


The prevalence of relational basic concepts on core vocabulary lists for AAC: is frequency enough?

Brittney Cooper & Gloria Soto


To cite this article: Brittney Cooper & Gloria Soto (15 Apr 2024): The prevalence of relational basic concepts on core vocabulary lists for AAC: is frequency enough?, Augmentative and Alternative Communication, DOI: [10.1080/07434618.2024.2332648](https://doi.org/10.1080/07434618.2024.2332648)

To link to this article: <https://doi.org/10.1080/07434618.2024.2332648>

 [View supplementary material](#) 

 [Published online: 15 Apr 2024.](#)

 [Submit your article to this journal](#) 

 [View related articles](#) 

 [View Crossmark data](#) 

RESEARCH ARTICLE



The prevalence of relational basic concepts on core vocabulary lists for AAC: is frequency enough?

Brittney Cooper^{a,b}  and Gloria Soto^{b,c} 

^aGraduate School of Education, University of California, Berkeley, CA, USA; ^bDepartment of Special Education, San Francisco State University, San Francisco, CA, USA; ^cDepartment of Speech, Language and Hearing Sciences, San Francisco State University, San Francisco, CA, USA

ABSTRACT

The selection of appropriate vocabulary is a crucial and challenging aspect of augmentative and alternative communication (AAC) intervention. Core vocabulary lists are frequently used to support vocabulary selection for children who require AAC. A vocabulary domain that has garnered limited attention within the AAC literature is relational basic concepts (RBCs). RBCs describe relationships between objects, persons, or situations, and play a pivotal role in language development, communication, and academic success. For the present study, we created a list of 156 RBCs, drawing primarily from assessments that measure basic concept knowledge in preschool and early elementary school students. We examined the overlap of these words on nine core vocabulary lists. We found that most concepts were not represented on any core lists. Additionally, there was relatively little overlap of RBCs between the core lists. These findings suggest that vocabulary selection resources created using exclusively a core vocabulary approach may have limited utility for identifying many concepts that preschool and early elementary students are expected to know and use. Implications for AAC research and practice are discussed with emphasis on the need for further consideration of RBCs within vocabulary selection practice and the field of AAC at large.

ARTICLE HISTORY

Received 1 August 2023
Revised 29 January 2024
Accepted 29 February 2024

KEYWORDS



Augmentative and alternative communication; core vocabulary; language development; relational basic concepts; vocabulary selection


Augmentative and alternative communication (AAC) intervention can promote communication and language skills in children who have little or no functional speech (Langarika-Rocafort et al., 2021). One critical and challenging aspect of AAC intervention is vocabulary selection, especially for preliterate children, who cannot yet fully rely on the alphabet. Determining appropriate and adequate vocabulary is always an individualized process; however, the need to convey essential messages and the eventual development of language skills have become two established principles for guiding AAC vocabulary selection decisions (Beukelman & Light, 2020; van Tilborg & Deckers, 2016). To meet these objectives, ample literature has called for a two-pronged vocabulary selection approach that includes personalized and context-dependent vocabulary often referred to as fringe vocabulary, along with high-frequency core words (Beukelman & Light, 2020; Dodd & Gorey, 2014; Fallon et al., 2001).

Fringe vocabularies are predominantly composed of words with concrete referents, such as people, places, objects, or actions that relate to an individual's preferences, interests, and needs, or to particular tasks, environments, and routines. Fringe words are an important component of personalized AAC intervention (Light et al., 2021). Core vocabulary is commonly defined as a relatively small set of words that are used across individuals, contexts, topics, and settings (van Tilborg & Deckers, 2016). Core words are considered beneficial for

promoting aided language development because they can be used in a variety of situations, promote word combinations, and can be presented in a consistent location on communication displays. Numerous studies have analyzed language samples of typically developing children within a focal age-range to uncover common and/or high-frequency words that can guide vocabulary selection for children developing aided language (Banajee et al., 2003; Beukelman et al., 1989; Boenisch & Soto, 2015; Marvin et al., 1994; Trembath et al., 2007).

Core words are an important element of vocabulary for aided communicators; however, there is agreement that a narrow focus on expressive word frequency might overshadow personal, contextual, and conceptual words that are important for linguistic and cognitive development (Bean et al., 2019; Beukelman & Light, 2020; McCarthy et al., 2017; Quick et al., 2019), especially for children at the early stages of language acquisition for whom many core words may not be developmentally appropriate (Frick Semmler et al., 2023; Laubscher & Light, 2020). Although core vocabulary is popular among researchers and practitioners (e.g., Center for Literacy & Disability Studies, 2020; Judge et al., 2023; van Tilborg & Deckers, 2016), many acknowledge that AAC systems limited to core words are insufficient to meet the communication needs of individuals (e.g., Cooper et al., 2022; Fallon et al., 2001; Frick Semmler et al., 2023; Laubscher & Light, 2020). Best practice for AAC intervention routinely

CONTACT Brittney Cooper  bcoop001@berkeley.edu  Graduate School of Education, University of California, Berkeley, Berkeley, CA, 94720, USA

 Supplemental data for this article can be accessed online at <https://doi.org/10.1080/07434618.2024.2332648>.

© 2024 International Society for Augmentative and Alternative Communication

states that systems should include both core and fringe vocabulary and there are widely available tools to support the identification of both word types (e.g., Beukelman & Light, 2020; Cooper et al., 2022; Fallon et al., 2001; Light et al., 2021; Soto, 2009).

Attention to core and fringe words will yield important vocabulary, however, many words that children who use AAC need may still be left out. An important vocabulary domain associated with relatively less research and fewer resources compared to core and fringe vocabulary is relational basic concepts (RBCs). RBCs are domain-general words that describe relationships between objects, persons, or situations in terms of space, size, quantity, and time (Boehm, 2004). Decades of research involving typically developing children has shown that RBCs are important for language and cognitive development as well as school success (Boehm, 2013; Chan et al., 2022; Gallivan, 1988; Gopnik, 1988; Steinbauer & Heller, 1978). A small but growing body of literature has brought attention to the importance of basic concepts when selecting vocabulary for children who use AAC (Bean et al., 2019; Cooper et al., 2022; McCarthy et al., 2017; Soto & Tönsing, 2023); yet the dichotomy of “core” and “fringe” appears to be a prevailing paradigm in research and practice (e.g., Frick Semmler et al., 2023; Judge et al., 2023).

Without special consideration of RBCs, there is a potential risk of neglecting important conceptual words that are not considered personally significant to an individual, tied to a specific context, or among the most frequently spoken words by children within a specified age range. Given the prevailing focus on core and fringe vocabulary and the widespread use of core lists in clinical practice (Judge et al., 2023), a closer examination into the presence of RBCs on core lists intended to serve vocabulary selection for AAC is warranted.

Relational basic concepts

Relational basic concepts (RBCs) are words that describe relationships between people, objects, events, and situations. They refer to position in space (e.g., *under*), movement (e.g., *away*), presence (e.g., *gone*), size (e.g., *small*), dimension (e.g., *thick*), quantity (e.g., *many*), and time (e.g., *before*; Boehm, 2004). RBCs are a subset of a larger category of words known as *basic concepts*. Basic concepts include a range of early developing concepts, such as letters, numbers, shapes, relational nouns (e.g., *brother*), materials (e.g., *glass*), states (e.g., *hungry*) and adjectives (e.g., *pretty*; Bracken & Crawford, 2010). RBC are unique from basic concepts, which have a stable definition across situations, because their meaning or referent changes based on context and arises from a relational judgment between objects, persons, situations, or in reference to a standard (Boehm, 2004; McCarthy et al., 2017). For example, something may be *first* from one direction but *last* from another. In addition, comprehension of a relational word in one domain may not ensure comprehension in another (e.g., *first* can refer to a spatial position and a temporal order).

