THE LANGUAGE OF BEGINNING WRITERS: IMPLICATIONS FOR CHILDREN WITH COMPLEX COMMUNICATION NEEDS

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A dissertation submitted to the faculty of the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Speech and Hearing Sciences in the Department of Allied Health Sciences.

Chapel Hill
2006

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ABSTRACT

SALLY CLENDON: The Language of Beginning Writers: Implications for Children with Complex Communication Needs
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Research that has examined the language produced by children with complex communication needs (CCN) suggests that these children frequently struggle to develop mature language skills. This study is the first study in the field of Augmentative and Alternative Communication (AAC) to consider the parallels that exist between learning to write and learning to use an AAC system, and the potential application that typical written language development has for children with CCN. 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. The cognitive, memory, and physical demands of such a process have obvious ramifications for the quantity and quality of the language produced.

This study analyzes the language used by typically developing early-elementary children in North Carolina and New Zealand when they write about self-selected topics. The findings of this study document school age and country-related differences in the vocabulary words, semantic themes, and syntactic and morphological structures used by typically developing children. School age comparisons highlight the restricted language abilities of children in the earliest

stages of writing development and country comparisons reveal differences in areas such as core vocabulary and clausal and phrasal diversity.

The findings of this study provide much needed information regarding the developmental nature of language use in written language. This information will be relevant to speech-language pathologists, teachers, and other professionals as they engage in selecting, prioritizing, and organizing language in children's AAC systems.

ACKNOWLEDGEMENTS

It would not have been possible to complete this dissertation without the guidance and support of many people. In particular, I would like to thank my advisor, mentor, and friend Karen Erickson for her remarkable intelligence, extreme generosity, and unwavering support. Over the past four years, Karen has provided me with a vast array of learning opportunities and has continuously challenged me to extend and deepen my thinking and to push myself to new academic and personal heights.

I would also like to thank David Yoder. David introduced me to the field of literacy in AAC when I was studying for my master's degree in New Zealand. He was the first person to encourage me to pursue doctoral-level studies and supported me as I transitioned to a new education system that was far away from home. I am very grateful for the opportunities that David has made available to me and for his constant encouragement and support.

I am extremely proud to be affiliated with Karen, David, and the other members of the Center for Literacy and Disability Studies team. The dedication that all of you have for children with severe disabilities is unparalleled. Thank you for being so willing to share your knowledge with me and for treating me as a colleague from day one. In addition, thank you to the faculty members and fellow students in the Division of Speech and Hearing Sciences and the School of Education. You have shaped my learning and have been a constant source of friendship and support.

I would like to express my sincere gratitude to a number of organizations and people outside the University that have supported this dissertation. In particular, I am indebted to the Rotary Foundation for the financial support that they provided in the first year of my doctoral studies through the Ambassadorial Scholarship Program, and to Dr. Thomas S. and Mrs. Caroline H. Royster for the financial support and educational opportunities that they provided as I completed my dissertation through the Graduate School’s Society of Fellows Program.

I am extremely grateful to the administrators who supported my research and the teachers and students who participated. I would also like to thank Mary Holman and Caroline Harper for patiently and generously assisting me with the transcription of so many writing samples, Margaret Maclagan for helping me to establish that my language analyses were accurate and reliable, and Mike Bowling for providing me with statistical support.

Finally, I would like to thank my friends and family for always being there for me. This would simply not have been possible if my Mum and Dad had not always encouraged me to aim high and to embrace every opportunity. I would like to thank Denise and Mike Bowling for serving as my parents away from home and from keeping me on track and focused on the final goal. I would also like to thank my husband James and my baby Jack. James has contributed to my doctoral work and dissertation in so many ways. The quality of my dissertation is a direct result of his hard work and dedication as my database consultant, my editor, my advocate, and my best friend. Jack has taught me that although it can be difficult at times, it is possible to pursue both professional and personal dreams.

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CHAPTER 1: INTRODUCTION

The aim of this investigation was to elicit information that would assist educators and speech-language pathologists as they engage in decision-making about teaching and supporting children with complex communication needs (CCN) who use augmentative and alternative communication (AAC). To achieve this aim, the investigation documented and analyzed the written language used by typically developing early elementary children when they wrote about self-selected topics. The information obtained has high utility in that it will provide professionals with an understanding of typical written language development and its potential application to planning vocabulary sets and language representation systems for children with CCN.

Children with Complex Communication Needs

Children with complex communication needs (CCN) have communication impairments that limit their ability to meet all of their daily communication needs. These impairments may be caused by a variety of congenital and acquired conditions such as cerebral palsy, autism spectrum disorders, developmental apraxia of speech, or traumatic brain injury (Beukelman & Mirenda, 2005). The prevalence estimates for children with CCN vary widely. It is estimated that approximately 0.2-0.6% of the children worldwide have severe speech impairments (Blackstone, 1990). In a recent study conducted in New Zealand, 0.15% of the children aged 21 years and under were identified as having CCN (Sutherland, Gillon, & Yoder, 2005).

Augmentative and Alternative Communication

Children with CCN are unable to use speech as their primary mode of communication. Instead, they are reliant on the introduction of some type of augmentative and alternative communication (AAC) system. AAC is a term used to describe “the use of non-speech modes as a supplement to, or a substitute for, spoken language” (von Tetzchner & Jensen, 1996, p. 1). AAC includes the use of systems such as communication boards and electronic communication devices. To use these systems, the individual must select a symbol or a combination of symbols (e.g., words, photographs, line drawings, abstract symbols). These symbols represent the message(s) that the individual wants to express. Some individuals have sufficient hand control that they are able to point to symbols. Others rely on alternative access systems. Some individuals, for example, control their AAC systems via switches that they trigger by pressing a button, puffing some air, or wrinkling an eyebrow (ASHA, 2006). Electronic communication devices differ from communication boards in that they produce voice output. Some electronic communication devices have extensive memory capacity and are able to store a large number of symbols.

Why Study Written Language?

Researchers in the field of AAC have characteristically collected spoken language samples from typically developing children and then endeavored to relate their studies’ findings to children with CCN (e.g., Beukelman, Jones, & Rowan, 1989; Fallon, Light, & Paige, 2001). However, the language that typically developing children use in the earliest stages of writing development may be more relevant to improving the face-to-face communication of children with CCN, than the language that typically developing children use when they speak. This is because writing may provide a more accurate reflection of the complexities of communicating through AAC than does speaking. Various authors (e.g., Gombert, 1992; Kroll, 1981; McCutchen, 2000; Scardamalia, 1981) have described the obstacles that beginning writers face and many of these obstacles resemble those experienced by children with CCN when they 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 obvious ramifications for the quantity and quality of the language produced. Harpin (1976) stated that:

> When children begin the process of learning to write there is a big gap between their general language competence and their performance. The effort involved in learning a new skill is considerable and attention is, naturally enough, on the mechanics of the business. What is drawn on from those oral language resources is sharply restricted. As the act of writing becomes habitual, so more opportunity is available to bring oral competence and written performance into harmony. (p. 52)

Written Language Research

A relatively small number of studies conducted to date have analyzed the language that typically developing children use when they write. Some researchers have conducted vocabulary analyses which have resulted in the compilation of frequency-based word lists (e.g., McGinnis and Beukelman, 1989; Rinsland, 1945). Other researchers have focused on determining whether there are syntactic and morphological differences between the spoken and written language modalities (e.g., Hidi & Hildyard, 1983), and/or whether there are differences between the written language produced by typically developing children, and children with language disorders, learning disabilities, and/or mental retardation (e.g., McFadden & Gillam, 1996; Scott & Windsor, 2000). These studies have tended to provide statistical tests indicating the presence or absence of a significant difference on a range of dependent variables; but they have not provided information that describes the actual content and form of the children's writing samples. Very few of these studies (e.g., Bear, 1939) have examined the written language skills of children below the third grade level.

This investigation is the first to examine the vocabulary, semantics, syntax, and morphology used in writing produced by children in kindergarten through third grade who were provided with regular opportunities to write about self-selected topics. The children's writing samples were analyzed in terms of the vocabulary (words and multiword sequences/phrases) and semantic themes used, and in terms of the syntax and morphology used. The findings from the syntactic and morphological analyses provide information that will be particularly useful for facilitating the development of children' precise communication, and the vocabulary and semantic analyses provide information that will be useful for guiding the development of both efficient and precise communication.

Efficient and Precise Communication in Augmentative and Alternative Communication

Children with CCN need to develop the ability to communicate both efficiently and precisely. *Efficient* communication is defined here as communication that involves transmitting the meaning and communicative intent of a message as quickly as possible. *Precise* communication is used here to mean communication that entails constructing a message that is grammatically correct and complete. Efficient communication strategies are important because they reduce the number of targets that individuals with CCN need to hit. This speeds up the rate of message transmission and allows them to participate in conversations in a timely manner (Harris, Doyle, & Haaf, 1996). Precise communication is also critical for individuals with CCN. It is necessary for the prevention of communication breakdowns and misunderstandings, for the communication of complex ideas, and for written language development (Lund & Light, 2003; Sutton, Soto, & Blockberger, 2002).

Efficient communication and precise communication are not necessarily mutually exclusive. For individuals with CCN, however, precise communication may often be sacrificed because of the pressing need to transmit messages at an efficient rate. In efficient AAC communication, precision may be sacrificed in different ways depending on whether the communication is creative or formulaic. *Creative* communication involves constructing a message from scratch (Wray & Perkins, 2000). In contrast, *formulaic* communication involves the use of pre-fabricated word sequences that are stored and retrieved as whole units (Schmitt & Carter, 2004; Wray, 2002). Efficient communication may be creative through the use of keywords, or formulaic through the use of strategies such as pre-programmed phrases. Efficient AAC communication that is creative may lack precision in that keyword constructions may differ from conventional English in their structure and form (Sutton, Gallagher, Morford, & Shahnaz, 2000). In contrast, efficient AAC communication that is formulaic may lack precision in that pre-programmed phrases may contain excessive or insufficient information, or they may fail to match the exact topic of conversation (Bedrosian, Hoag, & McCoy, 2003; Hoag, Bedrosian, McCoy, and Johnson, 2004).

Educators and speech-language pathologists have vital roles to play in building the language skills of children with CCN. These professionals must plan vocabulary sets and language representation systems that support both efficient and precise communication for these children, and they must teach these children the language skills that they will need in order to become effective communicators (Nelson 1992; Paul, 1997). Regrettably, limited information is currently available to guide professionals in this important process.

The Language Skills of Children with Complex Communication Needs

The language learning experiences of children with CCN differ significantly from those of typically developing children and research suggests that these differences may lead to significant deficits in vocabulary, semantics, syntax, and morphology.

Vocabulary and Semantics

Children with CCN frequently have access to vocabularies that are grossly inadequate to meet their communication needs. These inadequacies are driven by a myriad of factors including limited memory capacity in AAC devices (Marvin, Beukelman, & Bilyeu, 1994), the complexity of organizing the vast vocabulary used by persons without disabilities in face-to-face communication and writing (Yorkston, Dowden, Honsinger, Marriner, & Smith, 1988), as well as beliefs about many children with CCN and their ability to manage more than a few vocabulary items at a time (Carlson, 1981). The very best, most comprehensive AAC systems provide access to far less than the 14,000 words that are in the vocabularies of children without disabilities by age 6 (Clark, 1993). The AAC systems described here as inadequate seldom provide access to more than a few hundred concepts and many systems provide access to significantly fewer than that. In addition, until the children with CCN who use these AAC systems learn to spell, they have minimal control over the acquisition of new vocabulary. Without functional speech, they are reliant on adults to determine what vocabulary is necessary and appropriate for inclusion in their AAC systems (Light, 1997). Unfortunately, despite the best intentions of educators, parents, speech-language pathologists, and others; the vocabulary words that are selected for these children are often inappropriate to their individual personality, situation, and developmental profile (Carlson, 1981).

The findings of this investigation provide much needed information regarding the developmental nature of vocabulary use in written language. This information will be relevant to professionals as they engage in selecting, prioritizing, and organizing vocabulary in AAC systems. It will prompt professionals to remember that vocabulary selection is an ongoing process and that children with CCN need access to the words and multiword sequences that allow them to meet “today’s needs and tomorrow’s goals” (Fried-Oken & More, 1992, p. 52).

Syntax and Morphology

Research that has examined the language produced by children with CCN has suggested that these children frequently struggle to develop mature syntax and morphology. Many children with CCN are reportedly unable to move beyond the production of two- and three-word utterances (Harris, 1982; Udwin & Yule, 1990). Research conducted with older children and adults with CCN has also identified significant problems with syntax and morphology (Berninger & Gans, 1986; Kelford Smith, Thurston, Light, Parnes, & O'Keefe, 1989; Sutton & Gallagher, 1993). These problems include difficulty using morphological endings and auxiliary verbs, and limited use of complex sentence structures (Kelford Smith et al. 1989). It is unclear whether these difficulties occur as a result of the speech impairment, use of AAC, late introduction to literacy instruction, or whether they are merely a reflection of the types of difficulties all beginning writers experience. The findings of this investigation provide data to address this final possibility.

This investigation describes the syntax and morphology used by beginning writers when they write about self-selected topics. This information will provide professionals who work with children with CCN with knowledge about the range and complexity of language structures that typically developing children use when they are faced with one of their greatest cognitive challenges: the translation of thought into abstract symbols. Such information will assist professionals to develop realistic expectations for children with CCN and will guide professionals as they make decisions regarding which language structures to make available to children in "today's" AAC systems and which language structures to target in language intervention and "tomorrow's" AAC systems.

Summary

Although the existing evidence is limited, it is clear that attempts to inform AAC decision-making through the study of typical spoken language development alone have not been effective. Large numbers of children with CCN continue to experience significant language learning difficulties. Furthermore, there is sufficient evidence to support the hypothesis that early writing development may provide a more accurate parallel to AAC development. This investigation provides some initial information regarding school age and country-related differences in written language development when children engage in writing about topics of their own choice. Having an increased understanding of written language development in typically developing beginning writers will enable educators and speech-language pathologists to become more successful at supporting children with CCN to develop both efficient and precise communication.

CHAPTER 2: REVIEW OF THE LITERATURE

In the review of the literature that follows, four topics that are particularly pertinent to the current investigation will be examined. These are: (1) precise and efficient communication, (2) language learning for individuals with CCN, (3) the language of beginning writers, and (4) vocabulary selection and language representation for children with CCN.

Precise and Efficient Communication

For many individuals with CCN, generating messages that are both precise and efficient is not a straightforward endeavor. Frequently these individuals find themselves in communication situations where they are forced to make a choice between maximizing their rate of message transmission, and communicating precisely what they wish to say (Bedrosian et al., 2003; Hoag et al., 2004).

One primary barrier to precise and efficient communication is the nature of the architecture underlying AAC devices (Todman & Alm, 2003). Many of the devices currently available are letter- or word-based. These devices are advantageous in that they enable the individual with CCN to construct novel messages (Bedrosian et al., 2003). Thus, the individual can express precisely what she or he wants to say, instead of being restricted to a limited number of pre-stored messages. Communicating with these devices, however, is often a slow and frustrating process as the individual must string together multiple letters and/or words in order to produce an utterance (Bedrosian et al., 2003).

A slow rate of message generation can have a socially debilitating impact on the communication experiences of individuals with CCN (Higginbotham & Wilkins, 1999). Individuals with CCN and their communication partners may become extremely frustrated. Social exchanges that should be enjoyable may become laborious (Todman, 2000). Individuals with CCN may place more value on the time budgets of their communication partners, than they do on their own communication needs (Higginbotham & Wilkins, 1999). Consequently, they may make minimal contributions to a conversation (Higginbotham & Wilkins, 1999). They may produce very short utterances or just answer *yes* or *no* (Todman, 2000). In addition, it may be difficult for them to attain and maintain control of the conversational floor (Higginbotham & Wilkins, 1999; Todman, 2000). While individuals with CCN are busy constructing messages, conversations may move on to new topics and threads. As a result, these individuals may produce utterances that appear out of context. In circumstances like these, they may be perceived as having questionable intelligence or communicative competence (Higginbotham & Wilkins, 1999).

In an effort to enhance the efficiency of letter- and word-based AAC devices, AAC researchers and device manufacturers have developed rate enhancement features such as word prediction strategies and coding schemes (see Beukelman & Mirenda, 2005 for a complete review of these features). Rate enhancement features reduce the number of keystrokes required to produce a novel message. However, rate enhancement features fall short of providing a complete solution to the problem of restricted message output as message generation using these features is still very slow. Individuals with CCN who engage in face-to-face message generation typically produce approximately 10 words per minute (Higginbotham, Lesher, & Moulton, 2000a). Rate enhancement features can speed up message generation by reducing the number of keystrokes required by as much as 50 percent (Higginbotham, 1992; Venkatagiri, 1993). These savings are significant; however the rate is still extremely slow given that the average rate of message output in spoken English is approximately 150 words per minute (Higginbotham & Wilkins, 1999).

While some researchers have been exploring methods for increasing the efficiency of letter- and word-based devices, other researchers have been focused on developing AAC systems that increase rate by providing access to prestored utterances. Examples of these utterance-based AAC systems include CHAT (Alm, Arnott, & Newell, 1992), ScriptTalker (Dye, Alm, Arnott, Harper, & Morrison, 1998), SchemaTalk (Vanderheyden & Pennington, 1998), TALK (Todman, Alm, & Elder, 1994a), and Frametalker (Higginbotham, Wilkins, Lesher, & Moulton, 1999). The two systems that have received the most recent attention in the literature are the TALK system and the Frametalker system. These two systems will be described in detail.

The TALK (Talk Aid Using Pre-Loaded Knowledge) system (Todman et al., 1994a) was designed primarily for individuals with CCN who have already developed good language skills. This group of individuals experience little to no problems conceptualizing the content or the structure of the sentences that they wish to communicate. Instead, their difficulty lies in their ability to quickly retrieve those sentences and to transmit them at an efficient rate (Todman & Alm, 2003). The objective of the TALK system is to assist individuals with CCN to prepare in advance for social interaction by constructing and storing messages for use at a later time (File & Todman, 2002).

The TALK system uses a unique method of storage organization that is based on the premise that topics in natural conversation tend to shift a little at a time between differing perspectives (Todman, 2000). These perspectives may be a *person perspective* (i.e., shifting from my experiences and views to your experiences and views), a *time perspective* (i.e., shifting from past to present or future), or an *orientation perspective* (i.e., shifting from where to what, how, when, who, or why) (Todman, Elder, & Alm, 1995). In the TALK system, phrases are identified by a combination of one of each of the three perspectives, for example, the phrase *I visited my family at Christmas* would be classified as *Me/Past/Who*. The system supports the natural flow of conversation by allowing the user to quickly shift one perspective at a time. For instance, the *Me/Past/Who* phrase described above might shift to a *Me/Past/Where* phrase such as *We were in London* and then perhaps to a *You/Past/Where* phrase such as *Where did you go for Christmas?* The TALK system also provides access to various ‘quickfire’ utterances such as *Ah Yes*, and *Too bad*, and to comments such as *I didn’t mean to say that*, and *That’s life, isn’t it* (File & Todman, 2002).

In the past fifteen years, a number of research studies have been conducted to explore the efficacy of the TALK system. Initial evaluations (e.g., Todman et al., 1995) involved a member of the research team simulating an individual with CCN. Since then, the evaluations have become more akin to real-world situations, involving individuals with conditions such as motor neuron disease and cerebral palsy (e.g., Todman, 2000; Todman & Lewins, 1996).

Many of the research studies have focused on determining the existence of a relationship between rate of communication (or average pause times preceding utterances) and listeners' perceptions of conversations produced using the TALK system (Todman & Rzepecka, 2003). Findings suggest that the TALK system is able to produce conversational rates ranging from 40 words per minute with minimal training (Todman & Lewins, 1996) to 50-80 words per minute following the implementation of a relatively brief training program that focuses on teaching the unique features of the system (Todman, 2000; Todman, Rankin, & File, 1999). The findings also suggest that these increases in communication rate are positively correlated with a number of important conversational quality indicators such as coherence (File & Todman, 2002), number of topic shifts (Todman et al., 1994a), and reciprocity of structure (Todman, Elder, Alm, & File, 1994b). In addition, increases in rate appear to be linked to more positive perceptions of individuals with CCN's communicative competence and personal qualities (Todman, 2000; Todman & Rzepecka, 2003), and appear to result in a more enjoyable interaction for both the individual with CCN and the communication partner (Todman, 2000).

The Frametalker system (Higginbotham et al., 1999) differs from the TALK system in that it was not developed to facilitate social interaction. Instead, the Frametalker system was developed to support transactional interactions in highly situated communication activities, such as visits to a doctor or eating out at a restaurant (Higginbotham et al., 1999). A transactional interaction involves exchanging information in order to accomplish things in the world. This type of interaction is very different from a social interaction in which the primary goal is to develop a relationship (Todman & Alm, 2003).

The Frametalker system is based on a communication frame approach. A communication frame is defined as “an organized collection of language structures than an individual would typically use with a given interlocutor, in a specific context of communication, and where a particular topic or situation is in focus” (Higginbotham, Moulton, Lesher, Wilkins, & Cornish, 2000b, p. 1). Communication frames are organized hierarchically so that there are *Super Frames* (e.g., *Aches and Pain*), *Basic Level Frames* (e.g., *Headache*), and *Sub-Frames* (e.g., *Migraine Headache*). A communication frame contains various component frames and utterance constructions. For instance, the *backache* frame might contain the component frames *symptom*, *location*, *cause*, *time*, and *remedy*. Within each component frame would be utterance constructions such as *I fell down* (*cause*) or *I need a massage* (*remedy*). When appropriate, these utterance constructions would contain variable slots. In the construction *I need* <u>*a massage*</u>, the underlined slot would initially be filled by a default lexical item. This item would be chosen based on its importance or its documented frequency of use. The individual with CCN would also have access to alternative lexical items that they could select from if the default item did not meet their current communicative need (Higginbotham et al., 2000b).

The Frametalker talker system is currently in the initial stages of evaluation. The research team has plans to assess its operability, usability, efficiency, and effectiveness (Higginbotham et al., 1999). Preliminary research efforts have focused on exploring the selection savings that the Frametalker system affords. Selection savings is measured by calculating the number of selections needed to produce an utterance on an AAC device and then dividing that number by the number of selections required to produce the same utterance on a standard output device such as a keyboard (Cornish & Higginbotham, 2000). The Frametalker system has been compared to Co:Writer (Don Johnston) and to Minspeak-Unity (Prentke Romich Company). Co:Writer is a spelling-based word-prediction system with a dictionary of 40,000 words. Unity is a vocabulary system that consists of 4,000 encoded words. The selection savings for the three systems were as follows: Frametalker, 87%; Co:Writer, 45%; and Unity, 40%. It is important to note that the selection savings were measured using 10 utterances that were taken directly from the Frametalker system. The research team acknowledges that this may have introduced a degree of bias to the study’s findings; however, the study does provide some initial evidence to suggest that the Frametalker system may offer increased efficiency in situated communication activities (Higginbotham et al., 2000b).

