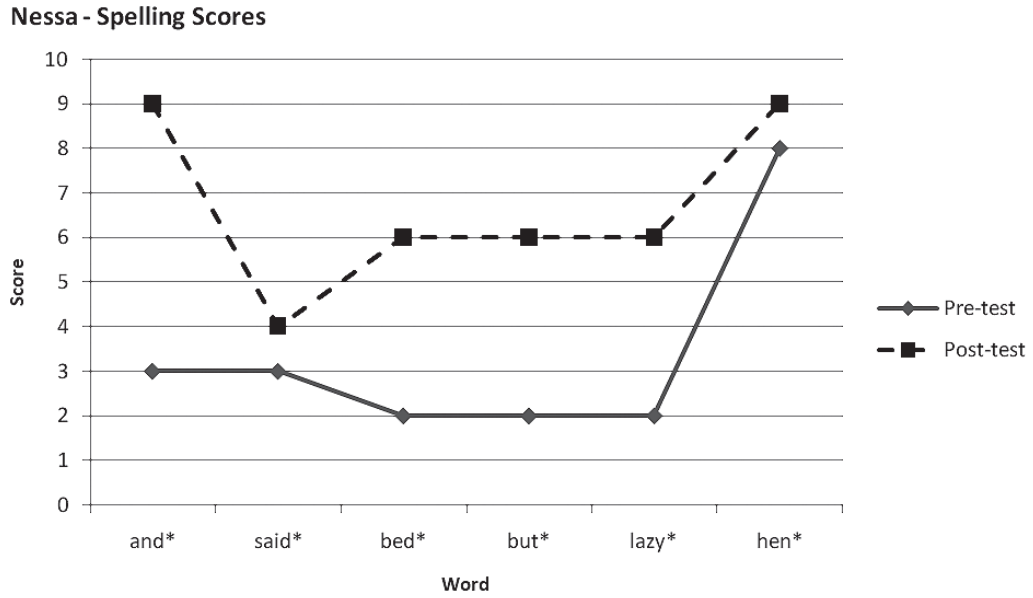

Figure 1: Comparison of Nessa's Pre- and Post-Intervention Spelling Scores.

Note: * indicates these words were direct targets of intervention.

ii. Participant 2: Evan

Evan was paired with Nessa for intervention and attended 80% of sessions offered. Evan had no functional speech production ability and had a communication book, but used this infrequently in the classroom. On pre-assessment, Evan scored close to ceiling on reading tasks (88%) and could attempt to spell all the target words, correctly selecting at least initial sounds (score of 51%). On post-assessment, some changes in spelling scores were noted (accuracy of 61%). These changes mostly reflected inclusion of an increased number of target phonemes, particularly vowels.

Evan's greatest gains were in communicative use of the target vocabulary. On pre-assessment, Evan was unable to locate any symbols on his board, although he could identify symbols if presented with a choice of two symbols, suggesting that his knowledge of the location of symbols was weak. He achieved a score of 0 on all but one symbol expressively. On post assessment, he could locate

ten of twelve symbols on his board, without cues, and used seven of the symbols expressively in response to a verbal utterance in conversation (see Figure 2).

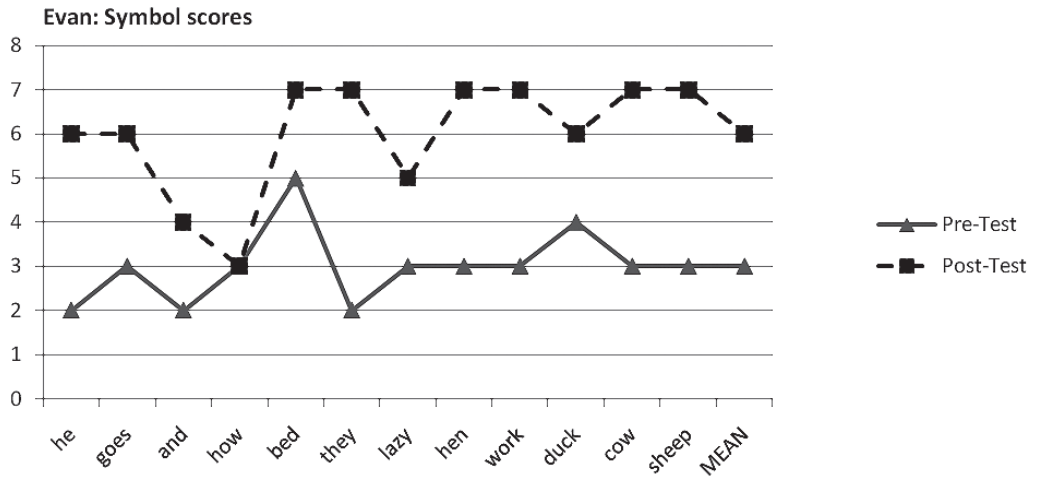

Figure 2: Comparison of Evan's Pre- and Post-Intervention Symbol Scores.

