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Vocabulary Selection in AAC: Application of Core Vocabulary in Atypical Populations

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Abstract

On the American Speech-Language-Hearing Association Community for Special Interest Group 12, Augmentative and Alternative Communication (AAC), a community member introduced a discussion related to the selection and use of core vocabulary with students with severe intellectual or multiple disabilities. It was questioned whether or not core vocabulary determined in typically developing children was applicable to AAC intervention in these students. The present article reviewed a vast amount of language sample studies related to core vocabulary in both typical and atypical populations. It was concluded that core vocabulary is comparable for both populations in various contexts, with various communication partners, over various topics, and in various modalities of language use. Core vocabulary is thus of high importance for all AAC users, regardless of physical or intellectual disabilities.

To achieve the most effective communication possible, clinicians need to apply a structured and scientific approach to Augmentative and Alternative Communication (AAC) intervention to significantly improve the quality of life for individuals who use AAC. When selecting vocabulary for an AAC system, it is essential that they apply principles of evidence-based practice (Hill, 2004). Evidence-based practice promotes the collection, interpretation, and integration of valid, important, and applicable patient-reported, clinician-observed, and research-derived evidence (McKibbon, Wilczynski, Hayward, Walker-Dilks, & Haynes, 1995). Language sample collection and analysis is n historically used evidence-based practice for selecting vocabulary for AAC systems (Kovacs & Hill, 2015). In 1981, Carlson noted that people who use AAC "are unable to create spontaneously their own lexicon and must operate with a vocabulary selected by someone else or preselected, not spontaneously chosen by themselves" (Carlson, 1981, p. 240). However, AAC users and AAC support teams rarely have enough knowledge and experience to select vocabulary for functional use for specific contexts, activities, ethnicity, or language group (Beukelman & Mirenda, 2013). The present article provides an overview of evidence-based clinical practice for vocabulary selection in AAC. This article discusses the concept of core vocabulary and its relevance in vocabulary selection for AAC practice. A secondary purpose is to review existing research articles, which are based on language sampling in order to investigate whether or not core vocabulary is comparable between typically and atypically developing individuals.

Vocabulary Selection in AAC

Vocabulary selection should be guided by two main principles: the need to convey essential messages and the eventual development of language skills (Beukelman & Mirenda, 2013). Selected vocabulary should be highly supportive of language and communication development because vocabulary development is key in language learning (Hohenberger & Peltzer-Karpf, 2009). Functional use of vocabulary is grounded in meaningful interactions (Tomasello, 2003) through which children can develop their language abilities and communication performance. Many studies have shown that the (language) development of individuals with intellectual disabilities closely resembles the (language) development of typically developing peers. The person with an intellectual disability acquires language at a slower pace, but follows the same sequence in developmental milestones (Dykens & Hodapp, 2001). For example, van Duijn, Dijkxhoorn, Scholte, and van Berckelaer-Onnes (2010) determined the adaptive levels and developmental sequence of motor, daily living, communicative, and social behavioural skills in a group of 984 Dutch children with Down syndrome, aged between 0 and 12 years, and found that these children seemed to acquire skills in a similar sequence and according to a similar trajectory as typically developing children. A developmental approach to vocabulary selection, in which the language on the AAC system closely reflects the language of typically developing peers, is therefore encouraged. This approach may provide the individual who is learning to communicate, using an AAC system, with the resources to communicate for purposes that extend beyond requesting (Dodd & Gorey, 2013).

Dodd and Gorey (2013) state that familiar and unfamiliar communication partners often use an oral language system with an individual that is still learning to use an AAC-based language. Whereas efficient AAC users may rely more on auditory (speech output) and motor planning than on visual modalities, beginning AAC users require to "code switch" between a verbal and a visually symbolic language system. These individuals often do not (yet) possess a solid language foundation in either system, which impacts opportunities for typical language development. Beginning AAC users may experience a discrepancy between the available language on their AAC system and their experiences that encourage their use of language (Dodd & Gorey, 2013). This results in an improper alignment between the external lexicon (i.e., the vocabulary of the AAC system) and the internal lexicon of a child (Romski & Sevcik, 1993). In his theory on modeling and vicarious processes, Albert Bandura (1969) states that individuals cannot acquire words and syntactic structures without exposure to verbalizing models. Some amount of modeling is therefore indispensable for language acquisition. According to this theory, language is learned from models in the environment, so children will have many experiences with, as well as learn from, language used by communication partners in daily life. Therefore, children encounter core vocabulary used by communication partners from early on in their language development. During language development, typically developing children become able to construct an almost infinite variety of sentences. Instead of only imitating and memorizing specific utterances, children learn sets of rules on the basis of an unlimited amount of grammatical sentences that they can generate. If individuals who have to rely on AAC reach comparable developmental milestones in language development as typically developing children do, they should be provided with the same opportunities to learn language.