From the research studies described, it seems apparent that utterance-based systems such as the TALK system and the Frametalker system have the potential to make a dramatic difference to the communication efficiency of individuals with CCN. Nevertheless, these utterance-based systems are not without their limitations. For instance, the developers of these systems have focused solely on the communication needs of adults when determining the vocabulary to include in these systems. Currently, there are no utterance-based systems that have been developed with the vocabulary needs of children in mind. The current study documents the multiword sequences used by typically developing beginning writers. This information will be useful for guiding the selection of appropriate pre-stored utterances for children with CCN.

Another concern that is expressed in the AAC literature is the mismatch that can occur between the prestored messages in an utterance-based AAC system and the conversation at hand (Bedrosian et al., 2003). It is simply not possible to predict the exact content of a conversation. Individuals with CCN that use utterance-based systems must therefore have strategies to cope with the unexpected.

Bedrosian and colleagues (Bedrosian et al., 2003; Hoag et al., 2004) have suggested that when a mismatch occurs, individuals with CCN can implement one of three trade-off strategies: (a) they can edit the prestored message, (b) they can edit the prestored message after first generating a conversational floorholder that informs their listener that there will be a delay, or (c) they can use the message as it is stored. Strategies (a) and (b) both maximize precision, but sacrifice efficiency. In contrast, strategy (c) maximizes efficiency, but sacrifices precision. If an individual with CCN chooses to implement strategy (c) then the consequences vary depending on the manner in which the prestored message differs from their preferred message. For instance, the prestored message may only be partly relevant, or it may contain too much or too little information.

Two studies have been conducted which have examined the impact that these trade-off strategies have on message delivery. The first study (Bedrosian et al., 2003) investigated message speed and message relevance by simulating a communication interaction in a bookstore. An individual with CCN was approaching a clerk at a checkout counter. The individual wished to communicate the following utterance: *I'd like Bag of Bones by Stephen King in paperback please*. The study included three experimental conditions. Each condition tested the impact of one of the strategies described above. The prestored message used when strategy (c) was implemented contained partly relevant information. This message was *Stephen King was seriously injured in a hit-and-run accident*. The interactions between the individual with CCN and the clerk were scripted and videotaped. These videotapes were then watched by 96 sales clerks. After watching the videotapes, the sales clerks completed a questionnaire that elicited information about their attitudes toward the individual with CCN and his or her communication.

Prior to conducting this study, the researchers had hypothesized that there would be a hierarchy of trade-off strategies, with some strategies being perceived more positively than others. The researchers predicted that strategy (c) would be the most effective strategy because they believed that efficient message delivery would be viewed more favorably than precise message delivery. They also predicted that the placeholder provided in strategy (b) would be viewed more favorably than the absence of a placeholder as in strategy (a). They believed that the placeholder would inform the listener that message efficiency was about to be sacrificed and thus would act as an anticipated repair strategy (Bedrosian et al., 2003).

The results of the study were not exactly as anticipated. The researchers' predictions about the benefits of using a placeholder were found to be accurate. When the individual with CCN took time to edit the prestored message, the inclusion of a placeholder did have a more positive impact on listener attitudes. The prediction that message efficiency would be deemed more important than message precision, however, was found to be inaccurate. The edited message was perceived much more favorably than the prestored message. The sales clerks preferred an entirely relevant message, even if it meant waiting 1.5 minutes instead of 4 seconds for message output to take place. The message containing partly relevant information was ranked as the least preferred strategy more than 90% of the time (Bedrosian et al., 2003).

The second study (Hoag et al., 2004) also simulated a communication interaction in a bookstore. This study differed from the first study in that instead of investigating the impact of message relevance, it investigated the impact of message informativeness. In this study, the individual with CCN wished to communicate the same utterance: *I'd like Bag of Bones by Stephen King in paperback please.* This study had four experimental conditions: the two edited message conditions that were included in the first study and two prestored message conditions. In the first prestored message condition, the message used contained inadequate information (*I'd like the Stephen King book please*). In the second prestored message condition, the message used contained excessive information downloaded from Amazon.com (*Bag of Bones by Stephen King. List price $7.95. Paperback. Seven hundred and thirty-two pages. Copyright 1999*).

In this study, a hierarchy of trade-off strategies was identified; however, the results were not as clear-cut as they were in the first study. Three of the trade-off strategies were perceived more positively. These three strategies were: the edited message without the placeholder, the edited message with the placeholder, and the prestored message with excessive information. There was no statistically significant difference between these three conditions. The least preferred strategy was the prestored message with inadequate information. Written comments revealed that many of the sales clerks appeared to appreciate the efficiency of the prestored message, as long as they were able to figure out the individual with CCN's communicative intent. In the inadequate information condition, they were frequently unable to do so. This resulted in many of the sales clerks feeling irritated and frustrated with the communicative interaction. They expressed concern about the amount of time and effort that they would need to exert in order to determine exactly what the individual with CCN wanted (Hoag et al., 2004).

The conflicting nature of these studies' findings suggests that additional research is necessary before any firm conclusions can be made about the hierarchy of preferred trade-off strategies. Future studies should examine whether these findings generalize to other settings and to other communication partners. Researchers (e.g., Todman & Rzepecka, 2003) have speculated that precise communication may be more important in situations where the goal of the interaction is transactional, and where the communication partner is unfamiliar and/or inexperienced at communicating with individuals with CCN. Precise communication may be considerably less important in social interactions, particularly when those interactions involve communicating with familiar communication partners such as friends and family.

Bedrosian and colleagues state that despite the limitations inherent in their research to date and the obvious need for future research their studies' findings do have some important implications for the design and use of utterance-based AAC systems. These researchers suggest that individuals with CCN should be encouraged to store phrases rather than complete sentences. Phrase generation retains the advantage of being more efficient than word-by-word generation. In addition, messages produced using phrase-generation are likely to be more precise than those produced using sentence generation. Phrases can be combined and recombined to create a variety of messages. Phrases can also be used with a tag that contains more detailed information. For instance, an individual with CCN could generate the pre-stored message, *I would like that dress, please*, and then choose from a selection of modifiers (e.g., cost, color, size, style) to clarify his or her exact communicative intent (Hoag et al., 2004).

Speech-language pathologists and educators who work with children with CCN do not currently have access to sufficient information and resources to guide them in making decisions about which phrases to incorporate into children's AAC systems. A number of studies have documented the vocabulary used by typically developing children for the purpose of informing the field of AAC; however none of these studies have analyzed the data beyond individual word frequencies. This may be because the practice of including phrases and sentences in children's AAC systems is actually a topic of controversy. Many professionals have expressed concern that providing children with access to pre-stored messages may be detrimental to children's language development. Specifically, these professionals have questioned the impact of providing children with access to utterances that are syntactically and morphologically more advanced than those that they are able to produce independently (Gerber & Kraat, 1992). They have also expressed concern that acquiring language in the context of pre-stored messages may prevent these children from learning to construct their own novel messages (Bedrosian,1997; Nelson, 1992). These are valid concerns that warrant further investigation; however, studies conducted outside the field of AAC suggest that the use of pre-stored messages is not a characteristic that is unique to individuals with CCN. Adults and children who use spoken language as their primary mode of face-to-face communication also rely heavily on pre-fabricated language forms. The current study provides important information regarding the phrases that beginning writers use most frequently and therefore informs decision-making regarding the use of phrases to support communication for children with CCN.

Extensive support for the prevalence of pre-stored phrases can be found in the linguistics literature, particularly in the body of research that is concerned with formulaic sequences. A formulaic sequence is defined as:

> A sequence, continuous or discontinuous, of words or other elements, which is, or appears to be, prefabricated: that is stored and retrieved whole from memory at the time of use, rather than being subject to generation or analysis by the language grammar. (Wray, 2002, p. 9)

Formulaic sequences are used extensively in both spoken and written language (Erman & Warren, 2000). In fact, formulaic sequences may comprise as much as 70% of language produced (Altenberg, 1990). A number of different types of formulaic sequences have been identified including idioms (e.g., *that's the way the cookie crumbles*), collocations (e.g., *sheer coincidence* or *pure coincidence*, but not *great coincidence*), sentence frames and builders with open slots (e.g, *Could you* *pass the ____?*), and standard situational utterances (e.g., *Can I help you?*) (Wray, 1998).

It is generally accepted that formulaic sequences occur frequently in language usage because of issues relating to cognitive resource allocation (Schmitt, Grandage, & Adolphs, 2004). Formulaic sequences increase processing efficiency. They are prepackaged in memory, which means that they can be processed more quickly and easily than sentences which are generated creatively (Schmitt & Carter, 2004). Formulaic sequences enhance fluency while at the same time freeing up cognitive resources so that individuals can focus on higher level language processing such as the structure of discourse and the social aspects of interaction (Nattinger, 1988).

Formulaic sequences feature prominently in social interactions and in situations that are recurring and that include conventionalized language routines such as apologizing, giving directions, or complaining. In these situations, communication partners expect to hear particular formulaic sequences (Schmitt & Carter, 2004). Formulaic sequences function as a social lubricant (Kecskes, 2003). They aid communication partners in co-constructing their interaction (Kecskes, 2003) and are critical to socially appropriate language use (Schmitt & Carter, 2004). Formulaic sequences are also important in transactional communication. They facilitate precise and efficient message transmission. Examples of formulaic sequences used to transact information include discipline-specific phrases that carry precise meanings such as the phrase *cleared to land*, which gives a pilot certain rights and responsibilities (Schmitt & Carter, 2004).

The exact nature of the relationship between formulaic language processing and creative language processing is yet to be determined. Today most researchers agree that both are involved in language processing and that both are important, but precisely what governs the choice of a formulaic processing strategy versus a creative processing strategy at any one time is still very unclear. A prominent theory in the literature at present is the phrase-first paradigm (Wray & Perkins, 2000; Wray, 2002). This theory posits that language processing is most effective when an appropriate balance is reached between formulaic and creative processing. The advantage of the formulaic system is “economy of effort when dealing with the expected” (Wray & Perkins, 2000, p. 11) and the advantage of the creative system is “the freedom to produce or decode the unexpected” (Wray & Perkins, 2000, p. 11). If language was totally formulaic, it would sound repetitive and clichéd. In contrast, if language was totally creative, it would sound pedantic, dysfluent, and unidiomatic (Wray, 1998).

The phrase-first paradigm incorporates both formulaic and creative processing; however, it assigns formulaic language the central role in language processing. The paradigm is based on a belief that the baseline strategy employed in everyday language processing “relies not on *the potential for the unexpected* in a given utterance but upon the *statistical likelihood of the expected*” (Wray, 1992, p. 19, original emphasis). Formulaic processing is relied upon because of its processing power and efficiency. Creative processing is also important. However, its role is secondary in that its function is to provide back-up when formulaic processing breaks down (Wray, 1998; Wray & Perkins, 2000).

The dynamic balance between formulaic processing and creative processing postulated in the phrase-first paradigm may not be achieved until late childhood or adolescence. One developmental theory (Wray & Perkins, 2000) proposes that very young children rely heavily on the use of formulaic sequences, but that this tapers off at around 20 months of age when children develop an increasing awareness of grammar. Children continue to learn formulaic sequences and use them in their spoken language, but the proportion of creative language compared to formulaic language increases. At approximately eight years of age, the strategy of creating messages from scratch becomes inefficient and a process of reorganization occurs. During this process, groups of words that have been repeatedly encountered and/or constructed are collapsed and restored as single formulaic frames. The language processing system is then continuously reorganized and refined until adult patterns of formulaic and creative language processing are achieved. For both beginning writers and children with CCN, the linguistic and cognitive resources that are available to support this developmental process are likely to be constrained as they focus their energies on learning to use a novel instrument to modulate their language output. The current investigation provides important information regarding the development and use of formulaic and creative language processing in beginning writing. This information will provide the AAC field with greater insight into the role of formulaic and creative language processing in children with CCN.

Summary: Precise and Efficient Communication

For speaking individuals, the ultimate goal of language processing is for formulaic and creative processing strategies to work in concert to ensure that individuals are able to express what they wish to say in a precise and efficient manner (Wray, 1998). Unfortunately, this goal is currently not attainable for individuals with CCN. The AAC devices that are available today are either word- or utterance-based. Word-based devices incorporate some pre-stored utterances, and utterance-based devices incorporate some capacity for creative message construction. None of the devices, however, are flexible and dynamic enough to even approximate what is possible through spoken communication. An additional concern is that the utterance-based AAC devices that are currently available have not been created with children in mind. This is perhaps because of the prevailing belief in the AAC field that providing children with access to pre-fabricated messages may be confusing and may impede the development of language skills (See discussion in Harwood, Warren, & Yoder, 2002 and in Wilkinson & McIlvane, 2002). Researchers in the field of formulaic sequences would argue that this would not necessarily be the case, particularly in the early stages of language development (Wray & Perkins, 2000). The architecture of future AAC devices must endeavor to provide children with CCN with language systems that support the development of a dynamic balance between both efficient and precise communication.

Language Learning for Individuals with Complex Communication Needs

The language learning experiences of children with CCN may differ significantly from those of typically developing children and “variables that are not usually at issue may come into play and interact in ways that are not fully understood” (Sutton et al., 2002, p. 193). One of the greatest challenges children with CCN face is the distinct asymmetry that exists between their primary channels of language input and their primary channels of language output (Smith & Grove, 1996). At the same time as these children are developing receptive language skills in the language(s) spoken in their home and school environments, they are also having to learn how language is represented or coded on their multimodal AAC systems (Light, 1989, 1997).

An additional challenge is the potential mismatch between the child with CCN's intended message and the message that is translated into spoken language by their communication partner or by the pre-programmed AAC system. Communicating with AAC has been described as a process that is characterized by the co-construction of meaning. As young children with CCN are developing competence in their use of an AAC system, they are particularly dependent on their communication partners to co-construct meaning. Communication partners use their knowledge of the child, the context, and the AAC system to interpret or co-construct the child's communicative intent. As communication partners engage in the process, they tend to align messages produced using AAC with the rules of spoken language by making changes such as altering word order, correcting syntax, or clarifying semantics (Soto, 1997, 1999).

The process of language learning for children with CCN is further complicated by the fact that many of these children must learn appropriate, effective, and efficient use of their AAC system with limited exposure to models of its use (Light, 1997; Light, Collier, & Parnes, 1985). Typically these children do not have regular contact with competent nonspeaking communicators (Light et al., 1985) and often they do not observe AAC systems being used outside of structured teaching situations (von Tetzchner & Jensen, 1996). In one study (Romski and Sevcik, 1996), it was found that when parents and school personnel interacted with children with CCN, they integrated AAC use with their spoken communication less than 10% of the time, even when they had received specific encouragement and instruction to do so. It was also found that when parents and school personnel did model AAC use, they typically used natural speech to communicate the main message and used AAC to highlight key concepts. Furthermore, these adults were restricted to the use of symbols that were already in the child's AAC system. Therefore, even when modeling of AAC systems did occur, the output was dramatically different from the language models that typically developing children receive.

Over the past 25 years, a number of studies have been conducted in the field of AAC that have investigated the process of language learning and the linguistic capabilities of children and adults with CCN. These studies have addressed one or more of the five language domains: phonology, semantics/vocabulary, syntax, morphology, and pragmatics. The following section of this paper will present a detailed review of the research addressing semantics/vocabulary, syntax, and morphology. The research addressing semantics/vocabulary will be reviewed first. This language domain was selected as an area of focus for the current investigation because despite the fact that attempts have been made to improve vocabulary selection and organization for individuals with CCN, vocabulary growth continues to be identified as a prominent clinical concern (e.g., Roth, 2005). The discussion will then shift to the literature addressing syntax and morphology. These language domains were selected as areas to address in the current investigation because they have received insufficient attention in the literature (Sutton et al., 2002). Early studies in the field of AAC focused primarily on the pragmatics or interaction skills of individuals with CCN (Smith, 1996). It is only recently that syntax and morphology have begun to receive the attention they deserve. Studies that improve the field's understanding of why individuals with CCN often struggle to develop mature syntax and morphology are urgently required.

Semantics and Vocabulary in Individuals with Complex Communication Needs

The term *semantics* is defined as the "subsystem of language that deals with words, their meanings, and the links that bind them" (Bernstein, 2002, p. 7). The term *vocabulary* is a term that specifically refers to the words that an individual has available for language comprehension or production. This set of vocabulary words is often referred to as an individual's lexicon (Nelson, Bahr, & Van Meter, 2004).

For typically developing children acquiring new vocabulary is a dynamic process. These children choose, store, and retrieve new words while they are actively responding to and manipulating their environments (Carlson, 1981). They are able to "capture and encode vocabulary that is most salient and interesting to them" (Light, 1997, p. 165). Children with CCN are presumably also attracted to new vocabulary, however many of these children must rely on other people to select the vocabulary that they are able to capture and encode. At least until they develop the ability to spell, children with CCN cannot independently program their AAC systems. As a consequence, many of these children often have access to restricted vocabularies that fail to reflect their interests, full linguistic potential, and changing language needs.

AAC systems serve a vitally important function for children with CCN in that they provide a means to interact and communicate with other people. However, the extent to which these children can effectively participate in interactions is largely dictated by the appropriateness of the vocabulary that is available to them (Light, 1997). Frequently in an attempt to provide functional vocabulary, the adults who program AAC systems select words which focus on the communication of wants and needs, but they fail to select words which provide children with the opportunity to express other important communicative functions such as those required to develop social closeness and those needed to seek and provide information about experiences and events (Light, 1988, 1997).

Children with CCN who wish to communicate beyond the boundaries imposed by their AAC system must learn to compensate for the vocabulary they do not have by employing metalinguistic cues that help their communication partner to accurately infer their communicative intent. Children with CCN who are able to develop this level of metalinguistic knowledge typically employ a variety of strategies including semantic bypasses (e.g., using a synonym), phonological similarity cues (e.g., using a homonym), and/or word modification markers (e.g., 'it's the opposite of', 'it's similar to') (Soto, 1997, 1999). The cues that a child with CCN employs at a particular point in time may reflect their underlying language skills, exposure to language models, familiarity with their AAC system, and/or previous experience with their communication partner.

Research: Semantics and Vocabulary in Individuals with Complex Communication Needs

A comprehensive search of the literature revealed five studies that have examined the vocabulary and/or semantic knowledge of children or adults with CCN. Appendix A1 provides a summary of the participants that were included, the assessment procedures and measures that were utilized, and the key findings that were obtained for each of the studies. The studies included in this review were published in refereed journals between 1986 and 1996. The discussion of research is organized into the following sections: participants, methodological approaches, and findings.

Participants

The sample sizes across the five studies ranged from 1 to 40 participants. The participants varied across (and sometimes within) samples according to age (3 to 40 years), type of speech impairment (dysarthria, developmental apraxia of speech), and degree of speech impairment. In addition, some of the participants presented with medical problems and sensory impairments, while others did not. In Berninger & Gans' (1986) study, for example, the 16-year-old boy had a severe hearing loss that was not diagnosed until 8 years of age. Similarly, in Udwin & Yule's study (1990), some of the children exhibited hearing loss, visual impairment, and/or epilepsy. The cognitive abilities of the participants also varied considerably. Their IQ scores ranged from significantly below average to within normal limits.

Additional within-sample and across-sample differences were evident in the types of AAC systems that the participants used. Some communicated using picture symbols (Blissymbols or Picture Communication Symbols). Others communicated using Makaton sign language, the alphabet, or typed words. The participants also accessed their AAC systems in a variety of ways. In Berninger & Gans' (1986) study, for example, one boy used a head wand attached to a headband to access a regular computer keyboard whilst the other boy used his index finger to access a touch sensitive computer keyboard. Unfortunately, the heterogeneous nature of the participants involved in these studies means that extreme caution must be exercised in the generalization of findings.

Methodological Approaches

Two studies focused on observing and/or quantifying participants' language skills by administering an assessment (Berninger & Gans 1986; Bishop, Byers Brown, & Robson, 1990). Another study (Romski, Sevcik, & Robinson, 1996) examined whether participants were able to fast map novel vocabulary words. The remaining studies (Harris et al., 1996; Udwin & Yule, 1990) investigated the impact of two different approaches to intervention. Language skills were evaluated by administering standardized tests (Berninger & Gans, 1986; Bishop et al., 1990) or by counting particular language behaviors such as the number of signs or symbols comprehended and expressed (Udwin & Yule, 1990), or the percentage of modeled vocabulary produced (Harris et al., 1996).

Findings

In the first study to examine the vocabulary skills of individuals with CCN (Berninger & Gans, 1986), the Peabody Picture Vocabulary Test – Revised (PPVT-R, Dunn & Dunn, 1981) was administered to three individuals with cerebral palsy: a 9-year-old who had an IQ score in the average range; and a 16-year-old and a 40-year-old who both had IQ scores in the low-average range. The 16-year-old and the 40-year-old exhibited significantly delayed vocabulary knowledge. In contrast, the 9-year-old exhibited advanced vocabulary skills. The findings from this study illustrate the considerable intraindividual differences in vocabulary knowledge that can exist within the population of individuals with CCN.

The second study (Bishop et al., 1990) compared the vocabulary skills of 24 young adults with cerebral palsy and severe speech impairments (anarthria or dysarthria), to a group of control participants who also had cerebral palsy but who had no coexisting speech difficulties. The two groups were matched according to chronological age and scores on Raven's Progressive Matrices (Raven, 1967). Administration of the British Picture Vocabulary Scale (BPVS, Dunn, Dunn, Whetton, & Pintilie, 1982) revealed that the participants with severe speech impairments exhibited significantly impaired vocabulary skills compared to their matched controls.

Udwin and Yule (1990) also compared the vocabulary skills of two groups of children; however, in this study both groups of children used AAC. One group included 20 children who were learning to communicate using Blissymbols (a system of graphic symbols representing 100 basic language concepts that can be used in isolation or combination) and the other group included 20 children who were learning to communicate using Makaton signs (a system of manual signs). The children were initially assessed when they had received an average of 10.5 months of symbol or sign training. They were then reassessed at 6-month intervals for a total period of 18 months. Udwin and Yule (1990) documented progress in the children's receptive and expressive knowledge of signs or symbols. The results of the study identified significant increases in the numbers of signs or symbols taught, the numbers of signs or symbols understood, and the numbers of signs or symbols produced. In general, however, progress was slow.

In the Blissymbols group, the children increased the number of symbols they understood from 54 to 113, and the number of symbols they produced from 50 to

109. In the Makaton signing group, the children increased the number of signs they understood from 35 to 72, and the number of signs they produced from 31 to 65. Statistical comparisons between the two groups revealed only one significant difference (percentage of signs or symbols acquired expressively at initial assessment) when disparities in IQ and language comprehension were taken into account. These findings indicated that neither the Blissymbols system nor the Makaton sign system had any benefit over the other in terms of ease of acquisition. Udwin and Yule (1990) emphasized, however, that it is inappropriate to infer that these systems will be equally effective for everyone. They observed considerable variability within the two groups of children.

Harris et al. (1996) examined the effectiveness of an intervention program that was designed to teach a child with developmental apraxia of speech who primarily communicated using pre-stored whole messages, to segment and combine grammatical constituents. The child's progress was monitored over a four month period using a multiple baseline design across contexts (storybook reading, structured discourse). The child demonstrated increased levels of lexical flexibility. In the treatment trials, the child's percentage of correct constituents score was consistently greater than his percentage of modeled vocabulary score indicating that the child was able to make semantically correct word choices that had not previously been modeled.