iii. Participant 3: Anna

On pre-assessment, Anna's main difficulty in communicative use of vocabulary was in locating symbols on her board (2/10), as she frequently could identify the correct symbol if presented to her from an array of six choices (5/10). By contrast, her expressive use of symbols seemed to reflect an 'all or nothing' profile. Either she used a symbol expressively appropriately in response to a verbal cue and scored maximum marks (5/10 targets), or else she did not select the symbol even when given both verbal and location prompts to a restricted set of symbols (5/10). On post-assessment this pattern changed, in that she could locate most items (8/10) on her communication board for the symbol comprehension tasks and used all but one of the target symbols expressively in response to a preceding verbal utterance.

On pre-assessment of reading skills, Anna correctly identified six of twelve target words correctly from a choice of six phonetically similar words, but could only identify the other six words from a choice of two -- potentially a chance performance. On post-assessment, she performed at ceiling, identifying all target words from an array of six phonetically similar words. Anna's greatest gains were in spelling scores. On pre-assessment, she attempted seven out of fifteen targets, with conventional spelling of only two words (*seen* and *he*). On post-assessment, she achieved recognizable phonetic attempts at fourteen of the fifteen targets, with conventional spelling of five words (see Figure 3).

iv. Participant 4: Kevin

Kevin presented with the greatest level of physical impairment of all four participants and had

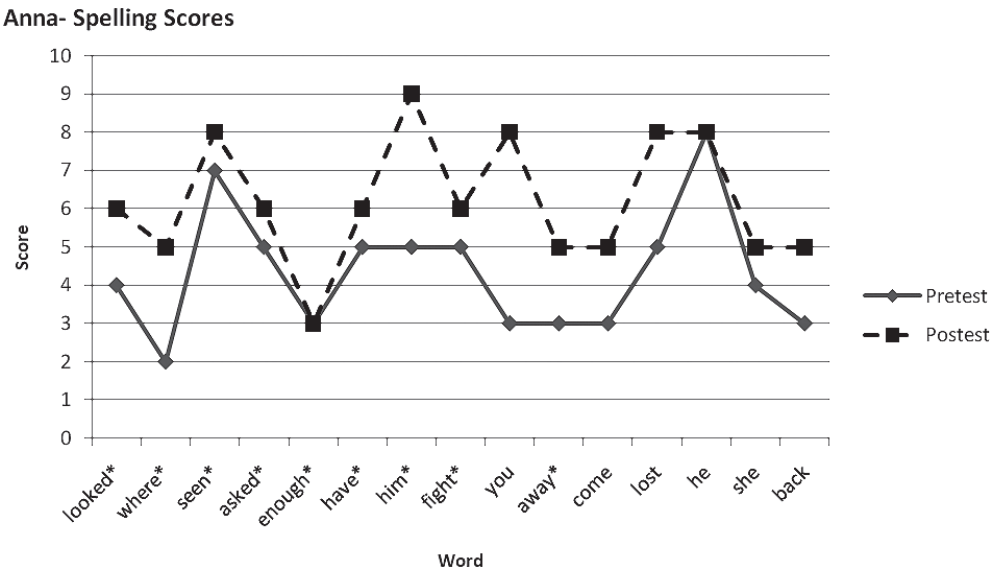

Figure 3: Comparison of Anna's Pre- and Post-Intervention Spelling Scores.

Note: * indicates these words were direct targets of intervention.

been assessed as presenting with moderate learning difficulties. He had a communication board on his wheelchair tray, but access was difficult. He missed four of the ten intervention sessions. In addition, he found the pre-assessment challenging. Although assessment was spread over several sessions, his performance within sessions was very variable, making it difficult to establish a baseline. His teachers described him as "resistant to literacy activities," although spelling skills were perceived as critical to his overall communicative effectiveness in the longer term.

From the point of view of communicative use of the target vocabulary, at pre-assessment Kevin typically identified symbols from a choice of two possibilities only (7/12 targets), and expressively did not achieve any score on ten of the twelve target items. Following the intervention, he could identify nine of the twelve targets either on his board or from a selection of six possibilities, and expressively selected symbols appropriately in response to a preceding verbal utterance. It was noticeable for Kevin that he made gains in expressive use of symbols that were explicitly targeted during the sessions he attended. Other symbols that were included in sessions (*lost*, *he*, *she*, *back*, *miss*) but not specifically targeted with him showed no gains (see Figure 4).