The opportunities to learn language are closely linked to the Cognitive Linguistic notion of "entrenchment" (Zenner, Speelman, & Geeraerts, 2014). Entrenchment refers to the degree of automatization of a cognitive unit resulting from repeated exposure (Schmid, 2007). Zenner et al. (2014) distinguish two types of entrenchment. The more an individual talks about a given concept, uses a certain word, or experiences the use of this word through language models, the more entrenched the word becomes in the individual's cognitive apparatus (i.e., communicative entrenchment). This affects automatization of the use of that word that may be on an AAC system. Concepts also can be activated perceptually. Entrenchment then results from frequent exposure to a concept in an individuals' daily activities (i.e., experiential entrenchment). There is often a non-coincidence between experiential frequency of concept exposure and the communicative frequency of concept use. Zenner et al. refer to this as the "toothbrush problem." Toothbrushes are used

every day, therefore people who use AAC need to have multiple experiences with toothbrushes. However, the frequency of use of the word toothbrush in daily conversations is relatively low compared to other words. Would "toothbrush" be a word that has a high priority in an AAC system? High priority words should be those words that are more communicatively entrenched and can be used in multiple contexts and with multiple communication partners. These high priority words are often referred to as core vocabulary.

There appears to be a certain "set" of these core words that can be used throughout several modes of communication and that can maximize the potential for spontaneous language generation, both in spoken and/or written modalities. Incorporating these words into an AAC system can provide users the opportunity to be engaged in communication and interaction in a proper, efficient, and relatively quick manner (Hill, Kovacs, & Shin, 2015; Weighton & Dodd, 2011).

Defining Core Vocabulary

In his article defining core vocabulary, Lee (2001) mentioned that core vocabulary can differ depending on the field of research in which the concept of core is used. Therefore, it is difficult to formulate a clear definition of core vocabulary. Lee posited seven possible definitions of core vocabulary, which can be integrated in constructing a core vocabulary list, all operationalized independent of one another. Core vocabulary could be defined as (1) the most frequent words in language as a whole; (2) the most frequent terms in a particular medium; (3) the most frequent words for a particular demographic group; (4) words that are most general, unmarked, or central to the language; (5) words that are cognitively basic or most salient; (6) words that have the most widespread usage across a wide range of genres; or (7) words useful for dictionary definitions.

In the field of AAC, core vocabulary is commonly defined as a small set of approximately 200–400 words, changing little over time, used consistently within environments and between individuals (Baker, Hill, & Devylder, 2000; Chen et al., 2011; Renvall, Nickels, & Davidson, 2013; Weighton & Dodd, 2011; Witkowski & Baker, 2012; Yorkston, Dowden, Honsinger, Marriner, & Smith, 1988). Core vocabulary entails up to 80% of all words used within communicative contexts, consists of high-frequency words, and represents various parts of speech or text (i.e., pronouns, conjunctions, prepositions, auxiliary verbs, modals, determiners, interjections, and adverbs (Renvall et al., 2013; Witkowski & Baker, 2012). Core vocabulary consists primarily of function words, which stand in contrast to those that are more concrete, content words.

Content words compose a person's extended vocabulary, also called fringe vocabulary. Extended vocabulary is considered large and highly individual, consisting mostly of nouns, verbs, and/or adjectives. With these words, an individual is able to reflect on his or her own activities, interests, environments, and their personal style (Stuart, Beukelman, & King, 1997). Generally, recommendations from articles on AAC and vocabulary selection recommend an AAC system that provides the person with a robust core vocabulary, combined with personalized fringe vocabulary.