The most recent study (Romski et al., 1996) investigated the word learning abilities of 12 males aged 10-25 years. All of the participants had significant cognitive impairments, and all had been exposed to the System for Augmenting

Language (SAL, Romski & Sevcik, 1996) for a minimum of five years. The SAL is a multifaceted approach to language intervention that includes: (a) the SuperWolf AAC system (Adamlab, LLC), (b) a vocabulary of arbitrary picture symbols (lexigrams) paired with printed English words, (c) a teaching approach that encourages but does not require communicative attempts, and (d) a resource and monitoring system that includes weekly visits with the researchers, and the completion of a questionnaire that elicits information about the participants' patterns of communicative use.

The purpose of the study was to explore whether the participants were able to engage in fast mapping. Fast mapping is defined as a child's ability to map a new word on to a novel object in the absence of any overt definition (e.g., pointing) (Carey, 1978). Fast mapping is important for vocabulary growth as it enables children to rapidly acquire new words. The researchers were interested in examining whether a relationship existed between the participants' fast mapping abilities and their prior symbol achievement. For that reason, the participants were divided into a beginning achievement group (n = 4) or an advanced achievement group (n = 8) based on the size of their symbol vocabularies.

The participants' fast mapping abilities were measured experimentally by exposing the participants to sets of stimuli consisting of four known objects and one novel object. The researcher asked the participants to *give me the* ____ while simultaneously activating the corresponding symbol on the SuperWolf. The researcher asked for a known object first and then asked for the novel object. If the participant did not point to or physically manipulate the novel object, then the researcher provided feedback. This process was repeated with three additional sets of stimuli. The participants' symbol comprehension and symbol production abilities were then assessed. The assessments were administered immediately following exposure to the novel words, and were then repeated one day and fifteen days later.

Overall, seven of the children successfully mapped the meanings of two or more novel symbols. The mean number correct was 0.5 (range 0 -1) for the beginning achievement group and 2.9 (range 0-4) for the advanced achievement group. The children were classified as 'mappers' or 'nonmappers'. Only one of the participants in the advanced achievement group was classified as a nonmapper. Symbol achievement was found to be significantly related to mapping status. The children classified as mappers were able to generalize their knowledge to word production and were able to retain comprehension and production of at least half of the novel symbols for 15 days following initial exposure.

Summary: Research Examining Semantics and Vocabulary in Individuals with Complex Communication Needs

The studies reviewed in this section have provided initial evidence to suggest that individuals with CCN frequently exhibit deficits in their semantic and vocabulary knowledge. Further research is required to determine the exact nature of the deficits, however, the findings of one study (Romski et al., 1996) suggest that the extent of the deficits may be linked to the ability to fast map novel vocabulary words. Only two intervention studies have been conducted to date. The findings of the first study (Udwin & Yule, 1990) suggest that teaching signs or symbols to children with CCN can lead to increases in the number of signs or symbols that children understand and produce, but that the rate of progress for these children may be slow. The second study's (Harris et al., 1996) findings suggest that teaching children to segment and combine grammatical constituents may lead to increased levels of lexical flexibility.

Syntax and Morphology in Individuals with Complex Communication Needs

Syntax is the term used to describe the system of rules that govern the structure of sentences. These rules dictate word order and the organization of various sentence types (Bernstein, 2002). Syntactic knowledge enables the individual to combine words into meaningful phrases, clauses, and sentences (Kamhi & Catts, 1999). *Morphology* is the term used to describe the system of rules governing the internal composition of words and the construction of words from morphemes (Bernstein, 2002). Morphemes are the smallest units of language that carry meaning. Every word is comprised of at least one morpheme that can stand alone. These morphemes are referred to as free morphemes (Nelson et al., 2004). In addition, there are two groups of bound morphemes that are affixed to free morphemes as prefixes and suffixes: derivational morphemes and inflectional morphemes. Derivational morphemes change a word into a new word that may reflect a different part of speech. For instance, the morpheme *–ness* changes the adjective *sad* into the noun *sadness*. Inflectional morphemes modify the variables of tense, person, or number (Bernstein, 2002) to fit the syntax of a particular sentence (Nelson et al., 2004). Examples of inflectional morphemes include the plural *–s*, the present progressive *–ing*, and the past tense *–ed*. Inflectional morphemes are sometimes referred to as grammatical morphemes (Nelson et al., 2004).

Research that has examined the structure of the language produced by individuals with CCN has identified several syntactic and morphological characteristics. Many individuals with CCN predominantly produce single-symbol utterances. This results in a high occurrence of simple clause structures and limited use of questions, commands, negatives, and auxiliary verbs. Other characteristics include atypical word order patterns and a tendency to omit syntactic and morphological structures such as verbs and articles, even when these structures are readily available in individuals' AAC systems (Soto, 1997, 1999).

Three theoretical models have been presented in the literature that suggest possible explanations for the differences observed in the language produced by individuals with CCN. The first of these models is the deficit hypothesis. This hypothesis purports that individuals with CCN have differences in their underlying knowledge of syntax and morphology that can be attributed to the limited opportunities that they have to actively manipulate and construct language (Blockberger & Johnston, 2003; Sutton et al., 2002). Many children with CCN do not receive AAC systems until the period of primary language development is already well underway (Sutton & Gallagher, 1993). Furthermore, even when these children do receive AAC systems, they tend to assume passive roles within communicative interactions. They rarely initiate and only respond when they are clearly obligated to do so (Light et al., 1985). The amount of time that these children spend experimenting with language is therefore extremely limited. Support for the deficit model was highly prevalent in the AAC field until Kraat (1985) questioned it in an influential paper that synthesized the interaction research at the time. Kraat suggested that the differences in the language produced by individuals with CCN did not reflect underlying language deficits. Instead she proposed that the differences reflected strategies and competencies necessary for successful AAC communication.

Following Kraat's paper, two alternative theoretical models were proposed and explored: the compensation hypothesis and the modality-specific hypothesis.

The compensation hypothesis suggests that the atypical patterns observed in the language structures produced by individuals with CCN occur due to the cognitive, physical, and linguistic constraints involved in communicating using an AAC system (Sutton et al., 2002). These constraints include reduced access to the full range of syntactic and morphological structures, reduced rate of communication, and the need for co-construction and negotiation of message meaning (Sutton et al., 2000). For instance, the compensation hypothesis suggests that individuals with CCN may intentionally omit inflectional morphemes because they are trying to conserve their physical resources and/or save time (Blockberger & Johnston, 2003). The inflectional morphemes in English are often predictable from context and they tend to carry a minimal share of the informational load (Blockberger & Johnston, 2003). For these reasons, individuals with CCN may purposefully omit inflectional morphemes because doing so allows them to generate messages at a faster rate without seriously compromising their message clarity.

The modality-specific hypothesis attributes the structural features of the language produced by individuals with CCN to the process of generating language in the visual graphic modality (Sutton et al., 2002). The exact nature of the relationship between spoken language and the construction of utterances using graphic symbols is still relatively unknown. It is not clear, for instance, whether individuals with CCN construct their utterances by generating their messages using subvocal speech, and then translating their messages from spoken language into graphic symbols, or whether they formulate their utterances by adhering to linguistic patterns that are unique to the visual graphic modality (Sutton et al., 2000). The modality-specific hypothesis suggests that the language structures produced by individuals with CCN are at least partially influenced by factors unique to the modality. Examples of these factors include the possibility to select more than one symbol at a time (Sutton et al., 2000) and the possibility to use one symbol to represent more than a single concept or word (e.g., the picture communication symbol *sit* could be used to represent the word *sit*, but it could also be used to represent the phrase *girl sit chair*) (Smith, 1996).

Research: Syntax and Morphology in Individuals with Complex Communication Needs

Fifteen studies have addressed issues relating to the syntactic and morphological abilities of individuals with CCN. Many of these studies have produced findings that support or contradict the viability of one or more of the three theoretical models described above. The studies are summarized in Appendix A2. In the section that follows, the studies will be reviewed in detail with reference to the participants involved, the methodological approaches employed, and the findings obtained. The studies were published in refereed journals or books between 1986 and 2004.

Participants

The earlier studies included only participants with CCN. Some of the more recent studies, however, included participants with no disabilities. In two of these studies (Blockberger & Johnston, 2003; Redmond & Johnston, 2001), the participants with no disabilities were incorporated as a control or comparison group. In the other four studies (Nakamura, Newell, Alm, & Waller, 1998; Sutton, et al., 2000; Sutton & Morford, 1998; Smith, 1996) these participants were the sole focus of the investigation. Researchers exploring the feasibility of the compensation hypothesis and/or the modality-specific hypothesis have often started by studying individuals who have intact physical, cognitive, and linguistic abilities. Smith (1996) was the first researcher to conduct a study of this type and in the discussion of her findings she referenced a quote from another group of researchers who were introducing signing to typically developing children: “it is hard to evaluate the results of using atypical input with atypical learners if you do not know what happens when the same atypical input is provided to typical learners” (Abrahamsen, Lamb, Brown-Williams, and McCarthy, 1991, p. 239). Smith went on to acknowledge that this approach to research is not without its limitations and that caution must be taken when attempting to apply the results to individuals with CCN. Obviously, individuals with no disabilities differ from individuals with CCN. For instance, they have access to other more efficient means of communication and prior to participating in the studies they have received minimal exposure to AAC (Smith, 1996; Sutton & Morford, 1998). These differences are substantial and clearly have an impact on the generalizability of studies’ findings.

In the studies that included individuals with CCN, the sample sizes ranged from 1 to 40 participants. The underlying etiology for all but one of the participants was cerebral palsy. With the exception of this one similarity, however, the participants were extremely heterogeneous. Considerable variability was evident in the participants’ age (3 to 63 years), type of speech impairment (dysarthria, developmental apraxia of speech), and degree of speech impairment. The participants differed according to their receptive language abilities, and the existence and severity of coexisting disabilities including physical impairments, cognitive impairments, sensory impairments, and medical problems (e.g., epilepsy). Finally, differences were evident in the types of AAC systems (e.g., Blissymbols, Picture Communication Symbols, Makaton sign language, number codes, the alphabet, typed words) that the participants used and in the types of access methods (e.g., head wand, hand pointer, touch-sensitive keyboard, eye-gaze) that they employed.

Two of the studies incorporated control participants. The first of these studies (Redmond and Johnston, 2001) included three control groups: 11 children aged 4-6 years, 13 children aged 7-10 years, and 21 adults. All of the participants had no history of speech or language delay, learning disability, or attention deficit (hyperactivity) disorder. The children exhibited age-appropriate performance on standardized tests of receptive vocabulary and nonverbal intelligence. The results of audiometric screening tests indicated that the children's hearing levels were within normal limits. The hearing levels of the adult participants were not tested. The second study (Blockberger & Johnston, 2003) included two groups of control participants. One group had delayed receptive language skills (mean age, 9 years) and the other group had no history of disability (mean age, 5 years). All of the children had normal hearing. On the PPVT-R (Dunn & Dunn, 1981), the average age-equivalent receptive vocabulary scores were equivalent for the two control groups and the experimental group.

The remaining four studies only included individuals with no disabilities. In these studies, the sample sizes ranged from 5 to 123 participants. Two of the studies (Smith, 1996; Sutton & Morford, 1998) involved children (aged 3 and 12 years) and the other two studies (Nakamura et al., 1998; Sutton et al., 2000) involved adults. All of the studies included English speaking participants. Nakamura et al's (1998) study also included a group of Japanese speaking participants.

Methodological Approaches

The studies featured a variety of different research designs including descriptive designs with and without comparison groups (e.g., Berninger & Gans, 1996; Blockberger & Johnston, 2003; Soto & Toro-Zambrana 1995; Sutton & Morford, 1998); single-subject multiple baseline designs (Harris et al., 1996; Lund & Light, 2003); pre-test/post-test designs (e.g., Sutton & Gallagher, 1993) and post-test only designs (e.g. Smith, 1996). To evaluate the syntactic and morphological abilities of the participants, the researchers either administered formal (Berninger & Gans, 1986; Bishop et al., 1990) or informal (Redmond & Johnston, 2001; Smith, 1996; Sutton & Gallagher, 1993) tests, or they collected language samples and then documented the incidence of specific language behaviors, for instance the number of grammatical morphemes (Kelford Smith et al, 1989), or the frequency and range of particular grammatical structures (Udwin & Yule, 1990). Two of the studies examined the participants' language skills in the context of written language activities (Blockberger & Johnston, 2003; Kelford Smith et al., 1989). Other studies examined language in the context of face-to-face communication activities such as conversation (Udwin & Yule, 1990) or the description of a video clip (Sutton & Morford, 1998). Some studies also assessed participants' receptive language abilities using tasks that required the participants to point to pictures or to judge whether sentences were or were not grammatically correct (e.g., Blockberger & Johnston, 2003; Sutton, Morford, & Gallagher, 2004).

Findings

Of the 15 studies, 13 can be tentatively tied to one of the three theoretical models: the deficit hypothesis, the compensation hypothesis, or the modality-specific hypothesis. Most of these studies were not specifically designed to test the feasibility of these theoretical models (Sutton et al., 2004). Nevertheless, collectively these studies have generated findings that have important implications for ascertaining which model or which combination of models provides the most accurate explanation for the differences observed in the language produced by individuals with CCN. The findings from these studies will be discussed and the findings from two intervention studies will also be presented.

Investigating the deficit hypothesis.

Studies that have investigated whether individuals with CCN exhibit deficits in their syntactic and/or morphological knowledge have produced mixed findings. Udwin and Yule (1990) assessed the syntactic development of 20 children who were learning to communicate using Blissymbols and 20 children who were learning to communicate using Makaton signs. Language samples were obtained in semi-structured conversational settings and were analyzed to determine: (a) the mean number of signs or symbols that the children produced per utterance (MSLU), (b) the frequency and range with which they produced particular grammatical structures, and (c) the extent to which the children's multi-term utterances reflected conventional English word order.

The children’s utterances were found to be severely restricted in terms of their number, length, and complexity. After having received between 18 and 36 months of sign or symbol training, the MSLU for the children in the Blissymbols group was 1.69 and for the children in the Makaton signing group was 1.06. Most of the children’s utterances consisted of a single noun or verb. Some progress was evident over time with a reduction in the production of single-term utterances and an increase in the production of two-term clause and phrase structures. When the children did produce multiple signs or symbols, their utterances usually reflected conventional English word order. The children produced very few, if any, question and command forms, negative constructions, adjectives, auxiliary verbs, and complex sentence structures. Statistical comparisons between the two groups revealed no significant differences when disparities in IQ and language comprehension were taken into account.

Blockberger and Johnston (2003) compared the morphological abilities of three groups of children: 20 children with CCN (mean age 9;3), 20 children with no disabilities (mean age 5;9), and 15 children with delayed receptive vocabulary skills (mean age 9;4). The two comparison groups were included in the study in order to evaluate whether the morphological difficulties experienced by children with CCN could be attributed to their limited speech production abilities or whether similar difficulties could be discerned in other groups of children with comparable receptive vocabulary scores. A comprehension task, a grammaticality judgment task, and a written cloze task were administered. The tasks assessed the children’s knowledge of three specific morphemes: possessive *s*, past tense –*ed*, and third person regular *s*. The written language task was only administered to the participants who were able to independently write or type a brief sentence.

The children in the CCN group achieved lower mean scores on the two receptive language tasks and were more likely to omit morphemes in obligatory contexts when writing. The researchers concluded that the morphological errors and omissions commonly observed in the language of individuals with CCN appear to reflect “deficiencies in their underlying knowledge of grammatical morphology” (p. 216). The finding that the children with CCN exhibited greater difficulty than the children with typical language development and the children with receptive vocabulary delays suggests that the problems experienced by children with CCN may be related to their lack of experience with language production.

In contrast to these findings, Soto and Toro-Zambrana (1995) analyzed the Blissymbol output produced by three Spanish adults and found that these individuals used a wide variety of syntactic and morphological structures. Language samples were collected across three different linguistic contexts: natural conversation, a sentence translation task, and a picture interpretation task. All of the participants appropriately used structures such as the present progressive, past, and future verb tenses; question and negative forms; and personal and possessive pronouns. However, there was significant variation between the participants. For instance, two of the participants used relative and subordinate clause structures whilst the third did not. This variation was thought to be associated with the participants’ differing cognitive and linguistic abilities. The two participants who used some of the more advanced syntactic and morphological structures had IQ scores of 71 and 78 and used Blissymbol systems with 352 and 500+ symbols. The participant who used mainly simple structures had an IQ score of 33 and used a Blissymbol system with 120 symbols.

When discussing their study's findings, Soto and Toro-Zambrana (1995) noted that some of the structures that the participants failed to produce would typically not be available in Blissymbol systems, for instance the conditional verb forms *could* and *would*. Unfortunately, the researchers did not list the specific symbols that the participants had access to. It was therefore impossible to determine whether the deficit hypothesis was accurate and the participants exhibited impaired knowledge of these structures, or whether the compensation hypothesis was accurate and they failed to produce the structures because they lacked the appropriate symbol(s) in their Blissymbol systems.

The findings of the three studies reviewed in this section suggest that many individuals with CCN do exhibit deficits in their knowledge of syntactic and morphological structures. The findings also suggest, however, that individuals with CCN are a heterogeneous group and that there is wide interindividual variability. Some individuals produce only single-term utterances while others are able to generate complex sentences and use a wide range of morphological markers.

Investigating the compensation hypothesis.

Five studies have produced findings that have implications for the feasibility of the compensation hypothesis. One study (Sutton & Gallagher, 1993) addressed the issue identified in Soto and Toro-Zambrana (1995) and examined whether the syntactic and morphological difficulties exhibited by individuals with CCN can be attributed to the fact that these individuals' frequently do not have access to AAC systems that include the full range of syntactic and morphological structures. The remaining four studies examined the receptive language skills (Berninger & Gans, 1986; Bishop et al., 1990; Blockberger & Johnston 2003; Redmond & Johnston, 2001) or the written language abilities (Blockberger & Johnston, 2003; Kelford-Smith et al., 1989) of individuals with CCN. If the compensation hypothesis is accurate and individuals with CCN have acquired syntactic and morphological structures through their language comprehension experiences, but they choose to omit them in order to increase the efficiency of their expressive communication, then their performance on receptive language tasks and written language tasks should be within normal limits (Blockberger & Johnston, 2003).

Sutton & Gallagher (1993) investigated whether individuals with CCN were able to produce a morphological distinction that was not previously available to them in their Blissymbol systems. In this study, two adults with CCN were taught a strategy that enabled them to distinguish between regular and irregular past tense verbs. Prior to the introduction of the strategy, the participants had marked past tense for both regular and irregular verbs using the same access method. They had used eye gaze to indicate a four-digit number code for the Blissymbol past action indicator followed by a four-digit code for the main verb. The new strategy was an extension of this access method. To encode irregular past tense verbs, the participants were instructed to use the same method that they had previously used to indicate past tense. To encode regular past tense verbs, they were taught to use an affixation strategy that required them to create a five digit number by repeating the last digit of the code for the main verb. Two tasks with real verbs and two tasks with nonsense verbs were used to assess the participants' receptive understanding and expressive use of the strategy.

The results of the study suggested that the participants did not encode regular and irregular past tense verbs using a strategy that reflected verb class membership. Chance level analyses suggested that the participants' responses were not random. However, the specific factors underlying the participants' usage patterns were unclear. The idea that individuals with CCN have intact knowledge of syntactic or morphological structures but that they are unable to use these structures because they are unavailable in their AAC systems may be inaccurate. The findings of this study suggested that individuals with CCN may have underlying deficits in their language skills.

Berninger and Gans (1986) examined the receptive language abilities of three individuals with CCN. The syntactic competence subtest of the Buschke Tests of Linguistic Competence (Buschke, 1975) and the sentence structures subtest of the Clinical Evaluation of Language Functions (CELF, Semel & Wiig, 1980) were administered to a 9-year-old who had an IQ score in the average range; and a 16-year-old and a 40-year-old who both had IQ scores in the low-average range. The Buschke subtest is a grammaticality judgment task that requires the participant to indicate whether or not a sentence sounds like an English sentence. This subtest is typically mastered within the preschool years. The 9-year-old achieved 90% accuracy and the 16-year-old and the 40-year-old achieved 40% accuracy. The CELF subtest is a standardized test that requires the participant to select which one of four pictures bests represents the syntactic structures used in a sentence spoken by the examiner. The 9-year-old and the 40-year-old exhibited age-appropriate knowledge of the syntactic structures assessed. The 16-year-old, however, exhibited poor knowledge of these structures.

Bishop et al. (1990) conducted a similar study that involved the administration of a standardized test comparable in format to the CELF subtest. The Test for Reception of Grammar (TROG, Bishop, 1983) was administered to 24 young adults who had cerebral palsy and severe speech impairments and to 24 control participants matched for chronological age and IQ who also had cerebral palsy but who had no coexisting speech difficulties. There was no significant difference between the two groups in terms of their understanding of grammatical structures. Both groups performed well below age level. Their scores converted to a mean age equivalence of 8 years which was consistent with the mean age equivalence they obtained for IQ on Raven's Progressive Matrices (Raven, 1967). There was a wide range of scores, however, with some participants in both groups exhibiting age-appropriate language skills.

In a more recent study (Redmond & Johnston, 2001), grammaticality judgment tasks were administered to four young adults with CCN to examine the sensitivity of these individuals to various morphological errors. These errors included aspect-marking errors (e.g., *you are open the box*), agreement violations (e.g., *she am throwing the ball*), and tense-marking errors involving regular (e.g., *she pull out a toothpick*) and irregular verbs (e.g., *he catched it*). In order to validate the experimental protocol, the tasks were first administered to three groups of individuals with no disabilities: 11 children aged 4-6 years, 13 children aged 7-10 years, and 21 adults. A clear developmental trend was identified with higher levels of linguistic sensitivity being associated with higher levels of linguistic maturation. The performance of the four young adults with CCN was then compared to the performance of four of the participants with no disabilities who were matched according to vocabulary age.

All of the participants accurately detected most aspect-marking errors, agreement violations, and tense-marking errors involving irregular verbs. The children with CCN, however, demonstrated difficulty with the detection of tense-marking errors involving regular verbs. The findings of this study suggest that individuals with CCN may not exhibit generalized limitations in their morphological competence. Instead, they may develop limitations that are specific to certain morphemes and to particular areas of morphological knowledge.

Kelford Smith et al. (1989) analyzed the written language skills of individuals with CCN. The written output produced by six young adults at home over a four-week period was collected for analysis. A number of summary measures were calculated to describe the syntactic and morphological complexity of the writing samples including: (a) total number of words, (b) frequency and accuracy of grammatical morphemes, (c) total number of sentences, and (d) types of sentences.

The mean total words produced ranged from 32 to 330 words and the mean total sentences produced ranged from 2 to 21 sentences. The accuracy of morpheme usage was relatively high (80-96%); nevertheless, the participants did exhibit some difficulty with the use of morphological endings, functors, and auxiliary verbs. All of the participants used simple, compound, and complex sentence structures. Two of the participants however, primarily used simple sentence structures. Accuracy in sentence formulation ranged from 56-100%. Compound sentences were the participants' main source of difficulty. The participants tended to make the mistake of including separate and independent ideas within the same sentence.