The acquisition of relational vocabulary is a developmental process (Bracken, 1988; de Villiers & de Villiers, 1978;

Walker, 1979). During the single word stage when children have fewer than 50 words, RBCs, such as those referring to recurrence (e.g., *more*), movement (e.g., *up*), and disappearance (e.g., *gone*, *alldone*), make up a significant portion of children’s expressive vocabulary (Bloom, 1973; Gopnik, 1988). By the time children enter preschool, they are expected to use numerous relational words and comprehend many more (Bracken & Crawford, 2010). Bracken and Crawford (2010) reviewed early childhood education standards in all 50 United States and found that knowledge and skills related to basic concepts, including RBCs, were incorporated into every state’s curriculum standards. Several RBCs, such as size (e.g., large/small) and time (e.g., before, after), are explicitly stated in curriculum standards while others are reflected indirectly through skills such as describing, identifying similarities and differences, and forming analogies (Dumas et al., 2013).

Among typically developing children, knowledge, exposure, and use of RBCs has been found to correlate with a number of academic and cognitive skills including overall vocabulary and language development (Steinbauer & Heller, 1978), early math and reading achievement (Busch, 1980; Estes et al., 1976; Gallivan, 1988; Piersel & McAndrews, 1982), numeracy skills (Chan et al., 2022), mental reorientation (Hermer-Vazquez et al., 2001), and analogies (Christie & Gentner, 2014; Silvey et al., 2017). Furthermore, assessments and screeners that include RBCs, such as the Wiig Assessment of Basic Concepts (WABC; Wiig, 2004), the Bracken Basic Concept Scale-Revised (BBCS-R; Bracken, 1998) and the Boehm Test of Basic Concepts-3rd Edition (BTBC-3; Boehm, 2001), are strongly correlated with school readiness and later academic achievement (Panter, 2000; Panter & Bracken, 2009). For example, Gallivan (1988) found that first grade scores on the BTBC predicted vocabulary and reading performance in 4th grade, suggesting that lasting reading challenges may be related to poor conceptual knowledge typically mastered by age six (Boehm, 2001).

Familiarity with RBCs at a young age likely contributes to academic achievement, in part, because of their frequent use by early education teachers (Boehm, 2004; McCarthy et al., 2012, as cited by McCarthy et al., 2017). Boehm et al. (1986; as cited in Boehm, 2004), analyzed teachers’ talk for the use of RBCs from the BTBC. In a single hour of recorded instruction, six pre-kindergarten teachers produced 47 of the 50 BTBC items along with 10 synonyms. RBCs provide children with the language and comprehension needed to understand and give directions, ask and answer questions, discuss content, and benefit from instruction (Bracken & Crawford, 2010). Despite their significance, many conceptual words including relational concepts are not included on widely used AAC language systems (McCarthy et al., 2017). Neglect of RBCs within the field of AAC raises questions about how their absence may influence communication, participation, and academic outcomes for children developing aided communication.

Relational language in aided communicators

Information about RBC development or about the relationship between RBCs and academic outcomes for children with

who use AAC is very limited. Formal assessments of language and intellectual functioning are often not conducted for children with communication access needs because standardized assessments are perceived as challenging (Kurmanaviciute & Stadskleiv, 2017). When formal assessments are used, comprehension of vocabulary concerning temporal, spatial, and movement concepts may be particularly difficult to assess given the frequent use of static images to represent concepts (Moseley et al., 2021). Furthermore, few studies have explicitly explored the topic of RBCs relative to children who use AAC (Erwin-Davidson, 2019; McCarthy et al., 2017; Moseley et al., 2021).

Some insights regarding the use of RBCs by children who use AAC have come from studies conducted as part of an international project called Becoming an Aided Communicator (BAC; von Tetzchner, 2018). Although none of the studies inquire about relational words specifically, there is some evidence suggesting that aided communicators comprehend graphic symbols representing nouns and verbs more easily than those representing prepositions and locatives; and that aided communicators provide relatively few descriptions of perceptual features (e.g., big round, small short) to describe objects (Deliberato et al., 2018).

Other studies (Batorowicz et al., 2016; Stadskleiv et al., 2018) sought to understand how aided communicators provide instructions to communication partners to carry out actions using the *BAC Construction* task. In that task, participants described a physical model (e.g., a dressed doll, beads on a string) so that their partner could construct an identical one without seeing the original. The findings from Batorowicz et al. (2016) show that nearly a quarter of the errors made by the aided communicators involved orientation and sequence and another 15% of errors related to size. Compared to a reference group of age-matched typically developing children, Stadskleiv et al. (2018) found that aided communicators used fewer words to describe attributes overall (i.e., size, shape, placement, number, color); but, noted similarities between the groups regarding the frequency of word categories used. Both the aided communicators and the reference group used color words most frequently and shape words least frequently. However, the use of visual-spatial vocabulary (i.e., location, sequence, direction) represented a notable difference, as this category was the second most frequently used category by the naturally speaking children, while representing the least common category for the aided group aside from shape words. In addition, errors related to visual-spatial vocabulary were the most common error type made by the aided group besides missing elements in the final construction.

There are several factors that potentially contribute to the relative difficulty that aided communicators present with relational vocabulary compared to other word types. Investigators have found a high incidence of visual-perceptual impairment among children with motor disabilities (Ego et al., 2015) and a tendency to demonstrate poor visual-spatial skills such as large-scale spatial awareness (Foreman et al., 1989; Wiedenbauer & Jansen-Osmann, 2006), mental rotation (Farran et al., 2021), visual-spatial perception (Critten et al., 2018; Stadskleiv et al., 2018) and visual-spatial memory (Critten et al., 2018).

A large body of literature has established a relationship between elements of motor development and visual-spatial skills in children (Anderson et al., 2013; Campos et al., 2000; Cortes et al., 2022), including a connection between independent exploration in infancy and the use of spatial language in later childhood (Oudgenoeg-Paz et al., 2016). Therefore, limitations in exploration, object manipulation, and locomotion in early childhood are thought to negatively impact the development of visual-spatial abilities and spatial language for children with physical impairments (Batorowicz et al., 2016; Farran et al., 2021; Light, 1997; Stadskleiv et al., 2018).

Another reason why children with motor impairments who use AAC may struggle to learn and use relational vocabulary may be due to their limited experience with activities that engender relational language (Batorowicz et al., 2016; Light, 1997; Murray et al., 2018; Stadskleiv et al., 2018; von Tetzchner, 2018). For instance, construction play, such as building with blocks or assembling pieces is associated with spatial ability (Casey et al., 2008; Zhang et al., 2020) and comprehension of spatial relational words (Marcinowski & Campbell, 2017). Adults also tend to use more spatial language when engaging in construction tasks with children compared to other types of play (Ferrara et al., 2011), which has consequences for the amount of spatial language children produce (Pruden et al., 2011; Pruden & Levine, 2017). Children who use AAC may also have limited opportunities to communicate information that is unknown to their communication partner or have practice providing instructions for action (Light, 1997; Murray et al., 2018; Stadskleiv et al., 2018; von Tetzchner, 2018), both of which are communication situations that elicit relational language.

Children who use AAC rely on others to provide and teach vocabulary. Considering the association between RBCs, educational outcomes, and communication, opportunities to learn and use these concepts should be an important part of intervention using AAC. Unfortunately, there is an absence of vocabulary selection resources dedicated to RBCs. Furthermore, it is unclear whether established vocabulary selection resources, such as core vocabulary lists, are adequate for supporting the identification of RBCs for school-aged children who use AAC. To address these gaps, the current study investigates the presence of RBCs on core word lists that are intended to guide vocabulary selection for school-aged children who use AAC.