Augmentative and alternative communications systems are used with individuals with a wide range of communication challenges and developmental abilities. On September 30, 2015 in the American Speech-Language-Hearing Association (ASHA) Online Community for Special Interest Group (SIG) 12, AAC (Westman, 2015), a community member introduced a discussion related to the selection and use of core vocabulary with students who are severely cognitively/multiply impaired. As part of that discussion, the following two inquiries were made: (1) which core words should be used initially and (2) how many and how frequently should core words be introduced. By June 2, 2016, 120 affiliates of SIG 12 responded, most wanting to be included in the development of a list of core vocabulary words appropriate for students with significant language and cognitive challenges. Some of the discussion related to this posting included concerns regarding whether or not core vocabulary lists based on typically developing individuals are valid for use in AAC systems of individuals from atypical populations: "Is core vocabulary the same for individuals from atypical populations?" To help in answering that question, this article

summarizes research articles from a wide range of (a)typical populations describing spoken and/or written language samples.

Language Sample Studies on Core Vocabulary

There are several research articles describing spoken and written language samples of (1) typically developing individuals of different age groups; i.e., toddlers, preschoolers, school-aged children, adults, elderly; (2) second language learners; (3) individuals with physical disabilities (children and adults); and (4) children and adults with intellectual disabilities. Included among the participants of these studies were individuals who were monolingual, bilingual, those diagnosed with primary language impairment, learning a second language and/or using AAC. Spontaneous language and written samples and narratives of these individuals were collected in various settings and with various communication partners. Please note that although the following is not an extensive literature review, the article reflects a significant overview of a wide array of language sample studies in several populations.

Spoken Vocabulary in Typically Developing Individuals

Toddlers. Banajee, Dicarlo, & Buras Stricklin (2003) studied whether or not vocabulary used by 50 toddlers, aged 24 to 36 months, differed across different activities, and which common words were used during child-directed free play across five different classroom activity centers (e.g., blocks, dramatic play), and during adult-directed snack-time activities. They found a core list of 23 words, accounting for 96.3% of the total sample, that were used by most toddlers across most of the activities. The total core list contained only function words and no content words, which could have been expected since activities in a typical classroom contain different materials and toys that might not be named often.

Preschool children. Trembath, Balandin, and Togher (2007) studied the language samples of six children, aged 3 to 5 years. A broad sample of 3,000 intelligible words of each child's language was gathered across a range of preschool activities: teacher-directed (e.g., group story and music time) and child-directed activities (e.g., construction and dress-up, or swings and playing in the sandpit). This resulted in a list of 263 core words, accounting for 79.8% of the total sample. Of these 263 core words, only 30 words were nouns. Many words in the fringe vocabulary were recorded only once and were unique to a single child; 770 fringe words of the 1,411 different words in the total sample. The results of Trembath et al. (2007) closely resemble the results of Beukelman, Jones, and Rowan (1989) and Fallon, Light, and Paige (2001). Beukelman et al. (1989) collected extensive spoken language samples from six typically developing children between 3:8 years to 4:9 years, who had been integrated into preschool classrooms for children with disabilities. Of their total language sample, the 25 most frequently occurring words represented 45.1% of the total sample, and the 250 most frequently occurring words represented 85% of the total language sample. Fallon et al. (2001) collected language samples of 1,000 words from five typically developing preschool children, aged between 3:9 and 4:9 years, during their daily preschool routine. The 25 most frequently occurring words accounted for 44% of the entire sample and the 250 most frequently occurring words accounted for 89%. Of the 671 unique words, 65 words were used at least once by all five children. The top 250 words were analyzed to determine the number of function and content words, and 45% of the sample was composed of function words. The most frequently observed semantic-syntactic categories included verbs (29%), prepositions (8%), and descriptors and pronouns (8%).

School-aged children. Robillard, Mayer-Crittenden, Minor-Corriveau, and Bélanger (2014) compared the core vocabulary used by children (*M* age=66.9 months; *SD*=6.9) who are monolingual (French; *n*=6), bilingual (English-French, *n*=19; French-English, *n*=22), and by French-speaking children identified as having a primary language impairment (*n*=10). All of the children were recorded in their classroom throughout an entire school day, following their usual schedule. The 50 most frequent core words represented 57%, 56%, 53%, and 60%, respectively of the total word collection. At least 8 of the 10 most frequent core words were identical between

groups. Robillard et al. (2014) concluded that even if overall language skills of children with and without primary language impairment differed, the words they used most often did not differ. These results provide evidence that children with and without primary language impairment use the same words most frequently.