The studies reviewed in this section have generated findings that challenge the explanations proposed in the compensation hypothesis. The findings of one study (Sutton & Gallagher, 1993) suggest that the idea that individuals with CCN frequently omit syntactic and morphological structures because these structures are unavailable in their AAC systems may be far too simplistic. It appears that having restricted access to the full range of language structures may not simply prevent these individuals from being able to access these structures. Instead, as suggested by the deficit hypothesis, the impact may be much more severe. Long-term linguistic constraints may actually prevent individuals with CCN from becoming aware of these structures and/or from truly understanding their use. The findings of the other studies (Berninger & Gans, 1996; Bishop et al., 1990; Blockberger & Johnston, 2003; Kelford-Smith et al., 1989) suggest that the explanation that individuals with CCN consciously omit syntactic and morphological structures in order to increase the efficiency of their expressive communication may also be inadequate. Many of the individuals who participated in these studies exhibited poor performance on tests which assessed their receptive language skills and written language abilities. This indicates that many individuals with CCN may not be purposefully omitting syntactic and morphological structures. In actual fact, they may be unintentionally omitting them because of underlying deficits in their language skills.

Investigating the modality-specific hypothesis.

To date, five studies have explored the feasibility of the third theoretical model, the modality-specific hypothesis. Smith (1996) conducted the first study of this type. Smith compared the language that children with no disabilities produced in the spoken modality with the language that they produced in the visual graphic modality. Studying children who were typically developing enabled Smith to separate out modality-specific influences from other potential influences such as those relating to language skills, and physical and lexical access problems. Five children were taught to use picture communication symbol (PCS) displays to communicate with a puppet. The children were told that the puppet was unable to hear. The children attended one 60-90 minute group session per week for a total of 10 weeks. Progress was evaluated using a referential communication task that required the children to describe pictures using their symbol displays.

The youngest child (3;5 years) had significant difficulty understanding that the task required her to use the symbol display to communicate with the puppet. Instead, she engaged in extensive symbol labeling. The symbol utterances produced by the other four children were reduced relative to their spoken output. Their symbol utterances were initially analyzed according to speaker-listener boundaries which revealed that 83% of their utterances were single-picture points. The children's utterances were then reanalyzed according to vertical sequences whereby the children's single-picture points and the examiner's verbal confirmations were considered to represent a single proposition. This analysis revealed that 49% of their utterances were still single-picture points. It was also evident that within these vertical sequences, linear word order constraints were frequently violated. The fact that the utterances that the children produced using symbol displays were reduced and syntactically different from the utterances that they produced in their spoken language suggests that AAC communication is not a direct translation from spoken language. The existence of disparities between the two modalities provides evidence to support the theory that variables relating to communication in the visual graphic modality may influence the language produced by individuals with CCN.

A cross-cultural study (Nakamura et al., 1998) conducted with 80 Japanese-speaking and 43 English-speaking university students also examined the language that individuals with no disabilities produced in the spoken modality and compared it with the language that they produced using AAC. The students in this study were asked to listen to a story and then to respond to questions by pointing to symbols on a touch screen interface. They were then asked to respond to the same set of questions using their natural speech. All of the students were exposed to one of two conditions: (a) a symbol home page organized according to English subject-verb-object (SVO) order, or (b) a symbol home page organized according to Japanese subject-object-verb (SOV) order. The Japanese speakers were exposed to one of two additional conditions: (a) access to morphological markers, or (b) no access to morphological markers.

Both the English speakers and the Japanese speakers omitted words when they communicated using symbols. The Japanese speakers' symbol utterances more closely resembled their spoken utterances when they had access to morphological markers. When the Japanese speakers did not have access to morphological markers, the SVO symbol home page led to the use of English word order 14% of the time, even though the speakers never used English word order in their natural speech or when they had access to morphological markers. In contrast, the English speakers never used Japanese word order, even when they communicated using the SOV symbol home page. Across all of the conditions, the Japanese-speaking students and the English-speaking students used a number of utterances that failed to reflect either English or Japanese word order.

The finding that the students tended to use fewer words in their symbol utterances and the finding that many of the students' symbol utterances featured word orders that failed to correspond to those used in their spoken language provide support for the modality-specific hypothesis. However, the finding that the Japanese speakers used more words when they were provided with access to morphological markers suggests that the differences observed in the language produced by individuals with CCN may also be partially explained by the compensation hypothesis. Language produced using AAC may appear reduced or telegraphic when individuals with CCN have restricted access to syntactic and morphological structures.

Sutton and Morford (1998) extended Nakamura et al.'s (1998) study by conducting a more detailed analysis of the word orders used in AAC communication. In this study, 32 children with no disabilities were asked to watch a video clip and then to describe what they saw using a PCS communication board. After completing this task, the children were asked to watch the video clip again and then to describe what they saw using their natural speech.

English word order was used more consistently in the spoken modality than it was in the visual graphic modality, and it was used more consistently by older children than it was by younger children. Although all of the children had mastered SVO word order in their spoken English, this knowledge did not automatically translate into their AAC communication. Instead, the younger children most frequently produced single verbs and the older children most frequently produced OV sequences. At all ages, the children produced more verbs and objects, than subjects. Interestingly, subject omission and OV ordering are both characteristics of other languages conducted in the visual modality, for example, American Sign Language. The findings of this study suggest that there may be a developmental progression in word ordering in AAC communication with the production of OV sequences serving as a transitional step between the production of single-picture points and the production of full SVO sentence structures.

Sutton and colleagues conducted two additional studies that examined word order effects in AAC. The first study included 43 adults with no disabilities (Sutton et al., 2000) and the second study (Sutton et al., 2004) included 25 adults with CCN. In both studies, the participants were presented with a series of subject and object relative clause sentence pairs (e.g., *The girl who pushes the clown wears a hat* and *The girl pushes the clown who wears the hat*) accompanied by photographs. The participants were asked to reproduce sentences by pointing to PCS symbols on a Macaw III (Zygo Industries, Inc) communication device. The PCS symbols did not include any grammatical markers so placement of the relative pronoun *who*, could not be marked. The second study (Sutton et al., 2004) also included an interpretation task. For this task, the examiner used the PCS symbols to construct a series of subject and object relative clause sentence pairs. The participants were asked to choose one photograph from an array of two that best depicted the symbol utterance. Since the PCS symbols did not include the relative pronoun *who*, both the subject sentences and the object sentences were identical.

In Sutton et al.'s (2000) study, 36 out of the 43 adults with no disabilities made some kind of distinction between subject and object sentences. The participants tended to use English word order when they were producing object sentences (e.g., GIRL, PUSH, CLOWN, HAT), and non-English word order when they were producing subject sentences (e.g., GIRL, HAT, PUSH, CLOWN). Most of the participants used a proximity strategy to convey the distinction between the two sentence types. When they were producing subject sentences, they altered the word order by moving the attribute (e.g., HAT in the example above) closer to the first noun.

In Sutton et al.'s (2004) study, only six of the 25 adults with CCN distinguished between subject and object sentences greater than 75% of the time. These six participants typically employed the constituent proximity strategy to convey the distinction between the two sentence types. Overall, the participants used 18 different word orders. The most frequently occurring word order (75%) was the word order that most closely adhered to conventional English. The participants who failed to distinguish between subject and object sentences typically used the same word order for both sentences and then associated this word order with a single interpretation (10 chose the subject sentence interpretation and 2 chose the object sentence interpretation). This finding indicated that the participants understood that a distinction existed between the two sentence types, but that they were unable to mark the distinction in their own symbol productions. The performance patterns of the participants in this study were extremely heterogeneous. The researchers observed that there was much more variability in this population than was evident in the population of individuals with no disabilities (Sutton et al., 2000).

The studies reviewed in this section have provided support for the modality-specific hypothesis. The studies' findings suggest that when individuals with no disabilities construct utterances in AAC, they do not directly translate from spoken language into the visual graphic modality. The utterances that these individuals produce using AAC differ from the utterances that they produce using spoken language in that they tend to be shorter in length and they often do not reflect conventional English word order. Instead, it appears that individuals with no disabilities may construct utterances in AAC by adhering to linguistic patterns that are unique to the visual graphic modality. To date, only one study (Sutton et al., 2004) has examined whether the patterns observed in individuals with no disabilities can also be observed in individuals with CCN. The findings of this study suggest that there may be wide syntactic variation in the utterances produced by individuals with CCN. Additional research is required to explore possible explanations for this interindividual variability.

Intervention studies.

Two studies have explored the effectiveness of intervention programs that were developed to teach syntactic or morphological skills to individuals with CCN. The first study (Harris et al., 1996) investigated the impact of an intervention program that was designed to teach a child with developmental apraxia of speech who primarily communicated using pre-stored whole messages, to segment and combine grammatical constituents. The goal of the intervention was "*not* to replace the highly efficient conversational system offered by single message coding strategies, but rather to promote literacy skills and to provide options for more sophisticated, versatile communication in selected situations" (p. 240).

A multiple baseline design across contexts (storybook reading, structured discourse) was used to monitor the child's progress. The child attended 22 45-minute sessions over a four-month period. The intervention had four goal levels with each of the levels requiring the child to construct more of the verbal turn. The child's percentage of correct constituents score increased substantially during intervention. However, the magnitude of the treatment effect and the degree of generalization were greater in the storybook reading context than in the structured discourse context. The researchers hypothesized that the storybook reading context provided more segmentation cues. The syntax, vocabulary, and prosodic patterns present in the storybook reading context were more predictable than those present in the structured discourse context.

The second intervention study (Lund and Light, 2003) examined the efficacy of a direct instruction program that was designed to teach the correct use of specific syntactic structures to two adults with CCN. Prior to intervention, both of the participants omitted and/or made errors with various syntactic and morphological structures in both their face-to-face and written communication. Reportedly this decreased others' perceptions of their communicative competence and negatively impacted on their ability to obtain employment. Conversational language samples were obtained from the participants and two syntactic structures were identified as targets for intervention. The targets were selected based on the following criteria: (a) the frequency of the error, (b) the frequency of the syntactic structure, (c) the degree of deviance from the accepted form, and (d) the impact that the error had on the individual's perceived communicative competence. The targets identified for the female participant were the use of correct word order in adjective phrases and the inversion of the auxiliary *did* in wh-questions. The targets identified for the male participant were the use of possessive pronouns and the inclusion of *to* when using infinitives as modal verbs.

Progress was evaluated using a multiple baseline design across behaviors. Both participants learned to produce the target syntactic structures. To achieve the criterion of 90% accuracy on two consecutive probes, the female participant required 52 hours of intervention and the male participant required 20 hours of intervention. The male participant maintained performance at 100% accuracy for two months following intervention, however, the female participant's performance dropped below 80% accuracy. Following the provision of booster sessions, the female participant was able to maintain at least 85% accuracy.

While limited in their scope, these two intervention studies suggest that individuals with CCN can learn to segment and combine grammatical constituents, and can learn to use specific syntactic forms. Future research should serve to replicate these studies with individuals of varying ages and disabilities. Furthermore, future research should endeavor to expand on these studies by incorporating other syntactic and morphological targets, and by comparing the efficacy of alternative instructional methods.

Summary: Research Examining Syntax and Morphology in Individuals with Complex Communication Needs

It is evident from reviewing the studies presented in this section, that individuals with CCN frequently exhibit deficits in their syntactic and morphological knowledge. These individuals tend to produce sentence structures that are short in length, and that are characterized by atypical word order and limited use of structure words and morphological markers. The review of the literature also reveals that there is no simple explanation for the deficits observed. It seems possible that underlying language deficits, compensatory strategies, and modality influences may all impact on language production. Furthermore, it seems likely that a fourth theoretical model, that reflects the interaction of the constructs in the existing three hypotheses may be required to capture the complexity of language produced using AAC. The current study will help the AAC field to understand whether additional constructs, similar to those found in models of written language development, need to be added as a fourth model in order to truly reflect language learning in children with CCN.

The Language of Beginning Writers

Acquiring an increased understanding of the written language used by typically developing children in the beginning stages of writing development may assist AAC professionals to provide children with CCN with access to more appropriate language in their face-to-face communication systems. At present, the primary source of information that AAC professionals reference when planning vocabulary sets and language representation systems for children with CCN are the findings obtained in studies that have examined the spoken language development of typically developing children. However, many of the cognitive, memory, and physical challenges that characterize the process of learning to write are similar to those that characterize the process of learning to communicate using AAC. Therefore, beginning writing development may provide a more accurate reference point than spoken language development for decision-making in AAC. The following section will provide a review of what researchers outside the field of AAC have already discovered about the language of beginning writers. First, two theoretical models of writing development will be presented. Then, research addressing the semantics/vocabulary of beginning writers, and the syntax and morphology of beginning writers will be described and discussed.

Theoretical Models of Written Language Development

Only a few theoretical models have been put forth in the literature that have attempted to describe the process of writing development in children, and unfortunately those that have been put forth have not yet been sufficiently tested by research. Nevertheless, two models have been proposed that do offer some useful insight into the manner in which the acquisition of written language appears to unfold (Singer, 1995). Kroll (1981) presented a four-stage model that explores the relationship between speaking and writing and how the relationship changes over time. Bereiter (1980) presented a five-stage model that examines the cognitive processes and writing skills that are needed at different stages of writing development.

Before describing the two models in detail, it should be noted that both Kroll (1981) and Bereiter (1980) acknowledged the various weaknesses inherent in stage models of development. Kroll stated that these models can oversimplify development "by making it appear to be unidimensional and strictly linear" (p. 40). Stage models may fail to reflect the considerable variation that exists in the age at which a child enters a stage and in the amount of time that a child takes to progress through a stage. Bereiter cautioned that stages are not necessarily universal and that children may not proceed through them in one particular order. Despite these limitations, stage models are still valuable. Kroll stated that "a general theoretical model is often useful precisely because it does oversimplify. A model's purpose is to enable one to see the broad outlines of development, those generalized phases that might be overlooked when focusing on the complexity of individual details" (p. 40).

Kroll's Developmental Model

Kroll's (1981) model is based on the premise that speaking and writing are both components of a child's productive language system and that these components move through four relationships: separate, consolidated, differentiated, and integrated, with each relationship signaling a different stage in development. The first stage of development in Kroll's model is the *preparation* stage. At this stage, speaking and writing are relatively separate processes. Children have well-developed spoken language skills but their written language abilities are generally extremely limited. Their cognitive energies are focused on learning the technical skills of handwriting and spelling. Children are typically at this stage when they enter school. The second stage is characterized by the *consolidation* of spoken and written language skills. Children learn to support their written language development by drawing on their spoken language resources. Spoken language and written language become increasingly integrated to the degree that children's writing often appears as though its spoken language written down (Kroll, 1981). Children move into this stage when they are approximately six or seven years of age (Perera, 1984).

Once children's spoken and written language skills have become relatively consolidated, the process of *differentiation* begins. During this stage, children become aware of the important differences that exist between written texts and spoken utterances. They learn that spoken utterances are usually casual and context-dependent, whilst written texts tend to be more formal and explicit. They discover that "writing serves different purposes, employs different forms, and has certain advantages over speaking" (Kroll, 1981, p. 50). Children are approximately 9 or 10 years of age when they enter this stage (Perera, 1984). The fourth and final stage involves the *systematic integration* of spoken and written language. At this stage, speaking and writing are both differentiated and systematically integrated. Children are able to talk 'writing' and write 'talking'. They can respond to a variety of contexts, audiences, and communicative purposes by applying the structures and styles from either modality. In addition, writing becomes a tool that aids in the discovery of thought. Children who reach this stage are regarded as mature writers (Kroll, 1981). However, some children, and even some adults, may never achieve the flexibility of language use that characterizes this advanced stage of written language development (Perera, 1984).

Bereiter's Writing Development Stages

Bereiter's (1980) model is based on theories relating to children's information-processing capacity limitations. Writing is a difficult and demanding process that requires a large number of skills to be juggled simultaneously. "To pay conscious attention to handwriting, spelling, punctuation, word choice, syntax, textual connections, purpose, organization, clarity, rhythm, euphony, and reader characteristics would seemingly overload the information processing capacity of the best intellects" (Scardamalia, 1981, p.81). Mature writers are able to manage such a complex process because they have highly automated and coordinated written language skills. For these individuals, some skills require little, if any, conscious attention. Other skills do require attention; however, mature writers have sufficient attention and working memory capacity that they are able to engage in efficient time-sharing. This means that they can successfully divide their attention across a variety of tasks without experiencing any instances of interference or lapses in attention (Bereiter, 1980).

Not surprisingly, beginning writers are unable to juggle all of the skills that are needed to achieve mature writing performance. Many written language skills are new to beginning writers and are therefore neither automated nor coordinated. In order to get started with writing, beginning writers employ a system that is structurally less complex and that is not so reliant on high levels of simultaneous and coordinated functioning. Since getting words on to paper is necessary for writing to even occur, the system initially places more emphasis on lower-level skills such as handwriting and spelling, than it does on higher-level skills such as planning and content generation. The system increases in complexity and places more emphasis on higher-level skills, as lower-level skills become progressively more automated (Bereiter, 1980).

According to Bereiter, the earliest stage of writing development is characterized by *associative writing*. At this stage, children's written language systems are focused on achieving fluency in the production of written language and in the generation of ideas. Children write "whatever comes to mind in the order in which it comes to mind" (Bereiter, 1980, p. 83). Writing produced during this stage may seem more similar to free-flowing and unplanned speech, than it does to literate writing. Much of the writing seen in the early school years is associative writing. The second stage in Bereiter's model is *performative writing*. At this stage, children's written language systems become more complex as associative writing is integrated with knowledge of stylistic writing conventions (e.g., spelling, punctuation, and the use or avoidance of particular language forms). Children learn to attend to both language content and language form. For many children this is not an easy endeavor. Until the application of writing conventions becomes automatic, many children are overly concerned about the correctness of their writing. Unfortunately, this concern tends to disrupt the flow of writing which leads them to forget their ideas and plans (Bereiter, 1980). Performative writing is often observed in the later elementary and junior high school grades (Singer, 1995).

Bereiter's (1980) third stage of development is *communicative writing*. Communicative writing occurs when children's written language systems integrate performative writing with social cognition. Prior to this stage, children have been unable to take the reader's perspective into consideration when they write. This is not because they have had deficits in social awareness, but more because, up until this point, they have been unable to integrate social cognition with all of the other demands inherent in the writing process (Bereiter, 1980). Children who produce communicative writing are able to create written products that are “calculated to have a desired effect on an audience” (Bereiter, 1980, p. 86). This ability usually does not emerge until the high school years (Singer, 1995). The next stage of writing development is *unified writing*. Unified writing is characterized by the ability to take into consideration not only the audience’s perspective, but also the writer’s own perspective. The writer’s evaluative reading skills become integrated with their writing abilities enabling them to appraise their own work. It is at this stage that the process of writing becomes more of a craft and less of a skill. Writers start to develop their own style and point of view (Bereiter, 1980). Unified writing typically emerges in the late high school and post high school years (Singer, 1995).

The last stage in Bereiter’s (1980) model is *epistemic* writing. At this stage, the written language system reaches its most advanced level of complexity with unified writing becoming integrated with reflective thought. When this stage is reached, writing becomes much more than simply a means for transmitting thought. It also becomes a means for discovering and developing thought.

Summary: Theoretical Models of Written Language Development

The theoretical models proposed by Kroll (1980) and Bereiter (1981) were included in this review because they provide an overview of important milestones in written language development, and because they reveal parallels between the production of written language and the production of language using AAC. Kroll’s *preparation* and *consolidation* stages and Bereiter’s *associative writing* and *performative writing* stages are particularly relevant to children with CCN. For instance, both models suggest that when typically developing children are first learning to write, their cognitive energies are focused on figuring out how to translate the words that they want to communicate into written symbols on the printed page. This process is extremely similar to that observed in children with CCN when they are learning to use an AAC system. Both groups of children are trying to transform language that is inside their heads into abstract symbol systems. The symbol systems may vary since many children with CCN are trying to translate into picture symbols and not into letters or written text. However, the constraints involved in the learning process and the impact that these constraints have on the quality of the language that is produced are likely to be very similar.

Semantics and Vocabulary in Writing

Since the late 1800s, the study of vocabulary has interested professionals from fields such as education, textbook publishing, and psychology. A number of large-scale studies have been conducted which have typically addressed one of five central themes: (1) the connection between vocabulary and intelligence, (2) the development of word lists to guide spelling, (3) the expansion of vocabulary, (4) the determination of textbook readability, and (5) the relationship between vocabulary and reading comprehension (Johnson, 2000).

Unfortunately, limited research has been conducted to examine the relationship between vocabulary and writing. In a search of the literature, seven studies (Farr, Kelleher, Lee, & Beverstock, 1989; Fitzgerald, 1938; Hillerich, 1978 as cited in Graham, Harris, & Loynachan, 1993; Lorenz, 1931; Rinsland, 1945; Shapiro & Gunderson, 1988; Smith & Ingersoll, 1984) were identified that have analyzed the vocabulary used by children below the fourth grade level in their writing. Appendix A3 provides a summary of these studies including information about the participants that were involved, and the number and type of writing samples that were obtained.

All of the studies focused on the compilation of frequency-based word lists for a variety of purposes. Fitzgerald (1938), for example, created a word list of 692 high frequency words that were used in 1,256 letters that were written about life outside of school. More recently, Farr et al. (1989) collected a corpus of over three million words from more than 21,000 children’s writing samples. These samples were obtained from national and state-wide assessments of writing performance. The data from these samples were used to develop a variety of vocabulary lists.

Rinsland (1945) conducted the largest analysis of the vocabulary used in children’s writing. This researcher contacted the administrators of 1,500 elementary schools throughout the United States and requested children’s writing samples, including personal notes, stories, poems, compositions, exam papers, reports, and observations. A total of 708 schools responded. The writing samples produced a corpus of 6,012,359 words, written by just over 100,000 children. These words were hand tabulated, recorded on paper, entered in ledgers, and checked before being analyzed to determine the frequency of individual words used at each grade level. Rinsland identified 25,632 different words from the total corpus. Different words ranged from 5,099 in Grade one to 17,930 in Grade eight. Total words written ranged from 353,874 in Grade one to 1,088,343 in Grade eight. As would be expected, the older children wrote more words and used a greater quantity of different words than the younger children.

The Rinsland (1945) study has been described in detail to provide an indication of the types of studies that have been conducted to explore the relationship between writing and vocabulary. There are some key findings that have emerged from these studies and from other studies that have examined the spoken and reading vocabularies of typically developing children which have implications for research that seeks to inform the process of vocabulary selection for children with CCN:

1. Vocabulary lists based on typically developing children's writing samples are likely to be more representative of children's current experiences than those based on basal reading materials (Shapiro & Gunderson, 1988).
2. There is greater variability in the content words (nouns, verbs, adjectives, adverbs) that have been included in frequency-based vocabulary lists than there is in the structure (pronouns, articles, prepositions, auxiliaries, conjunctions) words that have been included (Reich & Reich, 1979).
3. Vocabulary lists based on written language are less variable than vocabulary lists based on spoken language (Reich & Reich, 1979).
4. The vocabulary that children choose to write or say is influenced by the manner in which it is collected. Some studies, for example, presented children with pictures, films, or stories to stimulate their thinking and to encourage their flow of spoken or written language (e.g., Farr et al., 1989; Murphy, 1957). Other studies (e.g., Reich & Reich, 1979) were as nondirective as possible in order to elicit vocabulary related to the children's own experiences. Reich & Reich (1979) found that when children were encouraged to talk about their own experiences, they used remarkably similar vocabulary. Common themes

included home, families, pets, games, learning activities in school, and field trips.