Method

Procedures

Core vocabulary lists

Core vocabulary lists were included in this study if they met the following criteria: (a) were published in a peer-reviewed journal, (b) included vocabulary lists developed for the purpose of informing vocabulary selection for children who require AAC aged 7 or younger, (c) were developed by sampling the spoken or written production of English speakers; and (d) produced English word lists. Studies that included non-monolingual-English speakers were included in the present study if the data collected included English language samples exclusively. Words lists resulting from secondary

Table 1. Demographics, data collection summary, and description of core vocabulary list across studies

Study	Participants			Data collection		Core word list		
	N	Age*	Profile	Source	Context (location; activities)	Operational definition	# Of words	Organization
Banajee et al. (2003)	50	2;0–3;0	TD	LS	School or daycare; play and snack	Words used across 6, 5, or 4 different days or activities	23	Divided by commonality score then high frequency to low frequency
Beukelman et al. (1989)	6	3;8–4;9	TD	LS	Preschool, not specified	Words occurring with a frequency of at least 0.5 in 1000	250	High frequency to low frequency
Clendon et al. (2013)	124	Grade K–1	TD	WS	School writing workshop; writing of self-selected topics	140 Most frequently occurring words	140	High frequency to low frequency
Crestani et al. (2010)	28	5;0–7;2	TD	LS	Not specified; story retelling task	50 most frequently occurring words	50	High frequency to low frequency
Fried-Oken and More (1992)	45 ^a	3;0–6;3	TD, AAC	LS, IR	Not specified, play	Top 10% of words appearing on at least 3 of 90 source lists	211	Highest to lowest commonality score
Marvin et al. (1994)	10	4;0–5;2	TD	LS	Home and preschool; routine activities	Words occurring with a frequency of at least 0.5 in 1000	332	Divided as function words or content words then alphabetized
Sanders and Blakeley (2021)	16	5;0–5;11	TD	LS	University; dialogic book reading	Words used by at least 10 of the 16 participants	84 ^b	Divided by book then highest to lowest commonality score
Trembath et al. (2007)	6	3;0–5;0	TD	LS	Preschool; routine activities	Words occurring with a frequency of at least 0.5 in 1000 and used by at least 50% of participants	263	High frequency to low frequency
Wood et al. (2016)	94 ^c	Grade 1	TD	WS	Not specified; writing based on prompt	50 Most frequently occurring words	50	Divided by grade then high frequency to low frequency

Note. TD: typical development; AAC: children who use augmentative and alternative communication; LS: language sample; WS: writing sample; IR: informant report.

^a30 Typically developing children and 15 children with cerebral palsy; ^bidentified 59 core words for each book. 34 core words were shared and 50 were unique; ^cdata from 94 students in 1st grade is used in present study. Data from 117 4th grade students are not included in the present study.

*Years; months.

analyses of published lists or inventories were not included (e.g., Fallon et al., 2001; Laubscher & Light, 2020; Soto & Cooper, 2021).

Six databases [PsychInfo, Educational Resources Information Center (ERIC), Linguistics and Language Behavior Abstracts (LLBA), JSTOR, PubMed, GoogleScholar] were searched using the following search terms: (a) core vocabulary (“core vocabulary” OR “core words”) and (b) AAC (AAC OR “Augmentative and Alternative Communication”). Nine studies met the inclusion criteria (Banajee et al., 2003; Beukelman et al., 1989; Clendon et al., 2013; Crestani et al., 2010; Fried-Oken & More, 1992; Marvin et al., 1994; Sanders & Blakeley, 2021; Trembath et al., 2007; Wood et al., 2016). Information about the participants, language sampling context, length, and organization of each core word lists summarized in Table 1.

Relational basic concept list

To analyze the representation of RBCs in the core vocabulary lists, a RBC list was generated. The RBC list was created by extracting relational vocabulary included in a larger basic concept database produced by Schwarz and McCarthy (2012), which includes both relational (e.g., *far*, *different*, *most*) and non-relational concepts (e.g., *yellow*, *five*, *tired*,

winter, *penny*). The Schwarz and McCarthy database includes all the words on three widely used assessments for measuring school readiness of preschool and early elementary students: the Wiig Assessment of Basic Concepts (WABC; Wiig, 2004; normed for children aged 2.6–7.11), the Boehm Test of Basic Concepts-3rd Edition (Boehm-3; Boehm, 2001; normed for children Grades K-2), and the Bracken Basic Concept Scale-Revised (BBCS-R; Bracken, 1998; normed for children aged 2.6–7.11). It includes 334 words divided into eleven categories based on the organization of the BBCS-R (Bracken, 1998; see McCarthy et al., 2017 for the procedures used to create the basic concept database). The Schwarz and McCarthy (2012) basic concept database is available at <<https://www.uthsc.edu/asp/research/documents/l3-basic-concept-vocabulary-database.pdf>>.

Words from the Schwarz and McCarthy (2012) basic concept vocabulary lists were included in the RBC list if they met the following criteria: (a) described relationships or comparisons between people, objects, occurrences, places, events, or situations (b) changed in referential meaning depending on context, (c) did not refer to attributes of single entities, events, or situations (e.g., *smooth* can describe the surface of a table without comparing it to other surfaces); and (d) were not nouns, verbs, pronouns, or grammatical

function words (e.g., than). Each author identified RBCs from the Schwarz and McCarthy database, discussed discrepancies, and reached consensus for all the discrepancies.

To prevent duplicate entries, five superlative words listed in the original basic concept database (i.e., *farthest*, *fewest*, *earliest*, *newest*, *slowest*) were not included because their root word (i.e., *far*, *few*, *early*, *new*, *slow*) were included. Because the core vocabulary lists provide single words, multi-word entries in the Schwarz and McCarthy database were omitted or consolidated with synonymous words. The items “not the same” and “some, not many” were omitted; however, “same”, “some”, and “many” were included. “Next to” and “in front” were considered synonymous with existing items “beside” and “front”, respectively. “Medium-sized” and “a lot” were included but shortened to “medium” and “lot”. These procedures resulted in a total of 147 RBCs.

Data analysis

Using Microsoft Excel for Mac, the first author reviewed each of the core vocabulary lists to examine the presence of RBC vocabulary. Each word from the nine core vocabulary lists was associated with a binary coding (1 for success, 0 for failure) to describe whether the word was found on the RBC list (Quick et al., 2019). While reviewing the core lists, ten additional words that were not in the Schwarz and McCarthy (2012) database met the definition for RBCs stated in the previous section and were incorporated into the RBC. Nine words were added as new items: *again*, *best*, *bit*, *better*, *else*, *even*, *gone*, *like*, *not*. A tenth word, *done*, was incorporated as a synonym for *finished*. These additions resulted in a final list of 156 RBCs (Appendix A; the ten words from core vocabulary lists are marked with an asterisk). After totaling the number of successes on each core vocabulary list, the proportion of RBCs was calculated by dividing the number of successes by the total number of core words. In addition, the number of successes was divided by 156 to determine the percentage of the RBC list captured by each core word list.

Results

The results of the procedures are summarized in Table 2.

RBCs were present on all nine lists, regardless of participant age, sampling context, or inclusion criteria. This confirms that there is some overlap between RBCs and high-frequency core words. The number of RBCs included on the lists ranged from six (Wood et al., 2016) to 58 (Marvin et al., 1994), with the average being 24 RBCs. The 58 RBCs captured by Marvin et al.

(1994) represent 37% of the RBC list (i.e., 58 out of 156 RBCs). Wood et al. (2016) represents less than 4% of the RBC list.

For each core vocabulary list, we calculated the proportion of core words that were RBCs. On average, RBCs made up approximately 17% of core vocabulary lists. Wood et al. (2016)'s list of 50 core words was composed of the smallest proportion of RBCs (12%; 6 of 50). The 23-item list published by Banajee et al. (2003) had the largest proportion of RBCs (35%).