Many core vocabulary lists have been based on language samples elicited across a variety of linguistic contexts, such as playtime and mealtime. Crestani, Clendon, and Hemsley (2010) studied the vocabulary that 18 children, aged between 5 and 7 years, used in three spoken narrative tasks: (a) story retelling, (b) personal narrative, and (c) a story based on a picture sequence. A total of 145 narrative samples were collected, and a total of 6,679 words were produced, of which 908 were unique. A total of 173 words represented 80% of the total words used. Of the top 50 words that were used overall, 33 were function words and 17 were content words.

Adults. Balandin and Iacono (1999) focused on break time conversations at work as a source of information on vocabulary for individuals who use AAC, engaging in community-based employment. Participants were recruited from a family restaurant chain, a government-controlled gambling organization, and a registered charity that serviced individuals with cerebral palsy. A total of 34 employees, 25 female and 9 male, participated in the study, ranging in age from 17 to 57 years (*M* age=34.9 years). A total of 240 recordings of 15-minute samples during lunch and dinner times were collected, resulting in a total sample of 174,877 words. A core list of 347 words represented 78% of the total sample, and 308 of these words were function words.

Elderly. Stuart, Beukelman, and King (1997) studied the language samples of 65-to-74-year-old and 75-to-85-year-old adults. Language samples of routine conversations were collected over multiple days from 10 individuals for each age cohort. Environments where the conversations took place ranged from the participants' and friends' or relatives' homes, restaurants, malls, churches, hospitals, community rooms, and outdoors. Activities during the conversations ranged from talking on the telephone, eating, shopping, playing games, hobbies, volunteer work, and visiting. Analysis of the data identified 180 core words, making up about 72% of the total sample. The core words used by both cohorts contained a large degree of overlap.

English as a Second Language

Boenisch and Soto (2015) studied language samples of 30 typically developing children, ranging in age from 7–14 years, of which eight were children speaking English as a second language (ESL). Every student was recorded for a total of 105 minutes during a regular school day. A total of 98,053 words were generated from the 22 native speakers' samples, and 19,318 words were generated from the 8 ESL speakers' samples. A relatively small core vocabulary represented a large proportion of the words used by native speakers: 100 words accounted for 71% and 200 words accounted for 80% of the total vocabulary. The 100 words most frequently used by ESL students represented 75% of all spoken words, and 200 words represented 85% of their recorded vocabulary. When comparing the 20 most frequently used words in both groups, there was an overlap for 85% of the words, and for the 100 words most frequently used, the overlap was 76%. The 100 most frequently used words by both groups consisted mainly of function words. The percentage of content words (nouns, adjectives, verbs) increased considerably for both groups of speakers between the top 100 and 300 words. The use of nouns increased from 7% to 20% for native speakers and from 8% to 23% for ESL speakers.

Written Vocabulary of Typically Developing Individuals

Obstacles faced by beginning writers resemble those experienced by children who use AAC

> Both groups of children confront the challenge of taking language that is inside their heads and translating it into an expressive form, using an instrument that is not second nature to them (e.g., a pencil or a communication device). The cognitive, memory, and physical demands of such a process have an influence on the quantity and quality of the language produced. (Clendon & Erickson, 2008, p. 281)

Therefore, a better understanding of written language development for typically developing children can inform intervention for children with complex communication needs. Clendon and Erickson analyzed 2,271 writing samples from students in North Carolina (*n*=125) and New Zealand (*n*=113) in kindergarten and in Grades 1-4. Writings were about self-selected topics. The total sample contained 85,759 written words, including 5,274 different words. Of the writing samples, 163 words represented 70% of the total sample. The most frequently occurring 39 words accounted for 50% of the total words used. The ratio of function words to content words was 35:15 (70%) within the 50 most frequently occurring words, and 56:44 (56%) within the 100 most frequently occurring words. Seven of the top 10 words overall were represented in the top 10 words in all age groups. It was concluded that if only 39 words account for 50% of what children write, AAC teams should focus on teaching these words in their spelling and reading instruction. They should then also focus on providing fast and easy access to these words, so that children with complex communication needs can focus on spelling or otherwise generating less frequent or familiar words.