5. The findings from Reich & Reich's (1979) study suggested that vocabulary lists derived from spoken language may not differ significantly according to children's socioeconomic or ethnic backgrounds.

Together, these findings provide an important foundation for the current study as they support the practice of analyzing the vocabulary used by typically developing children for the purpose of informing vocabulary selection for children with CCN.

Syntax and Morphology in Writing

Studies have also been conducted that have explored the syntax and morphology that typically developing children use when they write. Some of these studies have compared the written language produced by typically developing children with that produced by children with language disorders, learning disabilities, and/or mental retardation (e.g., Gillam & Johnston, 1992; McFadden & Gillam, 1996; Scott & Windsor, 2000). Many of these studies have also examined differences between language produced in the spoken and written language modalities (e.g., Gillam & Johnston, 1992; Hidi & Hildyard, 1983; McFadden & Gillam, 1996; Scott & Windsor, 2000). Usually, these studies have employed tests of significant differences on various summary measures (e.g, total number of words, total number of t-units, t-unit length, clause length, total number of dependent clauses). Very few descriptive analyses have been employed that provide details regarding the actual content and form of children's writing samples. Most of these studies have been conducted with children above the third-grade level.

A review of the literature identified four large-scale studies (Bear, 1939; Hunt, 1964; Loban, 1976; O'Donnell, Griffin, & Norris, 1967) that have included more comprehensive analyses of the syntax and morphology used by typically developing children in their writing. These studies were all published prior to 1976. One of the major objectives of these studies was to find quantitative indexes of grammatical development that would be useful for informing educational decision-making (Scott, 1988). The Bear, Hunt, and O'Donnell et al., studies were cross-sectional. In contrast, the Loban study was longitudinal, carried out over a 13-year period. The Bear and Hunt studies focused only on written language, whereas the Loban and O'Donnell et al. study compared language produced in the spoken and written language modalities.

In Bear (1939), children in 1st through 8th-grade (n = 12,000) produced writing samples. In Hunt (1964), children in 4th through 8th-grade (n = 54) produced writing samples. Spoken language samples were obtained for the children in the O'Donnell et al. (1967) study who were in kindergarten through 7th-grade (n = 240), however, writing samples were only obtained for those who were in 3rd, 5th, and 7th grade (n = 90). In Loban (1976), spoken language samples were obtained when the children were in kindergarten through 12th-grade (n = 211). However, writing samples were only obtained after 2nd-grade.

The writing samples reflected a variety of different discourse contexts. The children in Bear (1939) were asked to write a story about "an interesting experience during the summer vacation" (p. 312). In contrast, the children in O'Donnell et al. (1967) were asked to write a story in response to a short film that was shown to them with the sound turned off. Loban (1976) and Hunt (1964) collected writing samples that were described as being typical of those that the children produced in school. The number of writing samples obtained from each participating child also varied across the studies. Bear and O'Donnell et al. collected one writing sample from each child, Loban collected one sample from each child per year, and Hunt collected multiple writing samples from each child, but only analyzed the first 1000 words.

The studies employed various units of analysis including t-unit length (Hunt, 1965; O'Donnell et al., 1967), c-unit length (Loban, 1976), clause length (Hunt, 1964), degree of subordination (Hunt, 1964; Loban, 1976), degree of elaboration (Loban, 1976), frequency of particular sentence types (e.g., simple, compound, complex) (Bear, 1939), and frequency of particular clause structures (e.g., subject-verb, subject-verb-object) (O'Donnell et al., 1967). All of the studies documented slow and steady syntactic growth across the age-span (Scott, 1988).

Only one study (Bear, 1939) examined the written language skills of children below the third-grade level. The findings of this study indicated that children used fewer simple sentence structures, and more compound and complex sentence structures as they advanced through the grade levels. For instance, in 1st-grade, the percentage of children who used one or more compound sentence structures was 7.1%. In 2nd-grade, this percentage increased to 15.5%, and in 3rd-grade, it increased to 26.9%. Similarly, in 1st-grade, the percentage of children who used one or more complex sentence structures was 6.2%. This percentage increased to 20.7% in 2nd-grade and 48.3% in 3rd-grade.

The two studies (Loban, 1976; O'Donnell et al., 1967) that compared the language produced in the spoken and written language modalities generated support for Kroll (1981) and Bereiter's (1980) theories of writing development. In the earlier grades, children's written compositions were syntactically less complex than their spoken compositions. In the later grades, however, this trend reversed and children's written compositions became more advanced than their spoken compositions. In Loban's study (1976), the time when this crossover occurred differed depending on children's levels of spoken language ability. Loban studied three groups of children: a group of children who were rated as being high in spoken language ability, a group of children who were rated as being low in spoken language ability, and a group of children who were randomly selected to represent the total group. When the elaboration index was used as the unit of analysis, the crossover periods for the three groups were: between 3rd and 4th-grade for the high achieving group, between 6th and 7th-grade for the randomly selected group, and between 7th and 8th-grade for the low achieving group.

Summary: The Language of Beginning Writers

This section has provided an overview of existing literature that has explored issues relating to language development in beginning writers. Two theoretical models (Bereiter, 1980; Kroll, 1981) were described and their implications for children with CCN were discussed. In addition, the findings from a number of studies that have examined the written language skills of beginning writers were reviewed. It is evident from examining the literature that additional studies that examine age-related differences in the vocabulary/semantics, and the syntax and morphology of beginning writers are required. Many studies conducted to date were carried out more than 30 years ago. Since this time, writing instructional practices and the expectations that educators and parents have for children have undoubtedly changed. Another limitation of the existing research is that only one study (Bear, 1939) has included children below the 3rd-grade level. In at least one of the studies, the reason for this was a concern that children in or below 3rd-grade “may jabber away with ease, fluency and exuberance”, but most will “write only under considerable duress” (Hunt, 1964, p. 4). However, it is the written language used by children in the earlier grades that may be most relevant to children with CCN. Two additional concerns in the existing research are that very few studies have examined patterns of syntax below the clause level, very few studies have collected writing samples about self-selected topics, and no studies have compared the written language generated by children in different countries. All of these limitations were taken into consideration and addressed in the current investigation.

Vocabulary Selection and Language Representation for Children with Complex Communication Needs

Over the past twenty years significant advances have been made in the AAC technologies that are available to children with CCN. Many children now have access to systems that are considered to be far superior to their predecessors. These systems have greater memory capacity, they produce more intelligible voice output, and they are able to interface with a variety of mainstream technologies including the internet. Despite these advances, some problems that have faced the AAC field since its inception continue to challenge clinicians. One of the greatest challenges is identifying the most effective method for selecting vocabulary and representing vocabulary on a child’s AAC system. In the sections that follow, these issues will be reviewed in detail. Vocabulary selection and language representation are at the heart of effective AAC use. They have a direct influence on children with CCN's communicative competence and their acquisition of language skills.

Vocabulary Selection

Vocabulary selection is a challenging process that necessitates a comprehensive understanding of the individual child and his or her changing and evolving language needs (Marvin et al., 1994). The vocabulary selected for a child must meet numerous criteria. It must be "reinforcing and dynamic, responsive and functional, meeting today's needs and tomorrow's goals" (Fried-Oken & More, 1992, p. 52). It must also be appropriate to the individual child's gender, background, and personality (Light, 1988).

Sources of Information for Vocabulary Selection

To date, vocabulary selection for children with CCN has largely been "a trial and error process based primarily on clinical experience and intuition" (Fried-Oken & More, 1992, p. 41). This is reflected in the AAC literature which includes a strong clinical component with a limited number of research studies (Beukelman, McGinnis, & Morrow, 1991). The vocabulary selection process is typically reliant on four sources of information: formal environmental inventories, recommended vocabularies for children with language disabilities, knowledge about language acquisition in typically developing children, and preselected vocabularies from electronic AAC systems and symbol sets. These extant vocabulary sources will be discussed below.

Formal environmental inventories.

Various researchers and clinicians (e.g., Carlson, 1981; Mirenda, 1985) have advocated for the use of a formal environmental inventory to guide the vocabulary selection process. Conducting a formal environmental inventory involves surveying the major settings and activities that a child needs to communicate within and generating a pool of important vocabulary words. From this pool of vocabulary words, appropriate target words are selected beginning with words which are at or below the child’s current developmental and interest levels. These words are then arranged in a system for the child to use to communicate. The remaining words are set aside for future use (Carlson, 1981).

Suggested vocabularies for children with language disabilities.

Recommendations developed to guide the vocabulary selection process used in developing the oral language for populations of children with language disabilities are also considered to be useful sources of information when selecting vocabulary for children with CCN. Holland (1975), for example, presented vocabulary selection guidelines and developed a sample core vocabulary of 35 words to use when teaching spoken language to children with language impairments. Holland’s guidelines were as follows: (1) use child language as a model; (2) incorporate events that are important to the child; (3) promote active and dynamic communicative interactions; and (4) focus on objects and events that are relevant to the here and now. These same four steps are useful in selecting vocabulary for use by children with CCN in their communication via AAC.

Language acquisition principles.

Understanding the processes underlying language acquisition for typically developing children is critically important during the vocabulary selection process. Knowing the order in which typically developing children acquire different language forms and the types and number of words that children use at different developmental stages helps to guide clinicians in determining which vocabulary should be included in children's AAC systems (Fried-Oken & More, 1992).

A major area of focus in the AAC literature has been the compilation of frequency-based word lists. These word lists are intended to support vocabulary selection. A number of researchers have created word lists based on studies that have documented the frequency of vocabulary used by typically developing children in home and preschool/school settings (Ball, Marvin, Beukelman, Lasker, & Rupp, 1999; Banajee, Dicarlo, & Stricklin, 2003; Beukelman et al., 1989; Fallon, Light, & Paige, 2001; Fried-Oken & More, 1992; Marvin et al., 1994; McGinnis & Beukelman, 1989).

Preselected vocabularies from augmentative and alternative communication systems.

Some electronic AAC systems and symbol sets include preselected vocabularies. Unfortunately, the selection procedures underlying many of these vocabularies have not been documented and/or have not been grounded in any empirically based research (Fried-Oken & More, 1992). Two notable exceptions are the Gateway language program and the Unity language program. Reportedly, the developers of both of these programs have selected vocabulary by taking into consideration the findings of research that has examined the vocabulary use patterns of typically developing children (Bruno, 2006; Prentke Romich Company, 2006). The developer of the Gateway language program has also selected vocabulary based on three additional criteria: syntactic complexity, social interaction needs, and academic needs (Bruno, 2006). Clinicians who choose one of the preselected vocabularies to use with a child with CCN often modify the set by adding and removing vocabulary, but the vast majority of the vocabulary available to a child with CCN was selected by a developer who had no knowledge of the individual child.

Summary: Sources of information for vocabulary selection.

No matter which system of vocabulary selection is employed, children with CCN face the challenge of meeting their communication needs using vocabulary that was selected for them. The methods reviewed here represent the four most frequently employed forms of vocabulary selection. However, the use of typically developing children's language samples is the only method that has been the focus of research. Furthermore, only one of the studies that have examined typically developing children's language samples have focused on children's written language. The current investigation of written language samples provides additional research-based information to support the process of vocabulary selection. This information will assist clinicians, and the children and families they serve.

Research: Vocabulary Selection for Children with Complex Communication Needs

A comprehensive search of the literature identified eight studies that were conducted to inform the process of vocabulary selection for children with CCN. All of these studies have examined the vocabulary use patterns of typically developing children. In the first of these studies (Beukelman et al., 1989), the spoken language samples of six children aged between 3;8 and 4;9 years were audiotaped and transcribed. The children attended one of three preschool classrooms and were described by their teachers as being active verbal participants. Language samples of approximately 3,000 words were obtained for each child in the classroom setting. The samples ranged from 2 to 7 hours in length and were analyzed in individual and composite form.

The number of different words that the children used ranged from 404 to 468 words. Across the 12 samples, 250 words occurred at least five times per 1,000 words. Additional analyses revealed that 45% of the composite sample could be accounted for by the 25 most frequently occurring words, 60% by the 50 most frequently occurring words, and 85% by the 250 most frequently occurring words. Therefore, a significant portion of the composite sample could be represented by a relatively small set of words.

The commonality (consistency) with which the six children used the 250 most frequently occurring words was also examined. The mean commonality score for the 25 most frequently occurring words was 6 indicating that all of the children used these words. The commonality score reduced with each set of 25 words until it reached a mean score of 3.68 for the 225th through the 250th set (Beukelman et al., 1989).

Marvin et al. (1994) expanded on the design used in Beukelman et al.'s (1989) study. These researchers examined the effects of time and context sampling on the vocabulary-use patterns of two groups of preschool children. Group A consisted of five children aged 4;5 to 5;2 years and Group B consisted of five children aged 4;0 to

4;10 years. The children in Group A attended one of two preschools and the children in Group B attended a third preschool. Prior to the commencement of the study, the children's teachers were asked to rank the children in their preschool programs according to their degree of talkativeness. Only those children who were ranked in the middle of the range were invited to participate in the study. Language samples representing 2.5 to 3.5 hours of continuous time were obtained for both groups of children in the home and preschool settings. For the children in group A, there was a delay of up to two weeks between collection of the preschool sample and collection of the home sample. For the children in group B, the two samples were collected on the same day. As was the case in Beukelman et al.'s (1989) study, the samples were analyzed individually and in composite form.

Type-token ratios (TTRs) were calculated to examine the amount of lexical diversity (proportion of different words to total words) evident in the children's language samples. The results of the analysis indicated that the children's vocabulary-use patterns were similar across settings and time spans. For instance, there was only a small (.01 to .02) difference in the mean TTRs obtained in the home and preschool contexts for both groups of children (Marvin et al. 1994).

The frequency of occurrence of individual words and the commonality of vocabulary-use across the home and school contexts were also calculated. The word frequency analysis found that the 250 most frequently occurring words accounted for the majority (approximately 80%) of the words expressed in both contexts. The commonality analysis revealed that approximately one third of the different words used were produced at home only, one third were produced at preschool only, and one third were produced across both contexts. The commonality scores were higher for Group B. The researchers speculated that this was because the children in Group B's language samples were obtained on the same day which meant that the likelihood of shared vocabulary was increased (Marvin et al., 1999).

The final analysis examined the proportion of content (e.g., nouns, verbs, adverbs, adjectives) and structure (e.g., pronouns, conjunctions, prepositions, auxiliary verbs) words used in each context. The results suggested that structure words made up less than 2% of the words that were unique to the home or preschool contexts. However, structure words were found to comprise 21 to 22% of the vocabulary that was shared across both contexts (Marvin et al., 1994).

A second study (Banajee et al., 2003) also examined the impact of context on children's vocabulary use patterns. In this study, language samples were collected on three separate days from 50 preschoolers (24-36 months) as they engaged in two different types of activities within the preschool setting: free-play across five different interest centers (e.g., blocks, dramatic play, art) and snack time.

Nine words were identified that were used during both free-play and snack time on all three days. These words were: *I*, *no*, *yes/yeah*, *want*, *it*, *that*, *my*, *you*, *and more*. Additional analyses identified that the TTRs obtained during snack time were slightly lower than those obtained during free-play. This difference was attributed to the fact that the snack time activity was adult-directed whereas the free play activity was child-directed. The vocabulary that the children used was found to serve a variety of different syntactic, semantic, and pragmatic functions. One notable finding was that none of the words that were assigned high commonality scores were nouns.

Ball et al. (1999) investigated the use of generic talk, a specific type of vocabulary. Generic talk, sometimes referred to as small talk, is a critical component of conversational interactions as it provides “a means of communicating successfully in socially prescribed ways” (Ball et al., 1999, p. 46). It is particularly important for the maintenance of social closeness and social etiquette (Ball et al., 1999). Ball et al. (1999) defined generic talk as an independent utterance that requires the communication partner to have little or no previous knowledge about the individual speaker or the cognitive or communicative content of the conversation, in order to be understood. Generic talk utterances were classified into eight different categories: confirmation and negation, comments, environmental control, continuers, expletives/exclamations, conversational openers and closings, information sharing, and social etiquette. The language samples analyzed in Ball et al’s study were the same as those analyzed in Marvin et al.’s (1994) study.

Almost one half (48%) of the children’s utterances were classified as generic talk. Most of the generic talk utterances were categorized as either: confirmation/negation (26%), comments (22%), environmental control (18%), or continuers (17%). There were no statistically significant differences between the frequencies and types of generic talk used in the home and school settings (Ball et al., 1999). The children exhibited a higher percentage of generic talk than the percentages previously observed in adult (21%) samples (King, Spoeneman, Stuart, & Beukelman, 1995). The children also differed significantly from adults in that they used a greater proportion of environmental control utterances (Lasker, Ball, Beukelman, Stuart, & Marvin, 1996).

All of the studies reviewed thus far have focused on the generation of word lists based on spoken language samples obtained from typically developing children. The three remaining studies have incorporated different methods. In the first of these studies (Fried-Oken & More, 1992) a word list for 3 to 6-year-old children was developed based on three sources: (a) word lists generated by the parents and clinicians (speech language pathologists or special education teachers) of 15 children with CCN, (b) language samples collected from 30 typically developing peers matched to the children with CCN according to age and gender, and (c) word lists generated by the parents of the typically developing children. The parents of the children with CCN were asked to “list the 110 most important single words that their child would say if he/she could talk” (p. 43). In contrast, the parents of the typically developing children were asked to “listen to their child for a few days and then to write down the 110 words that the child used most often” (p. 47). Only the first 100 unique words that the parents recorded were used in the analyses.

A total of 90 word lists were generated producing a database of 36,000 words. The database included 2,114 unique words. No one word appeared on every word list. In fact, 60% of the words appeared on fewer than three word lists. Ninety-four percent of the words were repeated in at least one other source. The most common word *mom* appeared on 85 of the 90 word lists. Only 46 words were common to half of the vocabulary sources (Fried-Oken & More, 1992)

When the word lists generated by the parents and clinicians of children with CCN were compared, only 38 words appeared on at least 50% of the parent lists *and* on at least 50% of the clinician lists. These common 38 words accounted for 7%

of the unique word types in either list. In the typically developing children's language samples, only 1,600 unique word types were required to represent the total sample of 30,000 words. Comparisons between the adult-generated word lists and the language samples obtained from the typically developing children revealed significant incongruity. The researchers attributed the lack of agreement to the significant variability that occurred across the parent-generated word lists.

Fallon et al. (2001) also investigated a multifaceted approach to vocabulary selection. First, language samples were obtained from five typically developing children aged 3;9 to 4;9 years. The samples were analyzed and a word list was generated based on the 250 most frequently occurring words. The words in the word list were organized into 24 different semantic-syntactic categories (e.g., animals, furniture, conjunctions, people's names). Second, a comprehensive vocabulary selection questionnaire was developed, implemented, and evaluated. The questionnaire was organized using a categorical framework. Informants were required to complete word checklists and to respond to open-ended questions. The final section of the questionnaire consisted of a blank sheet that provided the informants with the opportunity to add any vocabulary that had not been covered in previous sections. The questionnaire was sent to 15 teams consisting of a speech-language pathologist, a parent, and a teacher. Each team was asked to complete the questionnaire for a target preschooler with CCN. The preschoolers ranged in age from 1 to 6 years.

The typically developing children's language samples were 1000 words in length providing a combined total of 5000 words. There were 671 unique words in the total sample. Out of these 671 words, 65 words had commonality scores of 100% and 37 words had commonality scores of 80%. The 250 most frequently occurring words accounted for 89% of the total sample. The sample consisted of more content words (55%) than structure words (45%). The most commonly observed semantic/syntactic categories were verbs (29%), prepositions (8%), descriptors and pronouns (8%), adverbs (7%), and contractions (5%) (Fallon et al., 2001).

The vocabulary selection questionnaires were analyzed individually to calculate the number of words contributed by each informant. The three word lists completed for each child were then combined to determine the number of words that were selected by two or three informants (common words) and the number of words that were selected by only one informant (unique words). The results of the analyses identified that speech-language pathologists contributed the most words overall, followed by parents, and then teachers. The number of different words selected for each child ranged from 154 to 413. Approximately, 45% of each child's vocabulary list was comprised of words that were selected by more than one informant. For nine of the children, parents selected the greatest number of unique words. For the remaining five children, speech-language pathologists selected the most unique words. Speech-language pathologists expressed the highest levels of satisfaction with the questionnaire (average rating of 6.2 on 7-point scale), followed by parents (*M* = 6.0) and then teachers (*M* = 5.7). In addition, the speech-language pathologists took more time to complete the questionnaire (*M* = 47 minutes), than did parents (M = 36 minutes) or teachers (*M* = 39 minutes) (Fallon et al., 2001).

Only one study published in the field of AAC has attempted to document and analyze the written language used by typically developing children in order to support vocabulary selection. McGinnis and Beukelman (1989) collected writing samples from 70 second grade, 79 third grade, 80 fourth grade, 68 fifth grade, and 77 sixth grade children who all attended the same elementary school in Lincoln, Nebraska. The writing samples were taken from letter writing activities, science project assignments, and/or language arts assignments. Children across all of the grade levels wrote letters. Science project assignments, however, were only written by fourth grade children, and language arts assignments were only written by third, fifth, and sixth grade children. The researchers selected these written tasks because they believed that they provided an accurate representation of the typical writing demands placed on a mainstream student. The writing samples were transcribed into computer format and analyzed using the Systematic Analysis of Language Transcripts (SALT) software program (Miller & Chapman, 1984). The results of the analysis were used to assist an AAC team who were in the process of making decisions about vocabulary representation on a sixth grade child's augmented writing system.

When the 374 letter writing samples were combined, 161 words occurred at least once per 1000 words. Further analysis revealed that these 161 words accounted for 70% of the total sample. Therefore, a significant portion of the composite sample was represented by a limited number of words. The commonality (consistency) with which the children in different grades used the 161 most frequently occurring words was also examined. Extensive overlap was evident with

92 out of the 161 words being used by children in at least four out of the five grade levels (McGinnis & Beukelman, 1989).

McGinnis and Beukelman (1989) also compared the vocabulary used in the letter writing task with the vocabulary used in the science project and language arts assignments. The authors acknowledged that these comparisons were limited by the fact that not all of the writing tasks (letter writing, language arts assignments, science project assignments) were completed across all of the grade levels. As might be expected, the results identified greater similarities between the vocabularies used in the letter writing and the language arts assignments (62%), than those used in the letter writing and the science project assignments (37%). In addition, the science project assignments appeared to include a greater number of structure words than the other two assignment types.

Summary: Research examining vocabulary selection for children with complex communication needs.