To assess commonality, each relational word in the database was given a commonality score based on the number of core vocabulary lists where it was included (0–9). The list of RBCs appearing on one or more lists and the corresponding commonality score is available as Supplemental Materials. The commonality analysis revealed that 67 out of 156 RBCs appeared on at least one core vocabulary list. Of these, 47 were included on two or more, whereas 20 words appeared on only one core vocabulary list. Only two words, *in* and *on*, were included on every core list we analyzed. All the words on the Banajee et al. (2003) list had a commonality score of at least 5. Nearly 60% of RBCs ($N = 89$) did not appear on any list.

Discussion

The purpose of this paper was to examine the presence of relational basic concepts on core vocabulary lists that are commonly used as vocabulary selection resources for children who use AAC. The results revealed that there is some overlap between core words and RBCs; however, there was relatively little overlap of RBCs across the core lists. Only 2 RBCs (*in* and *on*) were present on all nine of the core vocabulary lists. Twenty RBCs were captured on only one core vocabulary list. More than half of the RBCs included on popular assessments for children in early grades were not captured by any core vocabulary list included in this study. For instance, *tall*, *short*, *empty*, *full*, *fast*, *slow*, *start*, *end*, *behind*, and *front* are just a few RBCs that were not captured by any of the core lists we analyzed.

A concerning finding from this study is that the majority of early emerging RBCs considered “core vocabulary” for toddlers 24–36 months old according to Banajee et al. (2003) are absent from one or more of other core lists. This warrants attention because words for early emerging RBCs are foundational to children’s vocabulary and remain necessary throughout a person’s life even if their frequency drops relative to other words in an expanding vocabulary. To illustrate, *here*, *more*, *done*, *some*, *off*, and *out* are considered core words for toddlers however, *here*, *more*, and *done* are not

Table 2. Summary of overlap between RBC list and core vocabulary lists.

Study	Total words	Overlapping words	% Core list	% RBC Database
Banajee et al. (2003)	23	8	34.8	5.1
Beukelman et al. (1989)	250	38	15.2	24.4
Clendon et al. (2013)	140	23	16.4	14.7
Crestani et al. (2010)	50	8	16.0	5.1
Fried-Oken and More (1992)	211	31	14.7	19.9
Marvin et al. (1994)	332	58	17.5	37.2
Sanders and Blakeley (2021)	84	14	16.7	9.0
Trembath et al. (2007)	263	37	14.1	23.7
Wood et al. (2016)	50	6	12.0	3.8

included on 4 lists (i.e., Clendon et al., 2013; Crestani et al., 2010; Sanders & Blakeley, 2021; Wood et al., 2016); *some* and *off* are not on three (i.e., Clendon et al., 2013; Crestani et al., 2010; Wood et al., 2016); and *out* is not listed on one (i.e., Sanders & Blakeley, 2021). While acknowledging that the core lists included in this study are relatively short, our findings point a need to consider factors other than frequency and commonality when judging a word's importance for AAC. For instance, Clendon et al. (2013), Crestani et al. (2010), and Wood et al. (2016) did not find *off* to be highly frequent in the speech of 5-to 7-year-old children based on the operational definitions of core employed in their studies. However, dismissing "off" as unimportant for a child in this age range simply because of its frequency may be misguided (e.g., prepositions like "off" and "out" are essential to the creation of prepositional phrases). While frequency analyses provide a method for selecting key vocabulary, we maintain that it should not be the only consideration.

It is possible that sampling context, such written language (i.e., Clendon et al., 2013; Wood et al., 2016), spoken language based on reading activities (i.e., Crestani et al., 2010; Sanders & Blakeley, 2021), spoken language during play and everyday routines (i.e., Banajee et al., 2003; Beukelman et al., 1989; Fried-Oken & More, 1992; Marvin et al., 1994; Trembath et al., 2007), or words provided by informants (i.e., Fried-Oken & More, 1992), influenced the inclusion of RBCs. The studies also differed in their approach toward defining and identifying core words for their lists. Some included the most frequently occurring words up to a predefined number, such as top 50 (i.e., Crestani et al., 2010; Wood et al., 2016) or top 140 (i.e., Clendon et al., 2013). Three studies (i.e., Beukelman et al., 1989; Marvin et al., 1994; Trembath et al., 2007) included all words occurring with a frequency of at least 0.5 in 1000 regardless of how many words met that criterion. Other studies used a commonality approach to identifying core words, such as words used across activities (Banajee et al., 2003), participants (i.e., Sanders & Blakeley, 2021; Trembath et al., 2007), or different sources (i.e., Fried-Oken & More, 1992). The studies by Trembath et al. and Fried-Oken and More used both frequency and commonality to generate their core word lists.

The number of words on each core vocabulary list, which is related to the operational definition of core words used by the study authors, seems related to the number of RBCs it includes. Lists that use a broader criteria for inclusion of core words, such as all words with a frequency of at least .5 in a thousand, generally incorporated a larger number of RBCs (e.g., Beukelman et al., 1989; Marvin et al., 1994; Trembath et al., 2007). Core vocabulary lists with a more stringent criteria like top 50 most frequently occurring words in the corpus contained fewer RBCs (e.g., Crestani et al., 2010; Wood et al., 2016). This pattern is reflected by the finding that Marvin et al. (1994) list is the longest included in the study ($n = 332$) and also contains the largest number of RBCs, albeit less than 40% of all the RBCs we looked for. On the other hand, the lists by Crestani et al. (2010) and Wood et al. (2016) contain the 50 most frequent words in their respective samples and capture eight and six core words, respectively. Banajee et al.

(2003) is the only exception to this pattern. Although the Banajee list only captures eight RBC words (i.e., *all done/finished, here, in, more, off, on, out, some*), these items make up almost 35% of the 23-item list; this is the largest representation of RBCs on any of the core vocabulary lists in terms of proportion despite being the shortest core list overall.

The age and syntactic level of the children sampled may have contributed to the findings as well. Banajee et al. (2003) sampled toddlers who reportedly communicated with 2–3-word utterances. The remaining core vocabulary lists all sampled children older than age 3 with Crestani et al. (2010) and Wood et al. (2016) including children as old as 7 or Grade 1. The present finding that the Banajee et al. (2003) list comprising the greatest proportion of RBCs is consistent with child language research showing that toddlers use a variety of conceptual-relational words, social words, nouns, and verbs (Bloom, 1973; Gopnik, 1988). In contrast, function words supporting grammaticalization emerge later in development (Brown, 1973; Frick Semmler et al., 2023). As lexical diversity and grammaticalization increase with age, function words are more likely to rank highest in terms of frequency (Bates et al., 1994), which contributes to the high representation of function words on core vocabulary lists developed from language samples of preschool and school-aged children (Frick Semmler et al., 2023).

Participant age, language sampling context, and the operational definition of a core word used by the study authors likely influenced the inclusion of RBCs. Given the procedural variability across the studies, determining the optimal method for incorporating RBCs within a core word approach is inconclusive. Although some overlap exists, the results strongly suggest that core word lists are not well suited for identifying most of the RBCs that children in early grades are expected to know and use. Many more RBCs are needed to support language acquisition; therefore, RBCs must be considered in addition to high-frequency core words.

Practical implications

The inclusion of RBCs into AAC intervention and instruction may have implications at the earliest stages of language development. A main premise behind identifying high-frequency core words for inclusion on AAC systems is to facilitate the production of multiword combinations, such as "I see" and "it go" (Bean et al., 2019; van Tilborg & Deckers, 2016). Teaching multi word utterances is pivotal for language development because they serve as the foundation for grammaticalization (Hadley, 2006). Typically developing children tend to produce word combinations once they have a productive vocabulary of at least 50 words including nouns, verbs, and descriptive words. Vocabulary selection for AAC, then, should include a range of RBCs to support children's expanding vocabulary base. Moreover, RBCs make ideal candidates for word combinations, as they can be combined with core words (e.g., *put down*), fringe words (e.g., *Mickey first*), verbs (e.g., *throw far*), and other RBCs (e.g., *almost done*).