Clendon, Sturm, and Cali (2013) examined the vocabulary used by 124 typically developing students in kindergarten and first grade in self-selected writing in nine genres: (1) label, (2) story, (3) narrative recount, (4) plan, (5) procedure, (6) description, (7) report, (8) opinion, and (9) explanation. A total of 457 writing samples were analyzed with a total of 11,673 words used, of which 1,590 words were unique. Seventy percent of the vocabulary used in the samples was represented by 140 words. In identifying the 40 most frequently occurring words, 28 were function words (70%). These 28 function words were used in an average of six genres, whereas the 12 most frequently used content words were used in an average of three genres.

Individuals With Physical Disabilities

Yorkston, Smith, and Beukelman (1990) collected language samples for 14 consecutive days from 10 linguistically intact individuals who used AAC devices ranging from 13 to 30 years of age. Four subjects had cerebral palsy and six participants had survived traumatic brain injury or aneurysm. All messages were produced in a letter-by-letter fashion. Extended samples were obtained in natural settings and contexts. The samples produced by the 10 individuals ranged in size from 2,263 to 9,551 words. The number of non-unique words ranged from 248 to 704 words. Of the total sample, 65 words represented 55.2%, that all occurred at least with a frequency of 30 per 1,000 words.

Boenisch and Sachse (2007) compared the vocabulary of 25 typically developing German children to that of 46 children with physical disabilities, of which 33 children were diagnosed with Cerebral Palsy or Spina Bifida. Children were between 2:3 and 7:7 years of age. Language samples were collected in structured play situations (e.g., doll's house, children's books) with an adult and two children. In total, a sample of 55,500 words was collected. The 100 most frequently used words by children with typical development and with physical disabilities accounted for 65% and 66% of their total word use, respectively. The 20 most frequently used words in both groups were comparable, even for their rank order, indicating no difference in core vocabulary between children with or without physical disabilities. Of the top 50 words, only 6% were nouns, and of the top 100 words, 20% were nouns. Further analyses towards the effect of age showed that only slight differences were found between different age groups, indicating that core vocabulary was not influenced by age. Subsequent analyses, described in Boenisch (2009), revealed that the children with physical disabilities produced on average 30–45% fewer words as well as 30% fewer prepositions than typically developing children.

Dark and Balandin (2007) studied whether or not SLPs, leisure support staff, and speaking adults with cerebral palsy could accurately predict the vocabulary that was needed to effectively participate in two leisure activities (i.e., sailing and visiting an Internet café). All participants were asked to predict a minimum of 20 and a maximum of 100 words that they thought necessary to communicate successfully in each of the activities. Next, they studied the language samples of three adults with cerebral palsy recorded during the sailing activity and at the Internet café. During sailing a total of 7,586 words were used, of which 1,244 were different. Core words consisted of 246 words, representing 78% of the total sample. Of these 246 words,

156 (63%) words were considered structure and function words. During the Internet café activity, a total of 3,422 words were used, of which 598 were different. Core words consisted of 304 different words, representing 92% of the total sample. Of these 304 words, 140 (47%) words considered structure and function words. Finally, Dark and Balandin compared the predicted vocabulary with the actual language samples: for the sailing activity 68% of the predicted vocabulary actually occurred in the language samples, for the Internet café 47% of the predicted vocabulary actually occurred in the language samples. An over-representation of nouns in the predicted word list accounts for this difference between predicted and actual vocabulary use.

Individuals With Autism Spectrum Disorders

Chen et al. (2011) investigated the core vocabulary in 10 children with Asperger Syndrome (AS), and their typically developing peers. Language samples were collected from story retelling after watching two cartoon films. Average chronological age of the children with AS was 9:7 years, and their average IQ score was 103. The children watched two 5-minute cartoon films in which there was no dialogue between the characters. The language sample of the typically developing children consisted of 14,588 words, whereas the sample of children with AS consisted of 3,249 words. Although children with AS used only half of the number of unique words compared to typically developing children, the overlap of the 80% most frequently used words was still 73%. Most of these overlapping words were function words.