Perhaps the most important finding from these studies was the evidence that only a limited set of words is needed to represent significant portions of the spoken and written language samples produced by typically developing children. This is encouraging for the field of AAC as it suggests that typically developing children share a core vocabulary and that this core vocabulary can be used to inform decision-making for children with CCN. However, the lack of commonality observed across different environmental contexts (home versus school) and across different activity contexts (free-play versus snack time; letter writing versus language arts assignments versus science project assignments) indicates that the core vocabularies identified in these studies were unable to address all of the vocabulary needs of children with CCN. Studies which document the vocabulary that children use in other environments and in other types of language activities (e.g., self-selected writing) are needed. In addition, it seems possible that variations may exist in the core vocabularies generated by different groups of children. For instance, it is well-recognized that children in different English-speaking countries use different vocabulary words to refer to the same language concepts, for instance children in the United States use the word *swimsuit*, whereas children in New Zealand use the word *togs*. What remains unclear, however, is whether there are differences in the frequency of use patterns for the vocabulary words that are used by both groups of children. The current investigation is the first to address this important issue.

Language Representation

Appropriate vocabulary selection for children with CCN is an important objective; however, it is only one step in the decision-making process for an AAC team. After selecting vocabulary words for a child, an AAC team must decide how to best represent those words on that child's AAC system. The manner in which vocabulary is represented may differ depending on the type of symbol set or system, and the overall type of language organization strategy that is selected. In other words, in addition to identifying the appropriate vocabulary, clinicians must select the symbols that will be used to represent that vocabulary, and the manner in which to arrange the vocabulary in order to support retrieval and use of the desired vocabulary across communication contexts. Decisions relating to language representation are important because of the strong implications they have for language development. In the section that follows, background information about the various options for language representation will be provided and then the implications that these options have for children's development of vocabulary/semantics, syntax, and morphology will be highlighted.

Types of Picture Symbols

A number of symbol taxonomies have been presented in the AAC literature. Three of these taxonomies have particular relevance to the development of children's language skills: the set/system taxonomy, the iconicity taxonomy, and the single meaning/multi meaning taxonomy.

The Set/System Taxonomy

Picture symbols can be classified as belonging to symbol sets or to symbol systems. Symbol sets contain a limited number of symbols. They can be expanded, however, there are no clearly defined rules governing the process of expansion (Vanderheiden & Lloyd, 1986). Examples of symbol sets include Picture Communication Symbols (PCS), basic Rebus symbols, and PIC symbols (Fuller, Lloyd, & Schlosser, 1992).

Symbol systems are sets of picture symbols that are "specifically designed to work together to allow for maximum communication. Symbol systems include rules or a logic for the development of symbols not already represented in the system" (Vanderheiden & Lloyd, 1986, p. 71). One example of a symbol system is Blissymbolics. The picture symbols in this system are comprised of 100 basic elements (Millikin, 1997). Using semantic rules, these elements are combined to generate a variety of different meanings. For instance, the elements that represent *cloth* and *protection* are combined to form the symbol for *clothes* (Schlosser, 1997), and the elements that represent *person*, *give*, and *knowledge* are combined to form the symbol for *teacher* (Millikin, 1997). New picture symbols are also generated in this rule-governed manner (Schlosser, 1997). Other examples of symbol systems include Sigsymbols, expanded Rebus symbols, and Picsyms (Fuller et al., 1992).

The Iconicity Taxonomy

Picture symbols can also be described in terms of their iconicity. Iconicity is a measure of a symbol's intelligibility (Fuller et al., 1992). It refers to the degree to which a symbol "visually resembles or suggests its referent" (Millikin, 1997, p. 100). Iconicity is often described as a continuum with transparent symbols and opaque symbols on either end. Transparent symbols look the most like the concepts they represent, whereas opaque symbols look the least like the concepts they represent. In the middle of the continuum are translucent symbols. A translucent symbol usually does not look like the concept it represents; however, once an explanation is provided, the relationship between the symbol and its referent can usually be perceived and understood (Beukelman & Mirenda, 2005; Millikin, 1997).

Most symbol sets/systems contain a mixture of symbols that are transparent, translucent, and opaque. Despite this variability, some sets/systems have been identified as being more transparent than others. In a series of three studies (Mirenda & Locke 1989; Mizuko, 1987; Mizuko & Reichle, 1989) for example, PCS symbols were found to be more transparent than Blissymbols.

The Single Meaning/Multi Meaning Taxonomy

The majority of AAC systems represent language using single meaning picture symbols. In these systems, one picture symbol is used to represent one word or message. These systems include most low-tech communication boards/books, as well as high-tech dynamic display systems. AAC systems with fixed displays that employ iconic encoding techniques represent language using picture symbols that refer to more than one word depending upon how they are used. One of the most widely-used iconic encoding techniques is semantic compaction or Minspeak. In this system, language concepts are retrieved using short sequences of multi-meaning picture symbols. The picture symbol *rainbow*, for instance, is used to represent the category ‘color’ and to represent the concepts of ‘happy’, and ‘rain’. When *rainbow* is selected prior to the picture symbol *heart*, the word retrieved is ‘red’. However, when *rainbow* is selected after the picture symbol *umbrella*, the word retrieved is ‘rain’, and when *rainbow* is selected after the picture symbol *heart*, the word retrieved is ‘happy’ (Semantic Compaction Systems, 2005). The picture symbols used and the sequences employed in the semantic compaction system are based on rich semantic associations (Beukelman & Mirenda, 2005; Light et al., 2004).

Approach to Language Organization

Picture symbols in light-tech communication boards/books, as well as in high-tech systems that offer levels or a dynamic display are typically arranged using one of four approaches to language organization: taxonomic grid displays, schematic grid displays, semantic-syntactic grid displays, or visual scene displays. In light-tech communication systems, the individual pages of vocabulary must be manually changed to reveal a new set. In high-tech dynamic display systems, selecting linked symbols automatically brings up a new set of symbols. A third type of system is a static display, high-tech system. These systems present a fixed set of symbols that are combined in different ways to produce exponentially more vocabulary items than there are symbols on the display. These static display systems do not present the same issues with respect to language organization as do low-tech communication systems, leveled systems, and dynamic display systems.

Taxonomic grid display.

In a taxonomic grid display, language is organized according to hierarchical categories (Blackstone, 2004). Language is grouped into superordinate level categories such as people, places, and feelings. It may also be grouped into basic level categories, for instance, the ‘people’ category may be broken down into more specific categories such as ‘family’, ‘friends’ and ‘teachers’. Light-tech communication boards/books and high-tech systems offering levels or a dynamic display can be organized using a taxonomic grid display.

Schematic grid display.

In the second approach to language organization, the schematic grid display, language is organized according to different event schemas such as going to a party, ordering food, or getting ready for school (Drager, Light, Speltz, Fallon, & Jeffries, 2003). Each display contains the language that has been identified as necessary for participation and communication within the particular event. Usually, the language for that event is then organized into various semantic categories, for instance people words, action words, feeling words, and so forth (Beukelman & Mirenda, 2005). Light-tech communication boards/books and high-tech systems offering levels or a dynamic display can be organized using a schematic grid display.

Semantic-syntactic grid display.

The third approach to language organization is the semantic-syntactic grid display. Language in this display is organized according to the parts of speech. One of the most commonly referred to formats is the Fitzgerald key (Fitzgerald, 1954). In this format, the parts of speech are arranged from left to right in a manner that corresponds to typical sentence order. In Bruno’s (2006) version of the Fitzgerald

Key, for instance, people words (nouns and pronouns) are presented on the left of the display followed by action words (verbs), little words (e.g., articles, prepositions, conjunctions), descriptive words (e.g., adjectives, adverbs), object words, and place words. In semantic-syntactic grid displays, the different parts of speech are color coded to provide visual support (Beukelman and Mirenda, 2005). Light-tech communication boards/books and high-tech systems offering levels or a dynamic display can be organized using a semantic-syntactic grid display.

Visual scene display.

The visual scene display is the newest approach to language organization (Beukelman & Mirenda, 2005). A visual scene display is similar to a schematic grid display in that it organizes language according to different event schemas. The main difference between the two methods is that the language within a visual scene display is organized schematically in a scene rather than semantically in a grid (Beukelman & Mirenda, 2005). Visual scenes are line drawings or photographs of particular environments (e.g., the park, the classroom). These scenes have language concepts embedded within them (Light et al., 2004), for example, in a park scene a swing in the playground might represent the concept 'swing' and in a classroom scene a book on the teacher's desk might represent the concept 'book'. When children press the individual pictures within the scene, the associated messages are spoken (Beukelman & Mirenda, 2005). High-tech dynamic display systems are required for visual scene displays.

Implications for Vocabulary and Semantic Development

The decisions that clinicians and families make regarding the type of symbol set/system to use and the approach to language organization to employ are extremely important. Language representation has a direct impact on the manner in which children with CCN learn vocabulary and develop their semantic knowledge.

Noun Overload

Symbol iconicity may influence whether or not symbols are included in children's AAC systems. For example, the ease with which many nouns can be represented may explain why many AAC systems have been found to include a preponderance of noun symbols (Sutton et al., 2002). Furthermore, the difficulties inherent in representing verbs, adjectives, adverbs, and structure words (e.g., determiners, pronouns, auxiliaries) may explain their under-representation in AAC systems. These language concepts are often more abstract and the symbols used to represent them may lack transparency and therefore may be less easily recognized. AAC professionals may perceive these symbols as being 'too difficult' and consequently may omit them from children's AAC systems. This is concerning given that restricted access to the full range of language concepts is likely to have a detrimental impact on the development of children's vocabularies and semantic skills.

Core versus Fringe Vocabulary

Technological advances have lead to increases in memory capacity and now most high-tech AAC systems are able to store a large number of symbols (Sutton et al., 2004). This is obviously a positive development as it means that limited space can no longer be regarded as a barrier to providing children with CCN with access to comprehensive vocabularies; however, it also means that issues relating to vocabulary organization have moved to the forefront and are of considerable concern.

One major objective of the AAC team is to organize vocabulary in such a way that children with CCN have efficient access to core and fringe vocabulary. Core vocabulary refers to words and messages that are used with high frequency, by a variety of individuals (Beukleman & Mirenda, 2005), across a number of different language contexts. In contrast, fringe vocabulary refers to words and messages that are content-rich, topic-related (McGinnis & Beukelman, 1989), and specific to the individual (Beukleman & Mirenda, 2005). When storing core and fringe vocabulary, one of the most important considerations is frequency of use.

Some AAC professionals feel that in order for children to be successful at school, they must have access to all of the vocabulary that they will encounter across the school day. This includes access to curriculum-related vocabulary such as words from storybooks or science textbooks. These words are often stored without any thought to their frequency of use. Children end up with pages of vocabulary scattered throughout their AAC systems. Some of the words on these pages occur so infrequently in the English language that they are only used during the week of school when they are the focus of discussion and assessment (Erickson & Clendon, 2005). Other words occur more frequently, however, they are buried so deep in children's AAC systems that when they are needed at a later date, children are unable to retrieve them (Erickson, 2003). In order to be able to communicate both efficiently and precisely, children with CCN need access to AAC systems that facilitate fast access to core vocabulary and logical access to fringe vocabulary.

Fast access to core vocabulary should be a primary objective no matter which approach to language organization is selected. With some approaches, however, it may be more difficult to achieve this objective. For example, as mentioned earlier, schematic grid displays and visual scene displays organize language according to different event schemas. Each display contains the core and fringe vocabulary needed for participation and communication within a particular event or scene. These displays may be less facilitative of fast access to core vocabulary for two reasons. Firstly, because these displays include all of the vocabulary needed for a specific event or scene, they frequently do not provide differential access to core versus fringe vocabulary. The pathway for accessing core vocabulary is no more efficient than the pathway for accessing fringe vocabulary. Secondly, because vocabulary is not necessarily unique to a particular event or scene, some of the core and fringe vocabulary words that are in these displays may appear in more than one place within a child's AAC system. These issues may both lead to decreased navigational efficiency, which in turn may lead to reduced communication proficiency, particularly when a child's AAC system includes a large number of schematic displays or visual scenes.

Stability

The stability of an AAC system can impact on a child's ability to learn and retrieve vocabulary. When organizing an AAC system, AAC professionals must consider how they expect a system to grow. Systems that employ iconic encoding techniques are probably the most stable AAC systems because they have fixed displays and the locations of picture symbols are never changed. For dynamic display systems, however, system stability can be a major issue unless careful planning goes into the development of a comprehensive system. It is possible to purchase prestored vocabulary sets with vocabulary that has been preselected by the developer. For example, Gateway (Bruno, 2006) is a set of prestored vocabulary that has been designed to take into consideration developmental growth. This program was created to support children and adults with CCN as they progress from being beginning communicators with limited expressive vocabularies to becoming competent adult communicators with vast vocabularies. The system incorporates features that promote system stability including a consistent display design that allows individuals to “seamlessly move from one page set to the next level of complexity while maintaining his/her communicative competence” (Bruno, 2006).

Implications for Syntactic and Morphological Development

The decisions that clinicians and families make regarding the type of symbol set/system to implement and the approach to language organization to use also influence the syntactic and morphological development of children with CCN. The manner in which language is represented in a child’s AAC system is important because the method used can serve to either inhibit or facilitate the development of these critical language skills.

Structure Words and Morphological Markers

Children’s AAC systems vary in terms of the amount of access they provide to structure words (e.g., determiners, pronouns, auxiliaries), and to morphological markers (Sutton et al., 2000). Frequently communication boards/books and electronic AAC systems with limited memory capacity provide no access to these language structures. Instead, these systems contain mainly nouns, as well as some verbs, adjectives, and adverbs. The space limitations inherent in these systems mean that AAC professionals often omit structure words and morphological markers in order to maximize children’s communicative power (Blockberger & Johnston, 2003). AAC professionals also exclude these language structures when their objective is to enhance children’s communicative efficiency. Systems that are designed to maximize efficiency include utterance-based AAC systems that include pre-stored phrases, and also AAC systems that allow children to generate syntactically and morphologically complete utterances by selecting key content words in a telegraphic manner (Redmond & Johnston, 2001).

The only AAC systems that provide complete access to structure words and morphological markers are those that incorporate traditional orthography. The remaining systems all fall somewhere in between (Redmond & Johnston, 2001). For instance, some of the symbol sets (e.g., PCS) include symbols for indicating relative size (e.g., big, bigger, or biggest), however, they do not include symbols for indicating other morphological markers such as plurals and past tense. Other systems do include symbols for indicating plurals and past tense. However, these systems do not allow children with CCN to encode regular and irregular noun or verb class distinctions (e.g., Blissymbols) (Sutton & Gallagher, 1993) or they automatically encode the distinctions for them (e.g., Minspeak). This increases communicative efficiency but does not allow children to actively select and manipulate the language structures. Reduced access to structure words and to morphological markers may negatively impact on children’s language growth.

Grammatical Category Ambiguity

Many of the graphical representations included in symbol sets/systems represent more than one grammatical category. For instance, the PCS symbol for the concept *sit* is a line drawing of a person sitting on a chair and the PCS symbol for the concept *throw* is a line drawing of a person throwing a ball. These symbols are intended to depict verbs; however, they also inadvertently depict subjects (e.g., the person) and objects (chair, ball). This ambiguity may create confusion for children with CCN and may influence the quality of sentence construction (Sutton et al., 2002)

Syntactic and Morphological Strategies

Some AAC systems include specific strategies that may help to build children's syntactic and morphological skills. Two examples of strategies that may facilitate sentence construction are the semantic-syntactic grid display and sentence development links. The semantic-syntactic grid display organizes language according to parts of speech and is intended to facilitate left-to-right, word-by-word sentence construction (Beukelman & Mirenda, 2005). The second strategy, sentence development links, use the natural branching capabilities inherent in dynamic display systems, and are intended to guide children through the process of sentence construction. When a child selects a verb (e.g., *go*), for example, the system automatically launches a page that includes associated vocabulary words (e.g., *grandmom's*, *outside*) that the child can use to appropriately complete his/her message (Bruno, 2006). Whether or not semantic-syntactic grid displays and sentence development links are actually effective in supporting language development is still unknown as no empirical research has been conducted to date.

Other AAC systems incorporate strategies that may help to build children's morphological skills. For instance, in the Gateway language program, some of the verbs on the page sets designed for children who are beginning communicators are affixed with the grammatical morpheme –ing. This is based on an assumption that hearing the morpheme used in the correct context, will lead children to spontaneously seek out the morpheme when they progress through the language program and begin communicating using more advanced page sets (Bruno, 2006). Again, no research studies have been conducted that have tested the accuracy of this assumption.

Summary: Language Representation

In order for children with CCN to become precise and efficient AAC communicators, they must have access to language that is organized thoughtfully and logically. Like vocabulary selection, language representation is a complex process. Numerous factors must be taken into consideration including the iconicity of the symbol set, the balance of core and fringe vocabulary, the balance of content words and structure words, and the provision of language strategies. All of these decisions can have a powerful influence on the development of children with CCN's vocabularies and their semantic, syntactic, and morphological knowledge.

CHAPTER 3: METHODS

Research Questions

This study addresses the following research questions:

1. Is there an *interaction* between school age and country-related differences in the vocabulary words used, the semantic themes used, and the syntax and morphology used by typically developing beginning writers who reside in North Carolina and New Zealand when they compose about self-selected topics?
2. Are there school age and country-related differences in the *vocabulary words* used by typically developing beginning writers who reside in North Carolina and New Zealand when they compose about self-selected topics, and if so what are these differences?
3. Are there school age and country-related differences in the *semantic themes* used by typically developing beginning writers who reside in North Carolina and New Zealand when they compose about self-selected topics, and if so what are these differences?
4. Are there school age and country-related differences in the *syntax* and *morphology* used by typically developing beginning writers who reside in North Carolina and New Zealand when they compose about self-selected topics, and if so what are these differences?

Recruitment

A total of 293 children were recruited from four schools in North Carolina and three schools in New Zealand. The children in North Carolina (*n* = 153) were in kindergarten, first, second, and third grade classrooms. The children in New Zealand (*n* = 140) were in year 1-4 classrooms. The average consent form return rates were 42% in North Carolina and 50% in New Zealand.

In order to participate in the study, the children had to be fluent in English and they had to have no history of cognitive, speech, language, and/or hearing problems (as evidenced by school records). As a result, 20 children in North Carolina and 16 children in New Zealand were excluded from participation.

After data collection an additional 18 children were excluded from participation. Four children in New Zealand were excluded because they exceeded the school age cut-off. Four children in North Carolina were excluded because they orally dictated their stories to their teacher. Since these children did not translate their thoughts directly into print, it seemed possible that they may have produced more complex sentence structures than their peers who produced early conventional texts. For this reason, these children were excluded from participation.

Another 10 children in North Carolina were excluded because they generated no writing samples over the data collection period. Four of the children in North Carolina produced no writing samples because they were in classrooms where self-selected writing was one of the activities that children could elect to engage in once they had completed the daily school work that was assigned to them. The children who produced no writing samples therefore either failed to complete the assigned school work, or they completed the assigned school work but elected to engage in other activities. Six of the children in New Zealand produced no writing samples because they were absent from school, moved to a new school, or their teacher forgot to provide the children's writing samples for photocopying.

This left 238 children who met the criteria for participation: 125 children in North Carolina and 113 children in New Zealand. Appendices B1 and B2 provide information documenting the recruitment process for each of the participating classrooms. These appendices present specific information regarding the number of children who were recruited, the number of children who were excluded, and the number of children who met the criteria for participation.

The Schools

The four schools in North Carolina are all public elementary schools that are located in three school districts in the central piedmont region. School A is located in a university town. Schools B, C, and D are located within 13 miles of the university town. Schools B and C are situated in semi-rural settings and School D is situated in a small town. When the study was conducted, the number of children enrolled in the schools ranged from between 400 and 700 children[1,2]. The ranking from largest to smallest enrollment was School C, School B, School A, and lastly School D. Under North Carolina's ABC accountability program, all of the schools had been designated as 'Honor Schools of Excellence'. This means that at least 90% of the children at these schools were performing at grade level. In the 2004-2005 academic year,

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[1] Statistics were obtained from school districts' websites.

[2] Figures are presented as approximate in order to maintain the anonymity of the participating schools.

Schools A, B, and D exhibited high student growth and School C exhibited expected student growth (Education First, 2005).

The three schools in New Zealand are located in suburbs of two small North Island cities. Schools E and G are situated in one city and School F is situated in the other city. Both cities are adjacent to a large North Island city. All of the schools are public primary schools. School E differs from the other two schools in that it is a Catholic school. When the study was conducted, the number of children enrolled in the schools ranged from between 200 and 400 children[1,2]. In terms of largest to smallest enrollment, the schools were ranked as follows: School G, School F, and School E.

Statistics characterizing the economic status of the communities surrounding the schools in North Carolina and in New Zealand are presented in Appendices B3 and B4. According to the 2000 Census in the United States, the median household income for the census tracts surrounding the four North Carolina schools ranged from US$40,424 for School D to US$54,897 for Schools B and C. The median household income for the census tract surrounding school A was US$47,063 (United States Census Bureau, 2000). However, it is important to note that this figure may not provide an accurate indication of the economic status of this school's community as it stands today because the Census was conducted prior to the construction of this school and much of its surrounding neighborhood. Information obtained from a local realtor suggests that the median household income in this neighborhood was US$57,206 at the time of the investigation (Necrason, 2006). The median household income for the tracts surrounding the four schools all exceeded the state average of

US$39,184. The median household income for the United States was US$41,994 (United States Census Bureau, 2000).

According to the 2001 Census in New Zealand, the median household income for the areas surrounding the three New Zealand schools ranged from NZ$35,195 for School E to NZ$66,789 for School G. The median household income for the city that Schools E and G are located within was NZ$45,667 and for the city that School F is located within was NZ$44,320. The median household income for New Zealand was NZ$39,588 (Statistics New Zealand, 2001).

The schools' decile ratings are also presented in Appendices B3 and B4. The Ministry of Education in New Zealand uses a decile rating system for school funding purposes. Each decile contains approximately 10% of schools. Schools in decile 1 have the highest proportion of children from low socio-economic backgrounds. Schools in decile 10 have the lowest proportion of these children. Decile ratings incorporate five indicators of socio-economic status including household income, parents' occupation, household crowding, parents' educational qualifications, and parents' receipt of income support. Out of the three New Zealand schools that participated in this study, two of the schools were designated as Decile 7 (Schools E and F), and one was designated as Decile 10 (School G) (Ministry of Education, 2005).

For the purpose of offering an additional means of comparing the schools in the two countries, a type of decile rating was also generated for the four schools in North Carolina. Since the complex range of statistics used to generate decile ratings in New Zealand were not available, the decile ratings for North Carolina were generated based on the percentage of children receiving free or reduced lunch. The National School Lunch Program is a federally assisted meal program that provides low-cost or free lunches to children from families with incomes below 185% of the poverty level. Eligibility is determined based on household size and household income (United States Department of Agriculture Food and Nutrition Service, 2005). This statistic is used in the North Carolina Public School System to identify children who are considered to be economically disadvantaged (North Carolina Public Schools, 2005).

The percentage of children receiving free or reduced lunch at the schools participating in this study ranged from 13.5% at School A to 48.63% at School D. Decile ratings were generated for these schools by ranking all of the schools in the state according to the percentage of children who receive free or reduced lunch and then dividing them into decile groups. Schools in decile 1 had the highest proportion of children receiving free or reduced lunch. Schools in decile 10 had the lowest proportion of these children. When decile ratings were generated for the four schools in North Carolina that participated in this study, one of the schools was designated as Decile 5 (School D), and the rest were designated as Decile 9. The procedure used to generate the decile ratings for North Carolina was not as complex and multifaceted as the procedure used in New Zealand. The decile ratings generated for North Carolina therefore only provide an approximate indication of socio-economic status and should be interpreted with caution.