Although the overlap between the core lists and the RBC list is limited, it warrants noting that several RBCs are highly

frequent in the speech of young children. For instance, *in*, *on*, *out*, *there*, and *up*, were identified as core words by at least seven of the core lists we reviewed (see [Supplemental Materials](#)). Because selecting vocabulary often involves competing priorities and constraints, RBCs that emerge relatively early in development and are frequently occurring may be an appropriate starting point for incorporating RBCs. Nonetheless, this study underscores the need to consider relatively less frequent RBCs that may also support linguistic, academic, and cognitive development.

The incorporation of RBCs into AAC intervention and instruction may also have significant implications for supporting action and autonomy, particularly for children with physical disabilities. For aided communicators who struggle to carry out their desired actions or explore the world independently due to severe physical impairment, the ability to use RBCs may hold even greater value than for children without motor limitations. RBCs play a critical role in directive language, which may offer aided communicators a means to engage with the world by instructing others to carry out their goals (Batorowicz et al., 2016). Unfortunately, many children with communication access needs have limited experience with giving directions to others (Batorowicz et al., 2016; Stadskleiv et al., 2018; von Tetzchner, 2018).

Our findings align with prior work that has highlighted the drawback of adopting a singularly core approach to vocabulary selection in AAC (e.g., Frick Semmler et al., 2023; Laubscher & Light, 2020). A relatively novel implication underscored by this research is a need to go beyond the conventional approach of balancing core and fringe words when striving to provide children with a robust vocabulary. Although the present study is focused on the utility of core lists for identifying RBC vocabulary, it stands to reason that RBCs are unlikely to represent an individual's fringe vocabulary, which should reflect their identity, personal needs, and interests.

Regardless of the type of vocabulary (i.e., core, fringe, RBCs), vocabulary selection is always an individualized process of identifying words that are most beneficial to a particular child. To facilitate the selection of appropriate RBCs, a cognitive approach is one framework that has been suggested. A cognitive approach focuses on the vocabulary an individual needs to comprehend, participate in, and discuss reasoning tasks like comparing, describing, evaluating, measuring, and categorizing (Cooper et al., 2022). When applied to these activities, established vocabulary selection strategies such as task analyses, observations, and communication diaries may be successful for noting valuable RBCs. To illustrate, when considering words that support participation in a lesson on currency and change, exercising a cognitive approach may elevate RBCs that support comparison such as *equal*, *almost*, and *enough*. Academic materials, curriculum standards, and assessments can provide an additional avenue for selecting RBC vocabulary. For example, foundational literacy standards for kindergarten students are to follow words from top to bottom; isolate initial, medial, and final sounds; and distinguish between same and different letters across words (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010). For some children with language disabilities,

explicit instruction and practice with concepts that underly these standards (i.e., top, bottom, first, middle, last, same, different) may contribute to academic participation and progress. Finally, several BAC researchers (see von Tetzchner, 2018 for introduction to BAC special issue) have pointed out the need to support aided communicators in using directive language as a potential means of compensating for limited mobility. Providing or examining opportunities to give instructions, such as incorporating barrier-games, may also shine light on useful RBC vocabulary.

Although RBCs are a critical component of children's vocabularies, RBCs alone are insufficient to meet a child's communication needs. A robust vocabulary for school-aged children using AAC must include a variety of core, personal, and task/environment-dependent vocabulary in addition to relational and non-relational basic concepts. To capture a broad scope of words, clinicians should draw upon multiple vocabulary selection approaches, strategies, and resources (Cooper et al., 2022).

Limitations and future directions

The present study has important implications for clinical practice; however, the outcomes must be considered in light of the study's limitations. Our analysis includes a relatively wide scope of core vocabulary lists in terms of participant age, sampling context, and analysis procedures. While our broad inclusion criteria may have contributed to this initial investigation of RBCs on core lists, it potentially constrained our ability to pinpoint effective procedures for capturing RBCs when using a core approach. Future research can explore ways identify RBCs that are frequent in children's speech. Another limitation of the present study is that we only include core vocabulary lists and words from RBC assessments published in English. Core vocabulary lists are language specific with relatively little overlap across languages (Soto & Tönsing, 2023). In addition, relational vocabulary refers to conceptual categories that may not be represented across all languages (see Bowerman & Choi, 2001 for a discussion about language specific spatial categories). Future research should investigate the presence of relational vocabulary on core lists developed for languages besides English as well as compare RBCs used by children learning different languages.

The final RBC list provided in [Appendix A](#) has limitations that need to be considered. The RBC list was created by reviewing a database of all the words included on three assessments of basic concepts for children aged 7 and below, which were not intended to be used as vocabulary selection tools. One ramification of using assessments is that they may not include some early developing concepts. As described in the method section, we identified 10 words from the core vocabulary lists that met the definition for RBCs that were not included on the assessments (i.e., *again*, *best*, *bit*, *better*, *done*, *else*, *even*, *gone*, *like*, *not*). Although we added these words to the final RBC list, it should not be considered an exhaustive list of all relational concepts. Future research should aim to generate other resources and

strategies for identifying developmentally appropriate RBCs that may not be captured on our RBC list.

The RBC list and the original Shwartz & McCarthy database do not clarify which RBC words children should be able to produce versus comprehend at certain ages. A limitation of the RBC list, then, is that it potentially overestimates the number of RBCs children aged 7 and below use expressively. It is important to acknowledge that all the words on the RBC list may not be appropriate for every child at every developmental stage. Clinicians must consider the child's linguistic level and communication needs when selecting specific vocabulary. Nonetheless, receptive language plays a critical role in expressive language development; hence, children using AAC need exposure to vocabulary and models of its usage, even for words that are not yet part of their expressive vocabularies (Quick et al., 2019). A related limitation is the lack of normative information on the RBC list. Future research should investigate the typical order of acquisition for relational vocabulary, including those on the RBC list. Normative information related to typically developing children, such as assessment norms, may be informative; however, its application to children learning aided language may still be limited.

This paper is intended to add to the ongoing discussion on vocabulary selection for children who use AAC and in doing so, attempts to invite other avenues for future research. For instance, there is a dearth of information regarding conceptual development among children with communication disabilities who use AAC (Moseley et al., 2021; Murray & Goldbart, 2009). Developmental research is sorely needed to understand how children acquiring aided language learn to use and comprehend relational words. In addition, scholarship in the AAC field is needed to illuminate the relationships between RBC knowledge, communication competence, nonlinguistic cognitive skills, and academic achievement.

Beyond identifying and providing access to relational vocabulary, ongoing exposure and experience with the vocabulary should be considered an essential component of AAC based intervention. Intuitively, activities that provoke attention to relations in the world such as comparing, measuring, sequencing, evaluating, navigating, directing, and categorizing are likely to engender opportunities to hear and use relational vocabulary (Cooper et al., 2022). Such claims should be investigated by future research to uncover clinical intervention approaches that maximally support the development of relational language. For example, intervention studies can be conducted to determine if the incorporation of certain activities into therapeutic intervention such as construction-based activities, giving directions for action, or communicating unknown information, contributes to relational word production and comprehension (Batorowicz et al., 2016; Stadskeiv et al., 2018; von Tetzchner, 2018).

Conclusion

Best practice for vocabulary selection in AAC advocates for a dual approach that incorporates both core and fringe vocabulary (Beukelman & Light, 2020). Drawing on assessments of basic concept knowledge for preschool and early elementary

school students, we created a list of 156 relational basic concept (RBC) words that are important for school success, academic participation, and communication. Comparing our RBC list to nine widely used core vocabulary lists demonstrates some overlap between core words and RBC words; however, only two RBCs (*in* and *on*) overlapped on all nine of the core lists and 20 RBCs appeared on only one core list. Most RBC items included in our analysis were not captured on any core list. These results demonstrate that resources generated using a core approach have limited utility for identifying many RBCs that preschool and early elementary school students are expected to know and use. By extension, this study also raises concern regarding the prevailing dichotomy of core and fringe vocabulary in AAC research and practice because of its tendency to overlook relational words. Given their importance for language development, communication, and academic achievement, RBCs should be incorporated into vocabulary selection procedures, along with core and fringe words. Additionally, further consideration of RBCs within AAC research and practice is warranted.