Individuals With Intellectual Disabilities

The first research that reported the oral vocabularies of individuals with (severe) intellectual disabilities, is the study by Mein and O'Connor (1960). They studied 40 male and 40 female patients from two psychiatric hospitals near London. Diagnosis was unknown in 42 of the cases, 19 were diagnosed with Down Syndrome, 11 with some form of epilepsy, 5 with Cerebral Palsy, 4 with schizophrenia, and 1 with post-meningitis, with 2 patients who suffered from dual disability. Patients ranged in age range from 10–30 years, with a mental age between 3 and 7. All participants demonstrated some intelligible speech. Student teachers carried out nine interviews per participant, and each individual was encouraged to talk as freely as possible. The total sample contained of 28,732 words, of which 2,419 were listed as different words. Words that were used by more than 50% of the participants were indicated as core vocabulary, leading to a core list of 218 words. Mein and O'Connor (1960) compared their results with the core vocabulary study of young children of the same developmental age conducted by Burroughs in 1957. They concluded that the individuals with intellectual disabilities had considerably fewer words at their disposal as a group, but that a relatively small proportion of these words tended to be used widely throughout the sample. Mein and O'Connor determined that their participants with intellectual disabilities had a relatively limited amount of fringe vocabulary, which represented the individual interests and personal experiences of the patients.

Chen, Chen, and Chen (2013) explored the core vocabulary of 15 children with intellectual disabilities and their typical peers in fifth and sixth grade during a dyadic conversation of about 30 minutes at school. IQ scores of children with intellectual disabilities ranged from 55 to 69. All of them had oral speech capabilities. The language sample of typically developing children consisted of 23,341 words, and the total sample of children with intellectual disabilities consisted of 15,107 words. Thirty words were used by the two groups in their top 50% most frequently used words like personal pronouns and common verbs, showing an overlap of 100% between groups. There was 94% overlap for the top 70% most frequently used words, and 86% overlap for the 80% most frequently used words in both groups.

Boenisch (2014) compared the core vocabulary of typically developing German children and teenagers (n=58) with the core vocabulary used by children with intellectual disabilities aged approximately between 8 and 16 years (n=44) who were able to use speech. Language samples were obtained throughout the school day. The language sample of the typically developing children and teenagers consisted of 133,453 words, whereas the sample of the children with intellectual disabilities consisted of 125,454 words. Boenisch found a large overlap between the top 20 (95%),

top 50 (94%), and top 100 (87%) words most frequently used by both groups of students. He also found almost no differences between typically developing children and children with intellectual disabilities in the frequency of use of different word classes, indicating that the language use of children and teenagers with intellectual disabilities closely resembles that of typically developing peers. The only difference found was in the total number of unique words used, where the typically developing children showed a larger spoken vocabulary throughout the day (i.e., they produced 14% more unique words).

Conclusions: Core Vocabulary in AAC Practice

Overall, we have shown that there is an extensive research base building a strong case for the existence of a core vocabulary. This core vocabulary is comparable for typically developing individuals, monolinguals, bilinguals, individuals with primary language impairments, second language learners, AAC users, and individuals with physical and/or intellectual disabilities. It was consistently found that core vocabulary in all aforementioned groups consists of a high number of function words, especially for the first 50 or 100 most frequently used words in the language samples. The amount of content words (e.g., nouns) increases after 100+ words. The relative decrease of the percentage of function words and adverbs can be explained by the fact that most function words (e.g., prepositions, conjunctions, pronouns, determiners) belong to closed word classes that contain a relatively small set of items and are frequently used (Boenisch & Soto, 2015). These findings are important for AAC teams to be aware of in terms of vocabulary selection. Practitioners should be aware of the importance of function words and the over-representation of nouns in AAC systems (Dark & Balandin, 2007). We hypothesize that this over-representation of nouns closely connects to the concept of experiential entrenchment (Zenner et al., 2014). Vocabulary is then selected on the basis of concepts that are physically present in the environment of an AAC user, rather than on the basis of concepts that are highly present in language of communication partners and models (i.e., communicative entrenchment).