The Teachers

The school principals at the seven participating schools were asked to identify K-3 (United States) or Year 1-4 (New Zealand) teachers within their schools who provided regular (at least three times per week) opportunities for children to write about self-selected topics. These teachers were approached and invited to participate in the study. Eighteen teachers in North Carolina and 13 teachers in New Zealand agreed to take part. Two of the teachers in New Zealand co-taught within the same class. After data collection, one of the kindergarten teachers in North Carolina was excluded from participation because all of the children in her class generated stories using oral dictation. Appendices B5 and B6 provide information about the teachers' years of teaching experience and levels of education. The teachers in North Carolina had between 2 and 24 years of experience (M = 8 years). The teachers in New Zealand had between 6 and 30 years of experience (M = 15 years). Most of the teachers in North Carolina had bachelor's degrees (n = 11). The remaining teachers had master's degrees (n = 6). The teachers in New Zealand had teaching certificates (n = 2), teaching diplomas (n = 2), bachelor's degrees (n = 7), or post-graduate diplomas (n = 2).

The Children

The 125 children in North Carolina and the 113 children in New Zealand who participated in the study represented a variety of ethnic backgrounds (see Appendices B7 and B8). In North Carolina, 72% of the children were United States European, 11% were African American, 3% were Hispanic, 7% were Asian, and 6% were classified as Other. In New Zealand, 70% of the children were New Zealand European, 12% were New Zealand Maori, and 18% were classified as Other. In both North Carolina and in New Zealand, the Other classification included children from Europe and children who represented multiple ethnic backgrounds.

The children were also classified into four groups according to their school age. This variable was defined as the length of time that the children had been at school. Children who had been at school for less than one year were assigned a school age of '1', children who had been at school for between 1 and 2 years were assigned a school age of '2', children who had been at school for between 2 and 3 years were assigned a school age of '3', and children who had been at school for between 3 and 4 years were assigned a school age of '4'. The creation of this variable was important as it enabled cross-country comparisons to be made. Comparing children in two different countries is not as straightforward as it might seem. Most children in the United States start school at the beginning of the school year within which they will turn five. In contrast, most children in New Zealand start school on their fifth birthday. Determining which grade level in the United States is equivalent to which year level in New Zealand is a difficult task. The school age variable was created because it circumvented this issue.

The number of children within each of the school age categories and their mean chronological ages are depicted in Appendices B9 and B10. In North Carolina, there were 14 children in School Age 1, 58 children in School Age 2, 34 children in School Age 3, and 19 children in School Age 4. In New Zealand, there were 32 children in School Age 1, 49 children in School Age 2, 25 children in School Age 3, and 7 children in School Age 4. The mean chronological ages for each of the school age categories were similar for the children in North Carolina and the children in New Zealand. However, there was greater variability in chronological age within each of the school age categories for the children in North Carolina (see Figure 3.1).

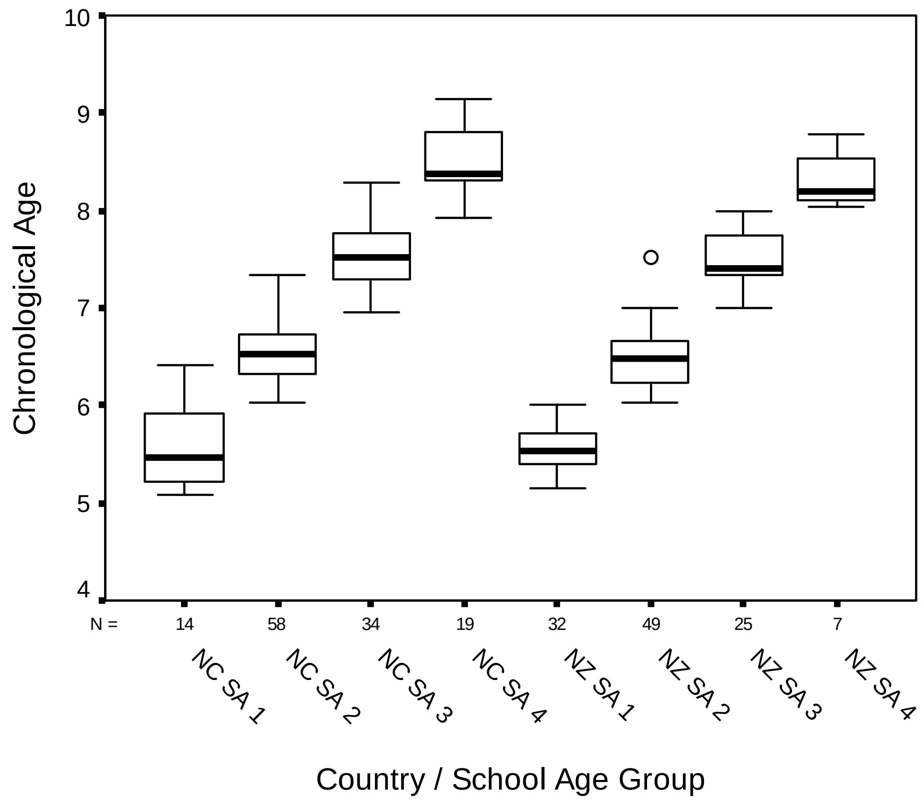

Figure 3.1 Variation in chronological age for School Ages 1-4 in North Carolina and New Zealand.

This is to be expected given that children in the United States may be anywhere between 4 and 6 years of age when they start school, whereas children in New Zealand are usually 5 years of age.

Data Collection

All writing samples produced during self-selected writing sessions over a six-week period were photocopied for analysis. The classroom teachers were asked to provide translations of any handwriting or spelling attempts that were unclear or unconventional, i.e., any words that could not easily be read by an unfamiliar conventionally literate person. The teachers were also asked to complete bi-weekly classroom context logs with descriptions of classroom, school, community, national, and international events that may have influenced children's writing topics, vocabulary, etc. A copy of the classroom context log is provided in Appendix B11.

Language Analysis

The writing samples were transcribed into a Microsoft Access database by the researcher and six undergraduate assistants using a three-step process that involved: (a) transcribing the actual text, (b) transcribing the glossed text, and (c) transcribing the text following the conventions used in the *Systematic Analysis of Language Transcripts* (SALT; Miller & Chapman, 2004) software program. The data entry form is depicted in Appendix B12. In the glossed version, the children's spelling and punctuation were corrected. However, their syntactic and semantic word choices were left uncorrected. A number of rules were generated to ensure consistency across transcripts. These rules are listed in Appendix B13. The transcripts were also checked for accuracy using the procedures described in Appendix B14. The transcriptions were exported from the database as SALT files.

The SALT files were then converted to the other file types needed to perform the various language analyses. Computer macros were used to automate data transfer from one file type to the next.

The researcher employed a variety of methodologies to analyze the writing samples. Vocabulary analyses were completed on all of the writing samples. Semantic, syntactic, and morphological analyses were completed on 98 writing samples. The 98 writing samples were selected by randomly choosing 49 children from North Carolina and 49 children from New Zealand. Within each country, the sampling was stratified based on school and school age in an effort to achieve balanced representation. In both groups of 49 children, there were 14 children in School Age 1, 14 in School Age 2, and 14 in School Age 3. There were, however, only 7 children in School Age 4. This was because there were only 7 New Zealand children in School Age 4 who participated in the study.

Vocabulary

The vocabulary was analyzed using the *Child Language Analysis* (CLAN) (MacWhinney, 2006) program[3]. The *Freq* command in CLAN was used to generate word frequency counts, and two summary measures: total number of words and total number of different words. It is important to note that type-token ratios were not calculated since TTR is considered to be a poor measure of vocabulary diversity when language samples are of differing lengths (Nelson et al., 2004). The *Cooccur* command was used to find and document the frequency of multiword sequences.

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[3] When the SALT files generated from the database were converted to the CHAT file format necessary for CLAN, they were modified slightly to ensure that they were functional for the CLAN program. These modifications are described in Appendix B15.

Semantics

The *Profile In Semantics-Lexical* (PRISM-L, Crystal, 1982) program in *Computerized Profiling* (CP) (Long, Fey, & Channell, 2004) was used to examine the frequency of different semantic themes and the semantic fields subclassified within these themes. One summary measure was calculated: total number of different semantic themes. PRISM-L classifies words into minor lexemes and major lexemes. The minor lexemes fall within three semantic fields: social (e.g., proper names), relational (e.g., articles, pronouns, auxiliary verbs), and avoidance (any lexemes that stands in for a different lexeme, e.g., *thingy*, *stuff*). The major lexemes fall within 61 semantic fields (e.g., *clothing*, *color*). These semantic fields in turn fall within eight semantic themes. A complete list of themes and fields is presented in Appendix B16.

Syntax and Morphology

The *Language Assessment, Remediation, and Screening Procedure* (LARSP, Crystal, Fletcher, & Garman, 1989) program in CP (Long & Fey, 2004) was used to examine the children's syntax and morphology. The LARSP analysis is recognized as one of the most comprehensive approaches to grammatical assessment (Klee & Paul, 1981; Lund & Duchan, 1983). The analysis is based on a structural linguistic model of syntax. It examines the use of various clause, phrase, and word level elements across a series of developmental stages. The LARSP analysis is generally used to examine the spoken language skills of children between the ages of 9 months and 4 years 6 months. Its use in this study, however, was deemed appropriate given that the writing samples were collected from beginning writers. The written language skills of beginning writers are typically inferior to their spoken language abilities (Kroll, 1981).

The first stage in LARSP consists of single word sentences that are classified as being either major or minor. Major sentences consist of elements (e.g., verb, noun) that “are able to combine with other elements according to the language’s rules to produce an indefinitely large set of sentences” (Crystal, 1982, p. 17). In contrast, minor sentences (e.g., vocatives, interjections, greetings) “do not permit the application of these rules, and do not readily allow an analysis into structural types” (Crystal, 1982, p. 17).

The first three clausal stages in LARSP, Stages II, III, and IV, are defined quantitatively with the stage number corresponding to the number of elements found within the clause (i.e., Stage II clauses are comprised of two elements, Stage III clauses are comprised of three elements and so forth). The next clausal stage, Stage V, is focused on clausal coordination and subordination (Blake, Quartaro, & Onorati, 1993). The two most advanced clausal stages (VI and VII) were not analyzed in this study for two reasons. Firstly, stages VI and VII are not well defined (Blake et al., 1993), and secondly these stages include clausal elements (e.g., passive verb tense) that are considerably more advanced than those typically observed in the population of children with CCN. For similar reasons, only the first three phrasal stages (II, III and IV) were included in the analysis. These stages consist of some phrase types that are defined quantitatively and some that are defined qualitatively (e.g., auxiliary verb, copula) (Blake et al., 1993).

The frequency of all clause, phrase, and word level elements was calculated for each writing sample (see Appendices B17-B25 for a complete listing of these elements). Following the procedure outlined in Blake et al. (1993), the children’s scores were then converted into relative frequencies for the across-school age and across-country comparisons. This helped to control for the writing samples' differing lengths. In addition, a number of summary measures were produced: mean number of t-units per writing sample[4], mean length of t-unit[4], relative frequency of stage I[5], relative frequency of each clausal stage[6], relative frequency of each phrasal stage[7], mean clausal complexity (weighted) and mean phrasal complexity (weighted).

Statistical Analysis

The writing samples were analyzed using a combination of univariate descriptive statistics, graphing techniques, and univariate and multivariate statistical methods. The statistical methods employed included analysis of variance (ANOVA) and multivariate analysis of variance (MANOVA). These methods were conducted using SPSS Version 13.0. The specific analyses that were used to answer each of the four research questions were as follows:

1. *Is there an interaction between school age and country-related differences in the vocabulary words used, the semantic themes used, and the syntax and morphology used by typically developing beginning writers who reside in North Carolina and New Zealand when they compose about self-selected topics?*

   The country X school age interaction effects for semantics and syntax were

[4] The calculations for mean number of t-units per writing sample and mean length of t-unit (measured in words) were based on complete and intelligible t-units. T-units that were abandoned or that contained unintelligible segments were excluded from the calculations.

[5] The relative frequency of Stage I constructions was calculated by dividing the total number of Stage I constructions by the total number of t-units.

[6] The relative frequency of each clausal stage was calculated by dividing the total number of clauses at each stage by the total number of clauses across all of the stages.

[7] The relative frequency of each phrasal stage was calculated by dividing the total number of phrases at each stage by the total number of phrase across all of the stages.

examined using an ANOVA and a MANOVA respectively. The country X school age interaction effect for vocabulary words was not examined because the variable failed to meet the assumptions of ANOVA. The problems relating to this variable are detailed below.

2. *Are there school age and country-related differences in the vocabulary words used by typically developing beginning writers who reside in North Carolina and New Zealand when they compose about self-selected topics, and if so what are these differences?* Descriptive statistics and graphs for total number of words and total number of different words in each school age and country were generated and compared. Core vocabulary lists were generated for the entire writing sample population as well as for each school age, each country, and each school age within each country. The most frequently occurring content words (nouns, verbs, adjectives, and adverbs) were identified as well as the most frequently occurring structure words[8] (pronouns, articles, prepositions, auxiliaries, conjunctions). The researcher intended to examine differences on the NDW measure using an ANOVA. Unfortunately, this analysis was unable to be completed because the variable failed to meet the assumptions of normality (positively skewed) and homogeneity of variance. Various solutions to these problems were explored including transforming the variable to a different scale (e.g., logarithmic, square root, inverse), and using a nonparametric statistical test (e.g., Friedman's test). However, none of the transformations improved the distribution, and the nonparametric tests could

[8] Lists of structure words were obtained from MacWhinney (1995).

not be used because these tests assume equal variances. Furthermore, the unequal sample sizes, coupled with the fact that the group with the smallest *n* had the largest variance, would have rendered the ANOVA very liberal and likely to over-report significance. It was therefore decided that the appropriate course of action was not to run the analysis.

3. *Are there school age and country-related differences in the semantic themes used by typically developing beginning writers who reside in North Carolina and New Zealand when they compose about self-selected topics, and if so what are these differences?* Descriptive statistics were generated to examine the frequency and diversity of the semantic themes and fields used in each school age and country. Differences on the summary measure, number of different semantic themes, were analyzed using an ANOVA.

4. *Are there school age and country-related differences in the syntax and morphology used by typically developing beginning writers who reside in North Carolina and New Zealand when they compose about self-selected topics, and if so what are these differences?* Descriptive statistics and graphs were generated to compare mean length of writing sample, mean length of t-unit, clausal complexity, phrasal complexity, and the types of clause, phrase, and word structures used in each school age and country. Differences on two of the summary measures (mean clausal complexity and mean phrasal complexity) obtained in the LARSP were analyzed using a MANOVA, followed by repeated contrasts. Originally, it was intended to include mean length of t-unit in this analysis as well; however, this variable failed to meet the

assumptions of normality (positively skewed), homogeneity of variance, and multicolinearity and singularity. Various solutions to these problems were considered including transforming the variable to a different scale (e.g., logarithmic, square root). However, the multicolinearity and singularity diagnostics indicated that the variable was significantly correlated with mean clausal complexity for children in New Zealand in School Age 1 (r = .731) and for children in North Carolina in School Age 2 (r = .920). It was decided to omit the variable because including redundant variables in the same analysis is not recommended as it increases the size of the error terms and weakens the analysis (Tabachnick & Fidell, 2001). Tabachnick & Fidell (2001) cautioned researchers to “think carefully before including two variables with a bivariate correlation of more than .70” (p. 84).

Reliability

The computerized version of LARSP (Crystal et al., 1989) found in CP (Long et al., 2004) does necessitate some human decision-making. Its analyses are not error-free and therefore it is important that the researcher reviews all of the analyses to check for errors (Long, Maclagan, & Wright, 2003). CP is reasonably accurate at coding word (94% accuracy), phrase (91% accuracy), and clause (84%) level elements, but has substantial difficulty with more complex syntactic structures such as subordinate clauses (14% accuracy) (Long & Channell, 2001).

Since CP has difficulty analyzing more complex syntactic structures, each sample selected for analysis with LARSP was hand checked for accuracy of coding by the researcher. Then, a random selection of 10% of the writing samples was also analyzed by a linguistics professor who has expertise in LARSP. Both the researcher and the professor analyzed the writing samples using CP and th en verified the accuracy of the analysis by reviewing each structural element. Percent agreement scores were 91% for clause level elements, 94% for phrase level elements, and 95% for word level elements.

Following this, the linguistic professor examined the discrepant analyses to determine whether the researcher’s alternate analyses were appropriate or inappropriate. A number of the discrepant analyses were deemed appropriate. The percent agreement scores for clause, phrase, and word level elements were adjusted accordingly. The adjusted scores were 96% for clause level elements, 98% for phrase level elements, and 97% for word level elements.

CHAPTER 4: RESULTS

Sample Characteristics

A total of 2743 writing samples were collected. Each of the participating children produced between 1 and 33 writing samples. The number of writing samples produced decreased as school age increased. The North Carolina children in School Age 1 generated an average of 22 writing samples which decreased to 13 writing samples in School Age 2, 10 in School Age 3, and 5 in School Age 4. The New Zealand children in School Age 1 generated an average of 13 writing samples which decreased to 12 writing samples in School Age 2, 8 in School Age 3, and 3 in School Age 4. All of the children in New Zealand and the children in School Ages 1 and 4 in North Carolina produced a different writing sample each day. However, the children in School Ages 2 and 3 in North Carolina often worked on the same writing sample over multiple days. For this reason, the total number of writing days was the variable used to weight for total output, rather than the total number of writing samples produced. The distribution of the total number of writing days variable is depicted in Figure 4.1. The average number of writing days was 15 for the children in School Age 2 and 14 for the children in School Age 3.

In Chapter 3, it was mentioned that the classroom teachers were asked to provide translations of any handwriting or spelling attempts that were unconventional. Of the 2743 total writing samples, the teachers provided complete translations for 22 writing samples that were entirely indecipherable. It was assumed that in order for

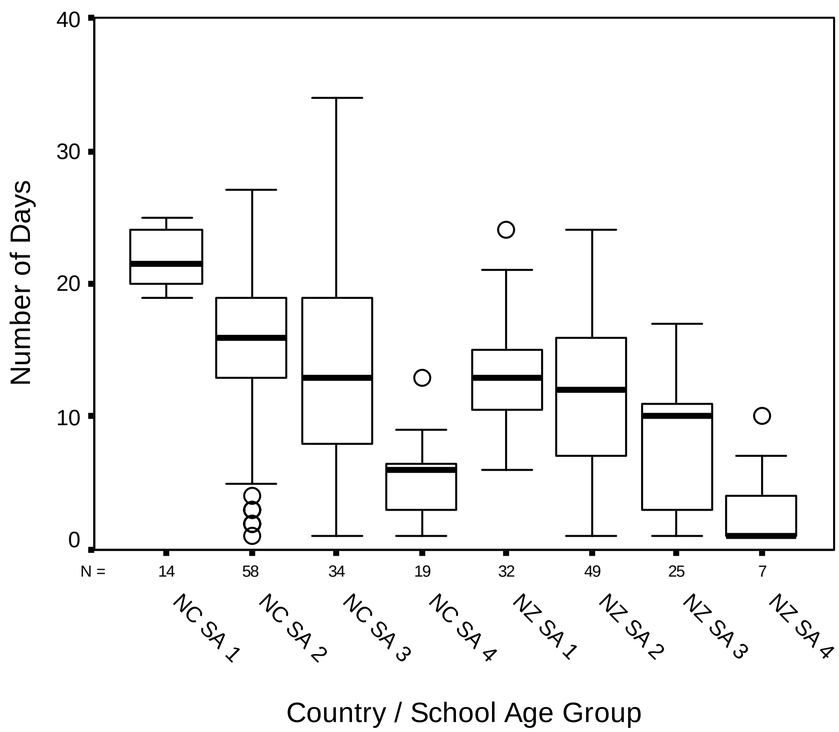

Figure 4.1 Variation in number of writing samples days for children in School Ages 1-4 in North Carolina and New Zealand.

the teachers to provide translations for these writing samples, they would have had to ask their children to orally describe what they had written. It seems possible that beginning writers who produce texts that are unconventional and that require oral translation may produce more complex sentence structures than beginning writers who produce early conventional texts. For this reason, these writing samples were excluded from the analyses. Therefore a total of 2721 writing samples were actually analyzed. It is important to note that there were an additional 504 writing samples that contained indecipherable words at the single word level that the teachers did not translate. These writing samples were included; however, whenever the researcher was unsure of a word, it was marked with an X and excluded from all analyses.

Vocabulary

Total Words and Different Words

The 2721 writing samples were comprised of a total of 85,759 words. Of these words, 5724 were different words. The total number of words and the total number of different words were calculated for each writing sample. Mean scores were generated for the set of writing samples produced by each child. These scores were used to calculate means for the four school ages within and across countries.

The Unit of Measurement

Before reviewing these findings, it is important to reiterate that because the children produced different numbers of writing samples, and because some children produced one sample each day and other children worked on the same sample over multiple days, it was necessary to establish a common unit of measurement, the writing day. To achieve this, the total number of words and the total number of different words were both weighted by the total number of writing days.

To calculate the total number of words and the total number of different words written per writing day, the total scores for each child were divided by the total number of writing days that the child took to generate the writing samples that were included in the study. This approach was effective for determining the total number of words written but it was problematic for determining the total number of different words written. The approach failed to take into consideration the likelihood that children who generated one multi-day sample would have reused vocabulary if they had written several samples (i.e., one per day) over the same timeframe. This problem was realized when the number of different words scores for the children who produced multi-day samples were examined and found to be lower than expected. To remedy this problem, each child's writing samples were divided into equal portions by the number of writing days. The number of different words score was then calculated for each portion of the writing sample. This ensured that the children who produced writing samples over multiple days received appropriate credit for their use of different words.

Mean Total Words and Different Words

When the writing samples written by children in North Carolina and New Zealand were combined, the mean number of words written per writing day increased as a function of school age. The children in School Age 1 wrote an average of 11.95 words. This increased to 24.96 at School Age 2, 46.08 at School Age 3, and 79.30 at School Age 4. The mean number of different words also increased from 8.74 at School Age 1 to 17.92 at School Age 2, 31.72 at School Age 3, and 50.13 at School Age 4.

When the writing samples written by the children in North Carolina and New Zealand were separated out, similar patterns were evident. In North Carolina, the mean number of words written per writing day increased as follows: 13.21 in School Age 1, 25.57 in School Age 2, 47.00 in School Age 3, and 79.36 in School Age 4. In New Zealand, the same increase was observed with children in School Ages 1-4 writing an average of 10.59, 26.08, 49.07, and 91.99 words respectively. The mean number of different words that the children in North Carolina wrote per writing day was 8.34 in School Age 1, 17.31 in School Age 2, 30.84 in School Age 3, and 47.44 in School Age 4. In New Zealand, the children in School Age 1 wrote 8.92 different words. This increased to 18.63 in School Age 2, 32.92 in School Age 3, and 57.41 in School Age 4. For both total number of words and total number of different words, the differences between the two countries were minimal across the first three school ages. In School Age 4, however, a different pattern emerged. The children in New Zealand produced noticeably more words and different words than the children in North Carolina. These trends are depicted in Figures 4.2 and 4.3.