Disclosure statement

No potential conflict of interest was reported by the author(s).

ORCID

Brittney Cooper  <http://orcid.org/0000-0002-2180-4062>

Gloria Soto  <http://orcid.org/0000-0002-3254-3099>

References

- Anderson, D., Campos, J., Witherington, D., Dahl, A., Rivera, M., He, M., Uchiyama, I., & Barbu-Roth, M. (2013). The role of locomotion in psychological development. *Frontiers in Psychology, 4*, 440. <https://doi.org/10.3389/fpsyg.2013.00440>
- Banajee, M., DiCarlo, C., & Buras Stricklin, S. (2003). Core vocabulary determination for toddlers. *Augmentative and Alternative Communication, 19*(2), 67–73. <https://doi.org/10.1080/0743461031000112034>
- Bates, E., Marchman, V., Thal, D., Fenson, L., Dale, P., Reznick, J. S., Reilly, J., & Hartung, J. (1994). Developmental and stylistic variation in the composition of early vocabulary. *Journal of Child Language, 21*(1), 85–123. <https://doi.org/10.1017/S0305000900008680>
- Batorowicz, B., Stadskeiv, K., von Tetzchner, S., & Missiuna, C. (2016). Children who use communication aids instructing peer and adult partners during play-based activity. *Augmentative and Alternative Communication, 32*(2), 105–119. <https://doi.org/10.3109/07434618.2016.1160150>
- Bean, A., Cargill, L. P., & Lyle, S. (2019). Framework for selecting vocabulary for preliterate children who use augmentative and alternative communication. *American Journal of Speech-Language Pathology, 28*(3), 1000–1009. https://doi.org/10.1044/2019_AJSLP-18-0041
- Beukelman, D. R., Jones, R., & Rowan, M. (1989). Frequency of word usage by nondisabled peers in integrated preschool classrooms. *Augmentative and Alternative Communication, 5*(4), 243–248. <https://doi.org/10.1080/07434618912331275296>
- Beukelman, D. R., & Light, J. C. (2020). *Augmentative & alternative communication: Supporting children and adults with complex communication needs* (5th ed.). Paul H. Brookes Publishing Co.
- Bloom, L. (1973). *One word at a time: The use of single-word utterances before syntax*. Mouton.
- Boehm, A. E., Classon, B., & Kelly, M. (1986). *Preschool teachers' spoken use of basic concepts*. [Unpublished manuscript]. Teachers College, Columbia University, New York.
- Boehm, A. E. (2001). *Boehm test of basic concepts* (3rd ed.). Psychological Corporation.

- Boehm, A. E. (2004). Assessment of basic relational concepts. In B. A. Bracken (Ed.), *The psychoeducational assessment of preschool children* (pp. 186–203). Lawrence Erlbaum Associates.
- Boehm, A. E. (2013). Basic concepts as building blocks to school success: Assessment to intervention using the Boehm Test of Basic Concepts—Third Edition (Boehm-3) [white paper]. Pearson. http://images.pearsonclinical.com/images/Assets/Boehm-3/Boehm_White_paper_RPT.pdf
- Boenisch, J., & Soto, G. (2015). The oral core vocabulary of typically developing English-speaking school-aged children: Implications for AAC practice. *Augmentative and Alternative Communication, 31*(1), 77–84. <https://doi.org/10.3109/07434618.2014.1001521>
- Bowerman, M., & Choi, S. (2001). Shaping meanings for language: Universal and language-specific in the acquisition of spatial semantic categories. In M. Bowerman & S. Levinson (Eds.), *Language acquisition and conceptual development* (pp. 475–511). Cambridge University Press.
- Bracken, B. A. (1988). Rate and sequence of positive and negative poles in basic concept acquisition. *Language, Speech, and Hearing Services in Schools, 19*(4), 410–417. <https://doi.org/10.1044/0161-1461.1904.410>
- Bracken, B. A. (1998). *Bracken basic concept scale – revised*. Psychological Corporation.
- Bracken, B. A., & Crawford, E. (2010). Basic concepts in early childhood educational standards: A 50-state review. *Early Childhood Education Journal, 37*(5), 421–430. <https://doi.org/10.1007/s10643-009-0363-7>
- Brown, R. (1973). *A first language: The early stages*. Harvard University Press.
- Busch, R. F. (1980). Predicting first-grade reading achievement. *Learning Disability Quarterly, 3*(1), 38–48. <https://doi.org/10.2307/1510424>
- Campos, J. J., Anderson, D. I., Barbu-Roth, M. A., Hubbard, E. M., Hertenstein, M. J., & Witherington, D. (2000). Travel broadens the mind. *Infancy, 1*(2), 149–219. https://doi.org/10.1207/S15327078IN0102_1
- Casey, B. M., Andrews, N., Schindler, H., Kersh, J. E., Samper, A., & Copley, J. (2008). The development of spatial skills through interventions involving block building activities. *Cognition and Instruction, 26*(3), 269–309. <https://doi.org/10.1080/07370000802177177>
- Center for Literacy and Disability Studies. (2020). Project core. <http://www.project-core.com/communication-systems/>
- Chan, J. Y.-C., Sera, M. D., & Mazzocco, M. M. M. (2022). Relational language influences young children's number relation skills. *Child Development, 93*(4), 956–972. <https://doi.org/10.1111/cdev.13737>
- Christie, S., & Gentner, D. (2014). Language helps children succeed on a classic analogy task. *Cognitive Science, 38*(2), 383–397. <https://doi.org/10.1111/cogs.12099>
- Clendon, S. A., Sturm, J. M., & Cali, K. S. (2013). Vocabulary use across genres: Implications for students with complex communication needs. *Language, Speech, and Hearing Services in Schools, 44*(1), 61–72. [https://doi.org/10.1044/0161-1461\(2012\)10-0112](https://doi.org/10.1044/0161-1461(2012)10-0112)
- Cooper, B., Muñoz, T., & Soto, G. (2022). Language and vocabulary features of AAC. In N. Hall, J. Juengling-Sudkamp, M. L. Gutmann, & E. R. Cohn (Eds.), *Fundamentals of AAC: A case-based approach to enhancing communication*. Plural Publishing.
- Cortes, R. A., Green, A. E., Barr, R. F., & Ryan, R. M. (2022). Fine motor skills during early childhood predict visuospatial deductive reasoning in adolescence. *Developmental Psychology, 58*(7), 1264–1276. <https://doi.org/10.1037/dev0001354>