From all the studies reported in this review, 12 studies, covering all aforementioned populations, provided core word lists in their results or an appendix. Three studies reported lists of two populations, making a total of 15 core vocabulary lists from different populations and backgrounds. We have compiled a word list based on the core vocabulary from all these studies, making a list of 1,852 words. Of these total word lists, 637 words were unique. Next, we generated a core word list based on commonality of word use in all these studies (see Table 1). Words are seen as core vocabulary based on commonality when they were incorporated in at least half of the word lists. This made up a total of 51 core words mentioned in more than half of the word lists in the 12 studies.

Table 1. Core Vocabulary List Based on Commonality over 15 Word Lists

Word	**N**	**Word**	***N***
To be, am, is, are, was, were, aren't, wasn't, weren't	15	To see, saw	10
To go, goes, going, gonna, went	15	We	10
No, not	14	And	9
That	14	Because	9
All	13	Here	9
To have, has, having, had, haven't	13	Just	9
To want, wants, wanted	13	She	9
I	12	Still	9
Then	12	The	9
To come, comes, came	12	They	9
A	11	Time	9
He	11	To do, doing, don't, did, didn't, does, doesn't	9
It	11	What	9
There	11	For	8
To know	11	Hello, hi, hey, ey	8
Yes, yeah, yep	11	Oh	8
You	11	Ok, okay	8
But	10	On	8
Can, can't	10	People	8
Good	10	So	8
In	10	This	8
My, mine	10	To	8
To eat, eating	10	To make, made	8
To like	10	To take, took	8
To look, looking	10	Two	8
To say, says, said	10		

Note. N = Word present on # of lists. Based on the word lists by Ball, Marvin, Beukelman, Lasker, and Rupp (1999) Banajee et al. (2003); Boenisch (2014); Boenisch and Sachse (2007); Boenisch and Soto (2015); Chen et al. (2011); Chen et al. (2013); Clendon et al. (2013); Dark and Balandin (2007); Marvin (1994); Robillard et al. (2014); Stuart et al. (1997).

To integrate core vocabulary in AAC systems, it is important that practitioners are aware of the importance of core vocabulary. Practitioners often tend to select nouns representing foods and objects as first symbols when designing AAC systems (Adamson, Romski, Deffebach, & Sevcik, 1992). Nouns are chosen because they are considered to be easy to teach, access, and

represent on a picture-based communication system. Furthermore, nouns are thought to be of considerable functional use to a communicator in everyday conversation. However, research indicates that nouns are often fringe vocabulary words, which leads the individual towards using their system primarily for the pragmatic function of requesting, and restricting its AAC system for other communicative purposes (Dodd & Gorey, 2013). If a practitioner plans a vocabulary for an AAC system based strongly on core vocabulary, however, this system will have the capacity to meet a wide range of communication needs. It is, therefore, pivotal that core vocabulary is available, as these words serve as the matrix that makes the vocabulary work for communication (Banajee, Baker, & Anderson, n.d.). In Adamson et al. (1992), core words were added to communication boards in addition to nouns that were used by young males with moderate to severe intellectual disabilities. This addition led to an increase of frequency of communication board use from 2% to 41%. Thus, the initial vocabulary set of AAC users should contain not only content words, but also core vocabulary to provide the user with a means to create novel sentence patterns and communicate for a variety of pragmatic functions (Dodd & Gorey, 2013).

That being said, an effective vocabulary set should pair core vocabulary with nouns that are activity-, place-, topic-, or communication-partner-specific to reflect the personal identity of the AAC user (Stuart et al., 1997). Van Tatenhove (2009a) has suggested that in clinical practice, the balance of core to fringe vocabulary should be at least four times more core words than fringe vocabulary words. For example, the AAC user may be engaged in a cooking activity in a classroom for students with severe cognitive and physical impairments. Imagine the user's AAC system is a manual communication board with 50 core vocabulary words. Attached along the top of this "core board" is a spiral bound row of 20 strips, each displaying 10 activity-, place-, topic-, or partner-specific vocabulary words. In one of those rows, the AAC user has generic cooking vocabulary, such as bowl, spoon, spatula, and pan. The AAC user has 50 core words and 10 fringe words for the cooking activity, exceeding the standard of 4 parts core to 1 part fringe vocabulary. Once the cooking activity is over, the temporary vocabulary for cooking can be exchanged with temporary vocabulary for a new activity. While the AAC user has access to more fringe vocabulary (20 strips x 10 words on each string=200 fringe vocabulary words) than core vocabulary words (50 words), at any one point in time (e.g., when cooking, reading a book, playing a game), the AAC user has at least four times more core words than fringe words. Utilizing the principle of a minimum of 4 parts core to 1 part fringe vocabulary, at any point in time, reduces the clinical tendency to slide back into the practice of over-representing nouns on an AAC system.