On pre-assessment, Kevin performed at chance level on reading tasks, selecting only from a choice of two possibilities, and frequently incorrectly and he was unwilling to attempt any of the spelling tasks. On post-assessment, while his reading scores remained at chance level, Kevin was willing to attempt all target spelling items, albeit rarely attaining more than an initial letter within the target word. However, the greatest change was his willingness to engage with these literacy tasks.

In sum, each of the participants made gains in relation to the target vocabulary, but the nature of the gains differed, with two participants (Evan and Kevin) showing most gains in communicative use of target symbols, while Anna and Nessa demonstrated gains primarily in literacy dimensions of the vocabulary.

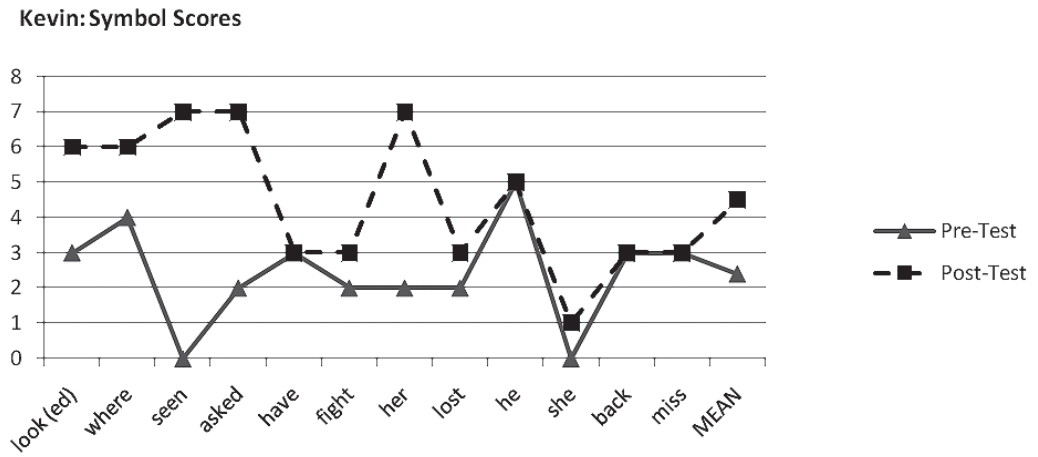

Figure 4: Comparison of Kevin's Pre- and Post-Intervention Symbol Scores.

VI. Discussion

This small-scale intervention project highlights a number of issues, including the complexity of word learning for children using aided communication, the challenge of devising and implementing an intervention with children with complex educational and physical needs, but also the gains that can be made when intervention is structured to integrate learning across a range of domains. All participants made measurable gains in at least one aspect of word knowledge: communicative use or literacy dimensions.

Implications of frequent absence from school. As noted above, one of the unanticipated difficulties that arose was the frequent absence of participants. Given the additional learning demands on children with complex communication needs, frequent absences from school is a particular source of concern. Some previous research has suggested that, even when present in a classroom, children who use augmentative and alternative communication are less likely to be actively engaged in literacy activities than their speaking peers (Mike, 1995). Absence from the educational context may create yet further barriers to effective progress in literacy skills. The decision to pair students was intended to support naturalistic interaction and create authentic communication opportunities to use the target vocabulary. However, the frequent absence of one member of each pair meant that vocabulary targets had to be revised making it difficult to compare progress across students. Nonetheless, the advantage of having peers together and providing listener-speaker role reversal opportunities outweighed these limitations. Grouping more than two students together might have overcome some of these challenges, but would have to be balanced against the consequence of potentially reduced rate of communication with a larger group and fewer opportunities for each individual participant to contribute actively.

Storybook reading as a scaffold for vocabulary learning. All of the participants engaged willingly in the intervention sessions and the incorporation of the storybook as the hook on which

all vocabulary learning was based provided a motivating and authentic context in which to engage in discussion about language, about vocabulary and about literacy. In this respect, the storybook offered a ready-made rich language environment in which to embed specific targeted vocabulary instruction. Although opportunities were provided at each session for participants to select a complementary book rather than the main text, this choice was made by only one student-pair on one occasion. The pleasure of reading the same story at the start of each session created a familiar structure that seemed to support all aspects of participation. Young children sharing storybook reading with parents frequently demand endless repetitions of the same stories. This familiarity supports the gradual embedding of increasingly complex talk (Teale & Sulzby, 1987; Yaden, Smolkin, & Conlon, 1989). As noted by Light and Kelford-Smith (1993), parents of young children who use aided communication read frequently to their children, but may not offer as many repetitions of the same story as parents of speaking children. As participants in this study became increasingly familiar with the stories, their active engagement in the story reading and re-telling increased. Using single message switches they took on active roles in "reading" parts of the story, assumed character identities, commented and changed story elements and re-enacted parts of the story.