- Crestani, C.-A. M., Clendon, S. A., & Hemsley, B. (2010). Words needed for sharing a story: Implications for vocabulary selection in augmentative and alternative communication. *Journal of Intellectual & Developmental Disability, 35*(4), 268–278. <https://doi.org/10.3109/13668250.2010.513966>
- Critten, V., Campbell, E., Farran, E., & Messer, D. (2018). Visual perception, visual-spatial cognition and mathematics: Associations and predictions in children with cerebral palsy. *Research in Developmental Disabilities, 80*, 180–191. <https://doi.org/10.1016/j.ridd.2018.06.007>
- de Villiers, J. G., & de Villiers, P. A. (1978). *Language acquisition*. Harvard University Press.
- Deliberato, D., Jennische, M., Oxley, J., Nunes, L. R., d'Oliveira de, P., Walter, C. C. d F., Massaro, M., Almeida, M. A., Stadskleiv, K., Basil, C., Coronas, M., Smith, M., & von Tetzchner, S. (2018). Vocabulary comprehension and strategies in name construction among children using aided communication. *Augmentative and Alternative Communication, 34*(1), 16–29. <https://doi.org/10.1080/07434618.2017.1420691>
- Dodd, J. L., & Gorey, M. (2014). AAC intervention as an immersion model. *Communication Disorders Quarterly, 35*(2), 103–107. <https://doi.org/10.1177/1525740113504242>
- Dumas, D., Alexander, P. A., & Grossnickle, E. M. (2013). Relational reasoning and its manifestations in the educational context: A systematic review of the literature. *Educational Psychology Review, 25*(3), 391–427. <https://doi.org/10.1007/s10648-013-9224-4>
- Ego, A., Lidzba, K., Brovedani, P., Belmonti, V., Gonzalez-Monge, S., Boudia, B., Ritz, A., & Cans, C. (2015). Visual-perceptual impairment in children with cerebral palsy: A systematic review. *Developmental Medicine and Child Neurology, 57*(Suppl 2), 46–51. <https://doi.org/10.1111/dmcn.12687>
- Erwin-Davidson, L. (2019). *How conceptual-relational words are taught, used, and learned: A cross-case analysis* (Publication No. 13858010) [Doctoral Dissertation]. University of North Carolina at Chapel Hill. ProQuest Dissertations & Theses Global. <https://www.proquest.com/dissertations-theses/how-conceptual-relational-words-are-taught-used/docview/2236411199/se-2>
- Estes, G. D., Harris, J., Moers, F., & Wodrich, D. (1976). Predictive validity of the Boehm Test of basic concepts for achievement in first grade. *Educational and Psychological Measurement, 36*(4), 1031–1035. <https://doi.org/10.1177/001316447603600431>
- Fallon, K. A., Light, J. C., & Paige, T. K. (2001). Enhancing vocabulary selection for preschoolers who require augmentative and alternative communication (AAC). *American Journal of Speech-Language Pathology, 10*(1), 81–94. [https://doi.org/10.1044/1058-0360\(2001\)010](https://doi.org/10.1044/1058-0360(2001)010)
- Farran, E. K., Critten, V., Courbois, Y., Campbell, E., & Messer, D. (2021). Spatial cognition in children with physical disability; what is the impact of restricted independent exploration? *Frontiers in Human Neuroscience, 15*, 669034. <https://doi.org/10.3389/fnhum.2021.669034>
- Ferrara, K., Hirsh-Pasek, K., Newcombe, N. S., Golinkoff, R. M., & Lam, W. S. (2011). Block talk: Spatial language during block play. *Mind, Brain, and Education, 5*(3), 143–151. <https://doi.org/10.1111/j.1751-228X.2011.01122.x>
- Foreman, N., Orencas, C., Nicholas, E., Morton, P., & Gell, M. (1989). Spatial awareness in seven to 11-year-old physically handicapped children in mainstream schools. *European Journal of Special Needs Education, 4*(3), 171–179. <https://doi.org/10.1080/0885625890040302>
- Frick Semmler, B. J., Bean, A., & Wagner, L. (2023). Examining core vocabulary with language development for early symbolic communicators. *International Journal of Speech-Language Pathology, 26*(1), 28–37. <https://doi.org/10.1080/17549507.2022.2162126>
- Fried-Oken, M., & More, L. (1992). An initial vocabulary for nonspeaking preschool children based on developmental and environmental language sources. *Augmentative and Alternative Communication, 8*(1), 41–56. <https://doi.org/10.1080/07434619212331276033>
- Gallivan, J. (1988). Concept knowledge as a predictor of first- and fourth-grade reading achievement. *Perceptual and Motor Skills, 66*(2), 407–410. <https://doi.org/10.2466/pms.1988.66.2.407>
- Gopnik, A. (1988). Three types of early word: The emergence of social words, names and cognitive-relational words in the one-word stage and their relation to cognitive development. *First Language, 8*(2), 49–69. <https://doi.org/10.1177/014272378800802204>
- Hadley, P. A. (2006). Assessing the emergence of grammar in toddlers at risk for specific language impairment. *Seminars in Speech and Language, 27*(3), 173–186. <https://doi.org/10.1055/s-2006-948228>
- Hermer-Vazquez, L., Moffet, A., & Munkholm, P. (2001). Language, space, and the development of cognitive flexibility in humans: The case of two spatial memory tasks. *Cognition, 79*(3), 263–299. [https://doi.org/10.1016/S0010-0277\(00\)00120-7](https://doi.org/10.1016/S0010-0277(00)00120-7)
- Judge, S., Murray, J., Lynch, Y., Meredith, S., Moulam, L., Randall, N., Whittle, H., & Goldbart, J. (2023). Attributes of communication aids as described by those supporting children and young people with AAC. *International Journal of Language & Communication Disorders, 58*(3), 910–928. <https://doi.org/10.1111/1460-6984.12833>
- Kurmanaviciute, R., & Stadskleiv, K. (2017). Assessment of verbal comprehension and non-verbal reasoning when standard response mode is challenging: A comparison of different response modes and an exploration of their clinical usefulness. *Cogent Psychology, 4*(1), 1275416. <https://doi.org/10.1080/23311908.2016.1275416>