Some authors state that core words may not always be the most motivating to use, at least in the early stages of language learning, since many of these words serve important syntactic functions but may carry little semantic "weight" (Smith, 2014). Priorities motivating early vocabulary selection and instruction may differ from those that become important as language skills develop. In the early stages, core words that have an immediate impact (e.g., more, stop, and out) are more essential, especially if access is difficult and selecting words in the AAC system takes time and effort (Smith, 2014). As children increase their vocabulary corpus, their vocabulary must support the development of language structure (Paul, 1997). Effective vocabulary selection therefore involves exploring what is necessary immediately for communication, but also what is important to support language and communication development, keeping an eye on both present and future needs (Beukelman & Mirenda, 2013).

In focusing back on the example of students in a special education class doing a cooking activity (see Table 2), suppose that these two students use AAC systems in the classroom, both having access to core vocabulary. The first student communicates at a one-word utterance, while the second student is learning to combine words into two- or three-word utterances. Imagine this exchange between the students and the classroom instructional assistant, who is conducting the lesson, as they start to make a cake.

Table 2. Cooking Class Activity Example

Instructional Assistant	**Student 1**	**Student 2**
Before we start making our cake, we have to do something to the oven. I am going to use this knob to do it. Tell me what I need to do?	on hot	turn on make hot turn up more up
I have our cake mix right here. What do we do with it?	put bowl	put in, in bowl, put in that
Great. What do I do with the water?	put	put in
(sabotage by only putting in a few drops) What do you think?	more	put more, more in, put more in
And the oil?	put	put in
And the eggs?	put	put in
We put in a lot of things. What do you think?	all done	done putting in

The scenario continues with the instructional assistant and the students putting the cake batter into the cake pan, then the pan into the oven, and eventually taking the cake out of the oven. Depending on the opportunities to communicate that are created by the classroom instructional assistant, the entire activity can be controlled by the students with the use of core vocabulary, providing motivation to communicate with core words. With access to core, the students can explore the flexibility of their core vocabulary when phrasal verbs (e.g., put, turn) are combined with prepositions (e.g., in, on, off).

Children who use AAC may know more words than are available on their AAC system, which is also the case in typically developing children. All children have a higher number of words they understand than what they can produce. If a typically developing child does not know a particular word, he or she may use different communicative acts such as pointing or eye-gazing towards an item. But, most likely, a child is able to describe unknown words by making use of solely core vocabulary words (Banajee et al., 2003; Rescorla, Alley, & Christine, 2001). In the aforementioned cooking example, a student could communicate about the ingredients by looking at each ingredient, provided they were arranged in such a way as to allow for eye-gazing. However, if the student had a sufficiently robust core vocabulary, the student could describe the cake mix as “dry stuff,” the eggs as “break open,” and the water as “wet, see through.” A descriptive term, other than “wet” needs to be used for the oil in the recipe to prevent confusion when telling the instructional assistant what ingredients to put in the bowl. Van Tatenhove mentioned that “use of descriptive teaching involves the focused use of the core vocabulary. These words are used to descriptively talk about, teach, and test educational concepts” (Van Tatenhove, 2009b, p. 44), for students who are placed in both special and general education classrooms.

To conclude, it was posited in the introduction of this article that for the field of AAC, core vocabulary continuously was found to be a small set of approximately 200–400 words, changing little over time, within environments, and between individuals (Baker et al., 2000; Chen et al., 2011; Renvall et al., 2013; Weighton & Dodd, 2011; Witkowski & Baker, 2012; Yorkston, Dowden, Honsinger, Marriner, & Smith, 1988). The present review shows that this definition holds true for both typical and atypical populations in various contexts, with various communication partners, over various topics, and in various modalities of language use. Core vocabulary is thus of high importance for all AAC users, regardless of physical or intellectual disabilities.

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