For example, *Have You Seen Elvis*? is a story about a cat and dog who fight incessantly until the cat (Elvis) runs away, leaving the dog to search for him, asking "have you seen Elvis?" During one intervention session, one of the authors who had the materials needed for the session "disappeared," so that the aided communicators had to ask a range of individuals in the school "have you seen…?" before finally locating the missing author and the materials. Together, this event was re-told by the aided communicators, transcribed as a story, generated as a typed text into story strips and transformed into a book, for re-reading to other students. Throughout these activities, there were multiple authentic opportunities to use the target vocabulary, to read and write the target words and to practice the narrative structure. The familiar structure of the narrative, derived from the multiple repetitions of *Have You Seen Elvis?* provided a solid foundation on which to build rich language and word learning.

Multi-faceted word learning. The key goal of the intervention reported here was to design and implement an intervention that focused on integrating many different dimensions of word knowledge, to support the development of 'quality' lexical representations. Words were selected to represent different qualities: communicative power, language support, spelling patterns, high frequency word recognition and importance overall as perceived by key communication partners and educators. The process of in-depth review of each potential word target generated considerable discussion across key stakeholders, including teachers and speech language pathologists, creating awareness of the complexity of word knowledge and word learning, the different dimensions that may pose challenges and the need to carefully select vocabulary that would likely lead to maximum gain for individual students. The shared ownership of target words supported a team approach to the intervention, an essential support for generalization of word learning outside of clinical intervention sessions.

Each session was carefully structured to ensure there were opportunities to engage in gestalt,

communicative and word level activities as well as analytic ssound- and letter-based tasks. The extent to which a balance was achieved was monitored only in terms of numbers of activities, but within each activity overlap of focus was a common occurrence. The unifying structure of *See it*, *Hear it*, *Analyze it*, *Use it* focused attention on the need at all times, in all activities to model, discuss, create communication opportunities, write and use voice output options. This over-arching structure quickly became embedded within sessions. All opportunities for participants to see, hear, analyze and use target vocabulary were tabulated at the end of every session, to ensure that the planned integration approach was implemented effectively. In any intervention with children with complex needs such as the participants described here, clinicians are faced with a daunting task of maintaining a focus on multiple aspects of performance, including children's positioning, physical state, access and operational demands, fatigue, attention, symbol use, language skills, device positioning. Having a key central focus to *SHAUR* up vocabulary greatly facilitated this multi-level attention.

All of the participants progressed in their knowledge of the target words, although to varying degrees and in different aspects. The findings reported here emphasize the areas of greatest change for each participant. In each paired participant group, one participant demonstrated greater gains in communicative knowledge and use of lexical items while for the other, literacy dimensions changed more. In other words, the same intervention activities supported learning of both communicative and literacy-related aspects of words. As such, this approach shows promise as a structure to support the complex integration of word knowledge referred to by Blachowicz (Blachowicz & Fisher, 2000).

Limitations. The study reported here is small-scale and exploratory in nature. Drawing on intervention techniques with an established evidence base, the target innovation in the intervention was the explicit integration of multiple aspects of word learning in a unified framework of storybook reading. As with many studies involving aided communicators, one of the limitations is the heterogeneity of participants and the implications for generalizing the findings to other groups. A further limitation relates to the assessment tools used. Given the specific focus of the intervention, it was necessary to create a tailor-made assessment tool to measure change. However, because the focus was on multiple aspects of word knowledge, each target word was assessed across four dimensions, making the assessment long and time-consuming. It had been intended to assess both target and incidental vocabulary items but it quickly became clear that time constraints would not allow this wider focus. The structure of the assessment, moving from more to less difficult items seemed effective in maintaining motivation and engagement of participants, while at the same time providing focused information on the specific nature of prompts required to support accurate responses. Further investigation of this approach is required in order to evaluate its impact overall on assessment participation.

VII. Conclusions

Word learning is a complex cognitive activity, requiring attention to multiple layers of

information. For aided communicators, additional complexity derives from having to incorporate words into an aided system, with associated symbol knowledge, location knowledge and navigation skills. However, word learning is particularly important for this group, for all aspects of their communication and literacy development. The findings reported here suggest that intervention can be structured to address multiple layers of information about words, in a way that supports naturalistic and authentic communication opportunities. Creating a scaffold though incorporating a story as the key hook for intervention creates possibilities for selection of target vocabulary items that occur frequently and naturally. The frame of *See it*, *Hear it*, *Analyze it*, *Use it* suggested by Blachowicz and Obrochta (2005) provided an effective support structure to develop tasks and activities in a flexible but structured way to enhance multiple aspects of word learning. Although preliminary in scope, the findings from this exploratory study suggest that such integration may be an efficient and effective approach to intervention that merits further investigation.

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