- Langarika-Rocafort, A., Mondragon, N. I., & Etxebarrieta, G. R. (2021). A systematic review of research on augmentative and alternative communication interventions for children aged 6–10 in the last decade. *Language, Speech, and Hearing Services in Schools, 52*(3), 899–916. https://doi.org/10.1044/2021_LSHSS-20-00005
- Laubscher, E., & Light, J. (2020). Core vocabulary lists for young children and considerations for early language development: A narrative review. *Augmentative and Alternative Communication (Baltimore, Md.: 1985), 36*(1), 43–53. <https://doi.org/10.1080/07434618.2020.1737964>
- Light, J. (1997). “Let’s go star fishing”: Reflections on the contexts of language learning for children who use aided AAC. *Augmentative and Alternative Communication, 13*(3), 158–171. <https://doi.org/10.1080/07434619712331277978>
- Light, J., Barwise, A., Gardner, A. M., & Flynn, M. (2021). Personalized early AAC intervention to build language and literacy skills: A case study of a 3-year-old with complex communication needs. *Topics in Language Disorders, 41*(3), 209–231. <https://doi.org/10.1097/TLD.0000000000000254>
- Marcinowski, E. C., & Campbell, J. M. (2017). Building on what you have learned: Object construction skill during infancy predicts the comprehension of spatial relations words. *International Journal of Behavioral Development, 41*(3), 341–349. <https://doi.org/10.1177/0165025416635283>
- Marvin, C., Beukelman, D. R., & Bilyeu, D. (1994). Vocabulary-use patterns in preschool children: Effects of context and time sampling. *Augmentative and Alternative Communication, 10*(4), 224–236. <https://doi.org/10.1080/07434619412331276930>
- McCarthy, J. H., Schwarz, I., & Menz, H. (2012). *Frequency of basic concept words in classrooms: Influences on instruction* [Paper presentation]. Poster session presented at the meeting of the American Speech-Language-Hearing Association Annual Convention, Atlanta, GA.
- McCarthy, J. H., Schwarz, I., & Ashworth, M. (2017). The availability and accessibility of basic concept vocabulary in AAC software: A preliminary study. *Augmentative and Alternative Communication, 33*(3), 131–138. <https://doi.org/10.1080/07434618.2017.1332685>
- Moseley, M., Howat, L., McLoughlin, L., Gilling, S., & Lewis, D. (2021). Accessible digital assessments of temporal, spatial, or movement concepts for profoundly motor impaired and non-verbal individuals: A pilot study. *Disability and Rehabilitation—Assistive Technology, 16*(3), 350–360. <https://doi.org/10.1080/17483107.2019.1683240>
- Murray, J., & Goldbart, J. (2009). Cognitive and language acquisition in typical and aided language learning: A review of recent evidence from an aided communication perspective. *Child Language Teaching and Therapy, 25*(1), 31–58. <https://doi.org/10.1177/0265659008098660>
- Murray, J., Sandberg, A. D., Smith, M. M., Deliberato, D., Stadskleiv, K., & von Tetzchner, S. (2018). Communicating the unknown: Descriptions of pictured scenes and events presented on video by children and adolescents using aided communication and their peers using natural speech. *Augmentative and Alternative Communication, 34*(1), 30–39. <https://doi.org/10.1080/07434618.2017.1420690>
- National Governors Association Center for Best Practices and Council of Chief State School Officers. (2010). *English language arts standards, reading: Foundational skills, kindergarten*. <https://www.corestandards.org/ELA-Literacy/RF/K/>
- Oudgenoeg-Paz, O., Volman, M. J. M., & Leseman, P. P. M. (2016). First steps into language? Examining the specific longitudinal relations between walking, exploration and linguistic skills. *Frontiers in Psychology, 7*, 1458. <https://doi.org/10.3389/fpsyg.2016.01458>
- Panter, J. E. (2000). Validity of the Bracken Basic Concept Scale-Revised for predicting performance on the metropolitan readiness test-sixth edition. *Journal of Psychoeducational Assessment, 18*(2), 104–110. <https://doi.org/10.1177/073428290001800201>
- Panter, J. E., & Bracken, B. A. (2009). Validity of the Bracken School Readiness Assessment for predicting first grade readiness. *Psychology in the Schools, 46*(5), 397–409. <https://doi.org/10.1002/pits.20385>
- Piersel, W. C., & McAndrews, T. (1982). Concept acquisition and school progress: An examination of the Boehm Test of Basic Concepts. *Psychological Reports, 50*(3), 783–786. <https://doi.org/10.2466/pr0.1982.50.3.783>
- Pruden, S. M., & Levine, S. C. (2017). Parents’ spatial language mediates a sex difference in preschoolers’ spatial-language use. *Psychological Science, 28*(11), 1583–1596. <https://doi.org/10.1177/0956797617711968>
- Pruden, S. M., Levine, S. C., & Huttenlocher, J. (2011). Children’s spatial thinking: Does talk about the spatial world matter? *Developmental Science, 14*(6), 1417–1430. <https://doi.org/10.1111/j.1467-7687.2011.01088.x>
- Quick, N., Erickson, K., & Mcwright, J. (2019). The most frequently used words: Comparing child-directed speech and young children’s speech to inform vocabulary selection for aided input. *Augmentative and Alternative Communication, 35*(2), 120–131. <https://doi.org/10.1080/07434618.2019.1576225>
- Sanders, E. J., & Blakeley, A. (2021). Vocabulary in dialogic reading: Implications for AAC. *Augmentative and Alternative Communication, 37*(4), 217–228. <https://doi.org/10.1080/07434618.2021.2016961>
- Schwarz, I., & McCarthy, J. H. (2012). *Basic concepts vocabulary database* [Data set]. <https://www.uthsc.edu/asp/research/documents/l3-basic-concept-vocabulary-database.pdf>
- Silvey, C., Gentner, D., Richland, L., Goldin-Meadow, S. (2017). Children’s spontaneous comparisons from 26 to 58 months predict performance in verbal and non-verbal analogy tests in 6th grade. Proceedings of the 39th Annual Meeting of the Cognitive Science Society (pp. 1072–1077). Cognitive Science Society: London. <https://discovery.ucl.ac.uk/id/eprint/10090524/>
- Soto, G. (2009). Academic adaptations for students with AAC needs. In G. Soto & C. Zangari (Eds.), *Practically speaking: Language, literacy, and academic development for students with AAC needs* (pp. 131–142). Paul H. Brookes Publishing Co.
- Soto, G., & Cooper, B. (2021). An early Spanish vocabulary for children who use AAC: Developmental and linguistic considerations. *Augmentative and Alternative Communication, 37*(1), 64–74. <https://doi.org/10.1080/07434618.2021.1881822>
- Soto, G., & Tönsing, K. (2024). Is there a ‘universal’ core? Using semantic primes to select vocabulary across languages in AAC. *Augmentative and Alternative Communication, 40*(1), 1–11. <https://doi.org/10.1080/07434618.2023.2243322>
- Stadskleiv, K., Batorowicz, B., Massaro, M., van Balkom, H., & von Tetzchner, S. (2018). Visual-spatial cognition in children using aided communication. *Augmentative and Alternative Communication, 34*(1), 68–78. <https://doi.org/10.1080/07434618.2017.1422017>
- Steinbauer, E., & Heller, M. S. (1978). The Boehm Test of Basic Concepts as a predictor of academic achievement in grades 2 and 3. *Psychology in the Schools, 15*(3), 357–360. [https://doi.org/10.1002/1520-6807\(197807\)15:3<357::AID-PITS2310150308>3.0.CO;2-6](https://doi.org/10.1002/1520-6807(197807)15:3<357::AID-PITS2310150308>3.0.CO;2-6)
- Trembath, D., Balandin, S., & Togher, L. (2007). Vocabulary selection for Australian children who use augmentative and alternative communication. *Journal of Intellectual & Developmental Disability, 32*(4), 291–301. <https://doi.org/10.1080/13668250701689298>
- van Tilborg, A., & Deckers, S. R. J. M. (2016). Vocabulary selection in AAC: Application of core vocabulary in atypical populations. *Perspectives of the ASHA Special Interest Groups, 1*(12), 125–138. <https://doi.org/10.1044/persp1.SIG12.125>
- von Tetzchner, S. (2018). Introduction to the special issue on aided language processes, development, and use: An international perspective. *Augmentative and Alternative Communication, 34*(1), 1–15. <https://doi.org/10.1080/07434618.2017.1422020>
- Walker, A. A. (1979). The development of relational concepts in three- and four-year-olds. *The Journal of Educational Research, 73*(1), 37–40. <https://doi.org/10.1080/00220671.1979.10885201>
- Wiedenbauer, G., & Jansen-Osmann, P. (2006). Spatial knowledge of children with spina bifida in a virtual large-scale space. *Brain and Cognition, 62*(2), 120–127. <https://doi.org/10.1016/j.bandc.2006.04.003>
- Wiig, E. (2004). *Wiig assessment of basic concepts*. Super Duper Publications.
- Wood, C., Appleget, A., & Hart, S. (2016). Core vocabulary in written personal narratives of school-age children. *Augmentative and Alternative Communication, 32*(3), 198–207. <https://doi.org/10.1080/07434618.2016.1216596>
- Zhang, X., Chen, C., Yang, T., & Xu, X. (2020). Spatial skills associated with block-building complexity in preschoolers. *Frontiers in Psychology, 11*, 563493. <https://doi.org/10.3389/fpsyg.2020.563493>

Appendix A: Relational basic concept list

above
across
after
again*
ahead
alike
all
almost
always
another
apart
around
away
back
backward
before
beginning
behind
below
beside/next to
best*
better*
between
big
bit*
both
bottom
center
close
closed
corner
covered
crooked
deep
diagonal
different
down
each
early
edge
else*
empty
end
enough
equal
even*
every
exactly
except
far
fast
few
finished/done*
first
forward
fourth
from
front/in front
full
gone*
half
heavy
here
high
in
inside
inside-out
into
joined
just
large
last
late
least
left
less
level
light
like*

little
long
loose
lot/a lot
low
many
match
medium
middle
missing
more
most
narrow
near
nearly
neither
never
new
next
none
not*
off
old
on
open
opposite
order
other
out
outside
over
pair
part
piece
quarter
right
same
second
separated
several
shallow
short
side
sideways
similar
skip
skipped
slow
small
some
space
start
still
strong
tall
there
thick
thin
third
through
tight
together
top
toward
turn
twice
under
underlined
unequal
up
upside-down
weak
whole
wide
with
without
young

Note. Bold words overlapped with one or more core word lists.

*Words not included in the Schwarz and McCarthy (2012) basic concept database.

(continued)