Most Frequently Occurring Words

The cumulative frequency distribution for the 1000 most frequently occurring words is depicted in Figure 4.4. From examining the distribution, it is evident that a relatively small set of different words accounted for a substantial proportion of the total words used in the writing samples. In fact, the cumulative frequency analyses revealed that the most frequently occurring 163 words accounted for 70% of the total words used, and the most frequently occurring 39 words accounted for 50% of the total words used. Figure 4.4 also highlights the finding that many of the most frequently occurring words were structure words. The ratio of structure words to

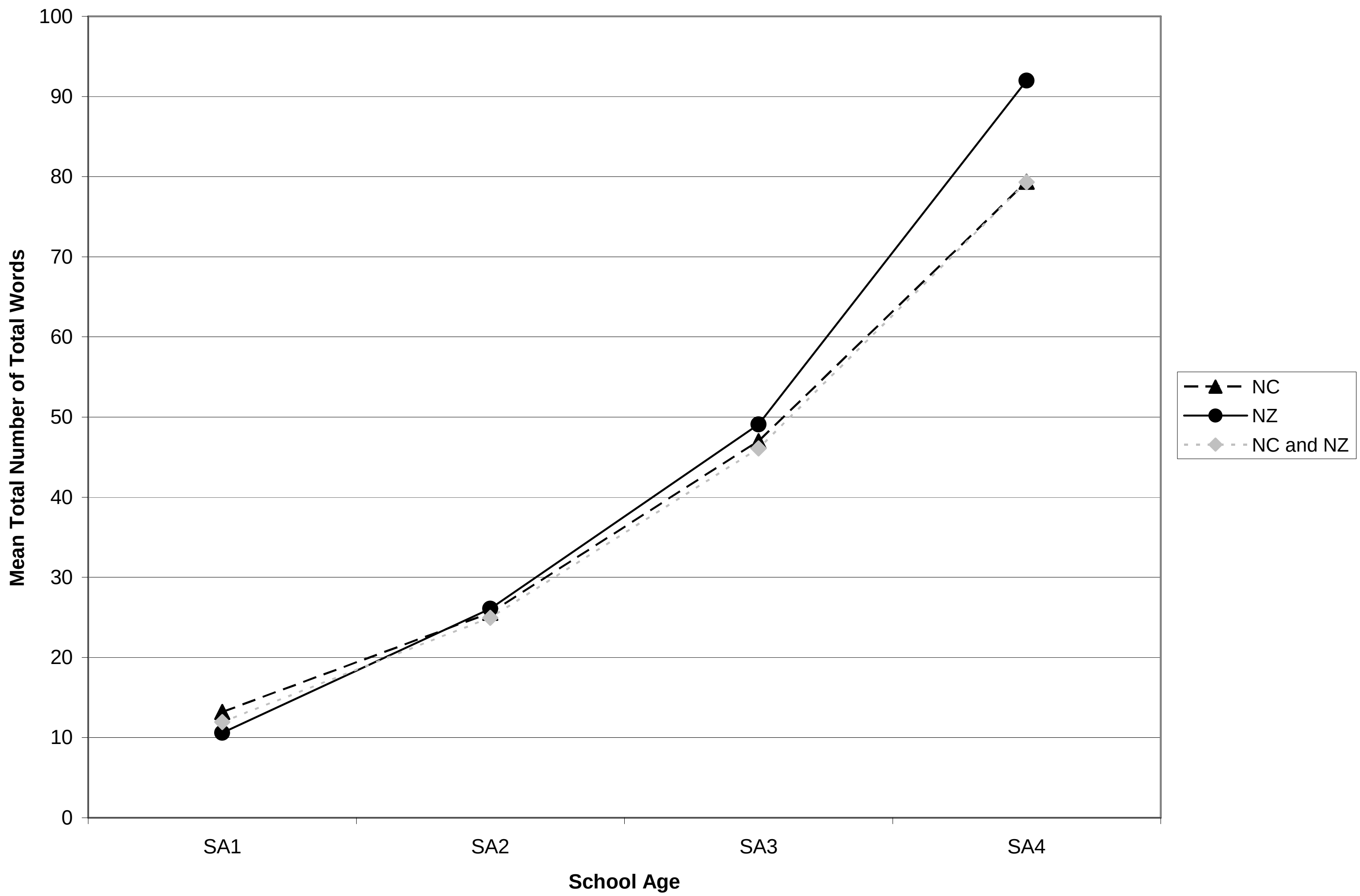

Figure 4.2 Mean total number of words for children in School Ages 1-4 in North Carolina, New Zealand, and North Carolina and New Zealand combined.

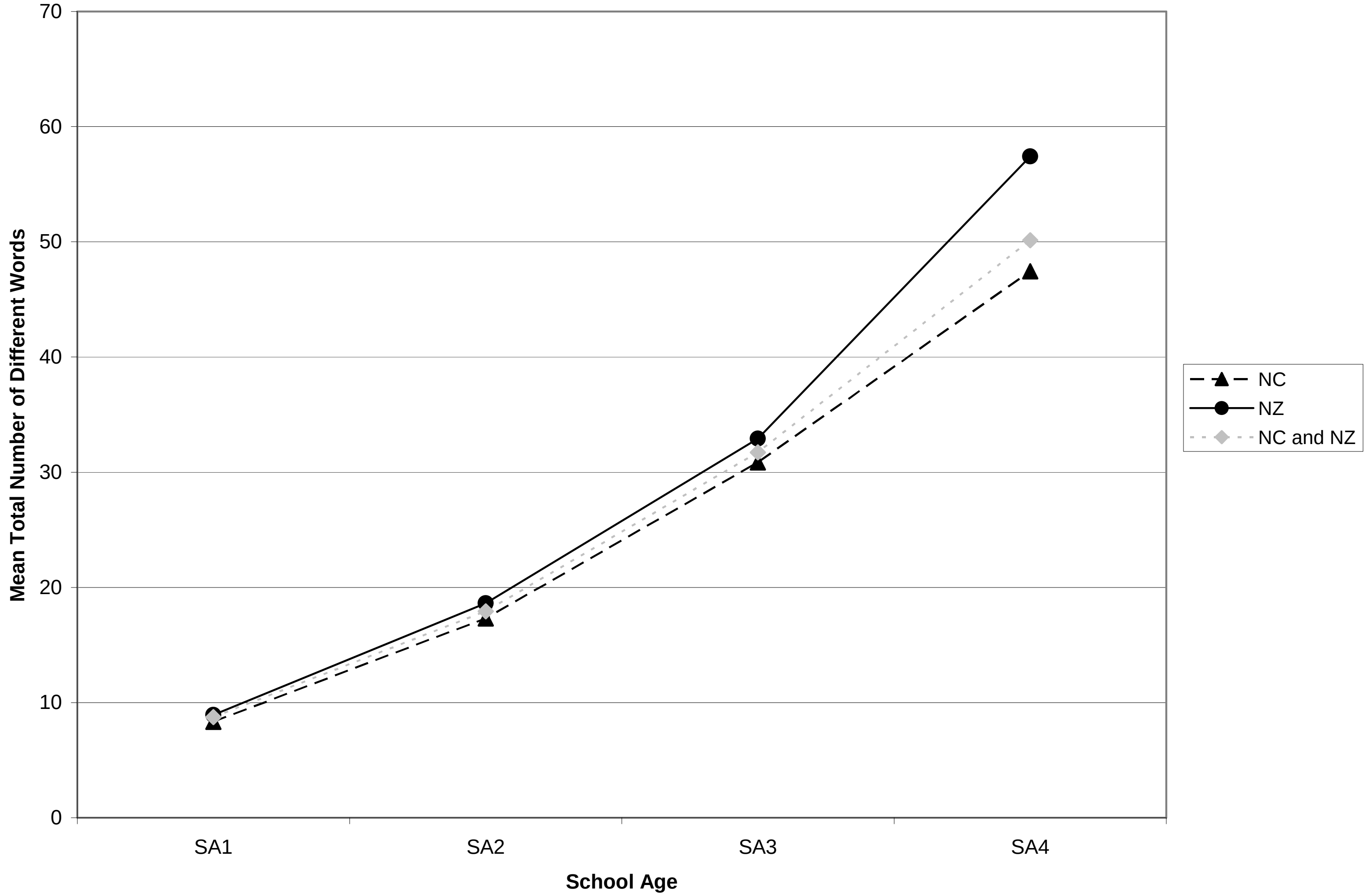

Figure 4.3 Mean total number of different words for children in School Ages 1-4 in North Carolina, New Zealand, and North Carolina and New Zealand combined.

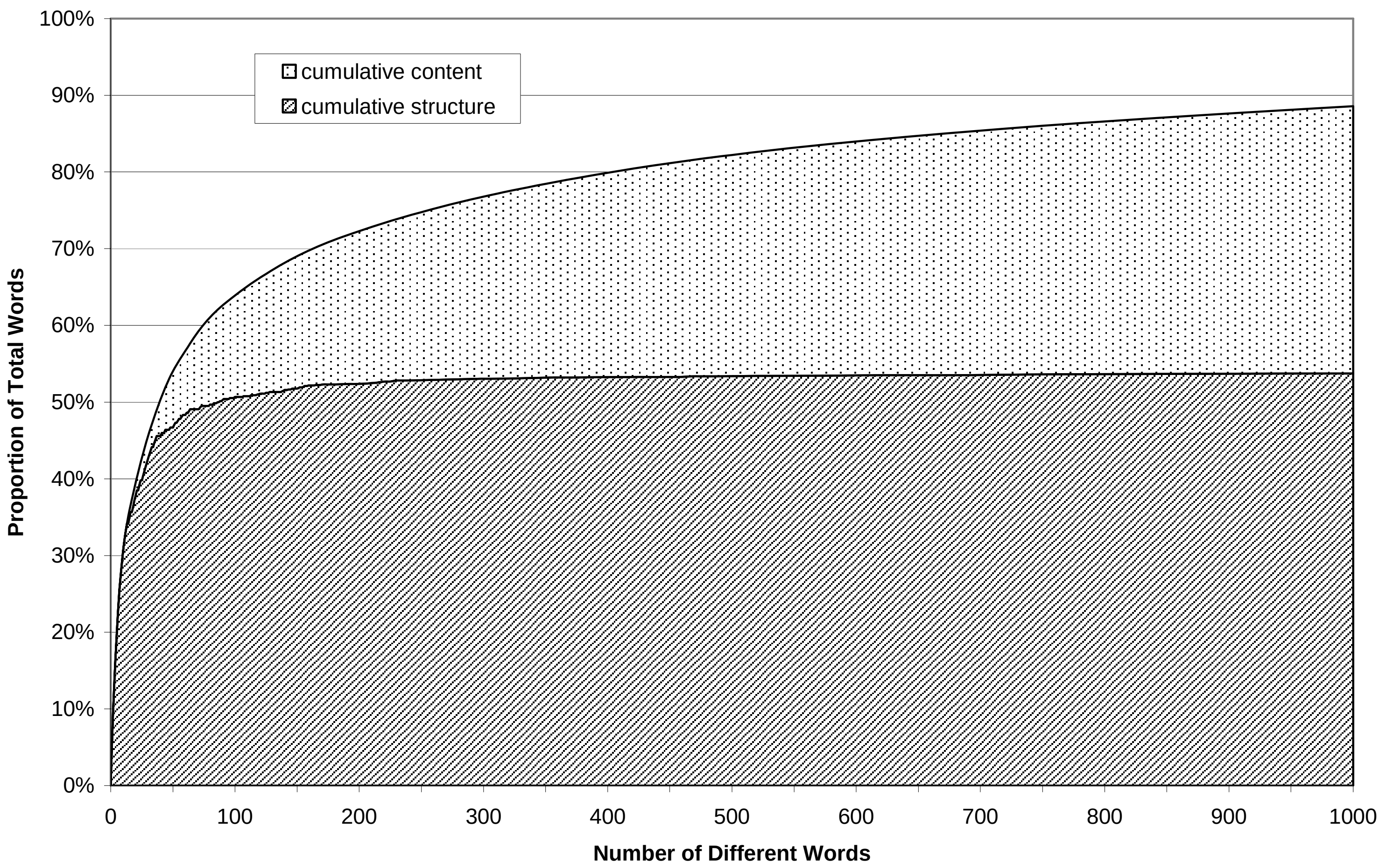

Figure 4.4 Proportion of total words represented by varying numbers of different words.

content words was 35:15 (70%) for the 50 most frequently occurring words, 56:44 (56%) for the 100 most frequently occurring words, and 68:82 (45.33%) for the 150 most frequently occurring words.

The 150 most frequently occurring words are listed in Appendix C1. Shading has been used to highlight the over-representation of structure words among the most frequently occurring words. Only three of the words (*Halloween*, *Fall*, *Christmas*) in this appendix appeared to directly correspond to an event or theme that was documented by the teachers in their context logs. The 50 most frequently occurring words are examined in more detail in Appendices C2-C5. The two columns on the left in these appendices list the 50 words that were used most frequently overall and their frequency. The remaining columns provide frequency and rank information illustrating the patterns of word usage when the countries were combined and the school ages were compared (Appendix C2), when the school ages were combined and the countries were compared (Appendix C3), and when the school ages and countries were both separated out (Appendices C4 and C5).

Most Frequent Words – Countries Combined

When the countries were combined and the school ages were compared, some interesting patterns were evident. All but three of the top 10 words overall were represented in the top 10 words in all of the school age groups. The three words that were not represented consistently were *is* (ranked 11 in School Age 4), *we* (ranked 14 in School Age 1), and *was* (ranked 22 in School Age 1). Across the four school age groups, some words received similar rankings and others did not. For the top 10 words, the average ranking range (highest ranking for a word – lowest ranking for a word) across the school age groups was 4.9. This increased dramatically for the second set of 10 words to 21.1. The words that had the most disparate rankings were the words *then*, *one*, *they*, *am*, *when*, *so*, *love*, and *said*. Six of these words (*then*, *one*, *they*, *when*, *so*, and *said*) were used very infrequently by children in School Age 1, and two (*am* and *love*) were used very infrequently by children in School Age 4.

Most Frequent Words – School Ages Combined

For the next analysis, the school ages were combined and the writing samples generated by all of the children in North Carolina were compared to those generated by all of the children in New Zealand. This analysis revealed more similarities than it did differences. For instance, 9 of the top 10 words overall were represented in the top 10 words in both countries. In addition, 15 of the top 20 words overall were represented in the top 20 words in both countries. Many of the words received similar rankings, but some did not. For instance, the word *see* was ranked 14 in North Carolina and 90 in New Zealand.

Most Frequent Words – Countries Separated

When the school ages from the two countries were examined separately, there were a number of disparities. The word *he*, for example was used much more frequently by children in School Age 1 in New Zealand (rank = 32) than it was by children in the same school age group in North Carolina (rank = 190). In addition, the word *is* was used much more frequently by children in School Age 4 in North Carolina (rank = 11) than it was by children in the same school age group in New Zealand (rank = 108).

Most Frequently Occurring Multiword Sequences

The 25 most frequently occurring two- and three-word sequences are presented for the school ages with the countries combined (Appendices C6 and C7), for the countries with the school ages combined (Appendices C8 and C9) and for the school ages in North Carolina (Appendices C10 and C11) and in New Zealand (Appendices C12 and C13) separated out. Appendices C14, C16, C18, and C20 document the usage patterns of the 25 two-word sequences that were used most frequently overall and Appendices C15, C17, C19, and C21 present the same information with reference to three-word sequences.

Significant variability was evident in the use of multiword sequences. One example of this variability was the sequence *I see*. This sequence obtained a ranking of 1 in School Age 1, 170 in School Age 2, and 7315 in School Age 3. It was not used at all in School Age 4. When the writing samples from the two countries were examined separately with the school ages combined, it was apparent that the patterns of use were very different in the two countries. Nine of the two-word sequences and sixteen of the three-word sequences that appeared in the top 25 rankings for North Carolina did not appear in the top 25 rankings for New Zealand. The sequence *I see* again illustrates the variability. The ranking for *I see* was 2 in North Carolina and 768 in New Zealand. As might be expected, the patterns of use for *I see* across the school ages within the two countries were also very different. In North Carolina, the pattern was similar to that observed when the writing samples from the two countries were examined together. The rankings were as follows: 1 in School Age 1, 107 in School Age 2, and 5186 in School Age 3. As mentioned earlier, it was not used at all by children in School Age 4. The pattern for the children in New

Zealand was very different. The children in School Ages 3 and 4 in New Zealand did not use the sequence *I see* at all and the rankings for children in School Ages 1 and 2 were 162 and 3004 respectively.

Other examples of words that demonstrated extensive variability were the sequences *in the* and *it was fun*. The two-word sequence *in the* obtained rankings of 25 or less for all school ages in New Zealand and for School Ages 2, 3, and 4 in North Carolina. In contrast, the same sequence obtained a ranking of 587 for School Age 1 in North Carolina. The three-word sequence *it was fun* obtained rankings ranging from 8 to 582 in North Carolina and from 18 to 338 in New Zealand.

The usage patterns of the verb *go* also highlighted the variability that existed in the use of multiword sequences. Across the 10 most frequently occurring three-word sequences used by children in New Zealand, the words *go*, *going*, or *went* appeared in 7 sequences at School Age 1, 8 sequences at School Ages 2 and 3, and 3 sequences at School Age 4. Interestingly, these words were used much less frequently by children in North Carolina. In North Carolina, the words were not used at all in School Ages 1 and 2. They appeared 6 times at School Age 3, and 7 times at School Age 4. In contrast, the North Carolina children showed a preference for using the verb *like* in School Ages 1 and 2.

Some of the multiword sequences that were used with high frequency when all of the writing samples were analyzed collectively were not used with the same high frequency when the school age groups were examined separately. The overlap between the top 25 two-word sequences overall and the top 25 two-word sequences in each of the school age groups in North Carolina was as follows: 7 words in School

Age 1, 20 words in School Age 2, 19 words in School Age 3, and 10 words in School Age 4. The pattern in New Zealand was somewhat similar in that the greatest overlap was in School Age 2 (17 words) and School Age 3 (17 words) and the least overlap was in School Age 4 (4 words). However, the children in School Age 1 in New Zealand used substantially more two-word sequences (16 words) that overlapped with the top 25 overall than the children in North Carolina.

In School Ages 1 and 3 in New Zealand, 12 of the 25 most frequently occurring three-word sequences overlapped with the 25 most frequently occurring three-word sequences overall. The overlap for School Age 2 was 14 sequences, however, it dropped to only 3 sequences for School Age 4. In comparison, in North Carolina, there was less overlap for the School Age 1 children (5 sequences) and more overlap for the School Age 4 children (11 sequences). At School Ages 2 and 3 in North Carolina, 15 of the sequences appeared in the overall top 25 list.

Several of the multiword sequences that were used with high frequency overall were not used across all of the school age groups. These sequences are marked with the symbol * in Appendices C14-C21. For North Carolina, 5 of the two-word sequences (*I see*, *see a*, *is for*, *we are*, *then we*) and 16 of the three-word sequences (*I see a*, *went to the*, *are going to*, *we are going*, *is going to*, *I like the*, *I like my*, *we went to*, *I got a*, *going to be*, *going to have*, *there was a*, *me and my*, *I love my*, *it was a*, *I had a*) were not used by one or more of the school age groups. For New Zealand, 7 of the two-word sequences (*I like*, *I see*, *it is*, *see a*, *am going*, *is for*, *to go*) and 18 of the three-word sequences (*I see a*, *I am going*, am going to, *I like to*, *are going to*, *we are going*, *is going to*, *I like the*, *I like my*, *we went to*, *I have* *a*, *I got a*, *going to have*, *me and my*, *I love my*, *to go to*, *like to play*, *it was a*) were not used by one or more of the school age groups.

Semantics

Number of Different Semantic Themes

The mean number of different semantic themes was calculated for the countries with the school ages combined, and for the school ages and countries separated out. It is important to reiterate that the semantic analyses were only completed on 98 of the writing samples. These writing samples were selected by randomly choosing 98 children and then by randomly choosing one sample from each of those children. Instead of the unit of measurement being the child, as it was in the vocabulary analyses, the unit of measure for the semantic analyses was the writing sample. For this reason, weighting of number of writing days was not carried out.

When the school ages from the two countries were examined collectively, the number of different semantic themes increased as a function of school age. On average, the children in School Age 1 used 2.50 semantic themes per writing sample. This increased to 3.36 at School Age 2, 4.57 at School Age 3, and 5.29 at School Age 4.

Growth trajectories for the children in North Carolina and New Zealand were similar to those observed for the school ages when the two countries were combined. The mean number of semantic themes for children in School Ages 1-4 in New Zealand were 2.21, 3.64, 4.29, and 5.14 respectively. The children in North Carolina used slightly more semantic themes than the children in New Zealand in three of the four school ages (School Ages 1, 3, and 4).The children in School Age 1 in North

Carolina used 2.79 semantic themes. This increased to 3.07 at School Age 2, 4.86 and School Age 3, and 5.43 at School Age 4.

Analysis of Variance

A 3 X 2 analysis of variance (ANOVA) was conducted to examine school-age and country related differences in the number of different semantic themes used. Before conducting the analysis, the descriptive statistics were screened for problems such as out-of-range values, reasonable means and standard deviations, outliers, skewness, and kurtosis. No problems were detected. The assumption of homogeneity of variance was evaluated using Levene's test. The result of this test indicated that the distributions of errors within the groups were sufficiently homogeneous (p = .117).

The ANOVA indicated a significant main effect for school age, $F(3,90) = 16.660$, p = <.001. The main effect for country, however, was not significant, $F(1,90) = 0.514$, $p = 0.475$. Furthermore, there was no significant interaction between the two factors, $F(3,90) = 1.020$, $p = 0.387$.

Since the main effect for country was not significant, no further analysis for this variable was necessary. The results made it possible to conclude that there was no significant difference between the number of different semantic themes used by the children in North Carolina and the children in New Zealand. The main effect for school age, however, required further analysis.

Repeated contrasts were used to determine which of the school age groups were significantly different. Significant differences were identified between School Ages 1 and 2 (p = .026) and School Ages 2 and 3 (p = .002). There was no significant difference, however, between School Ages 3 and 4 (p =.126).

In summary, the results of the ANOVA indicated that there were no country related differences in the number of different semantic themes used. There were school age related differences, however. The children in School Age 3 used a greater number of different semantic themes than the children in School Age 2, and the children in School Age 2 used a greater number of semantic themes than the children in School Age 1. There was no significant difference between the children in School Age 3 and the children in School Age 4. In addition, there was no significant interaction between country and school age.

Types of Semantic Themes and Fields

Appendices C22–C30 provide frequency information for the eight semantic themes (*human form and function*; *activity and sensory*; *leisure*; *transport*; *fauna, flora, and elements*; *domestic setting*; *dimensions*; *institutions and the world*) examined in the PRISM analysis as well as for the 61 semantic fields subclassified within these themes. The appendices contain frequency information for the school ages when the countries were examined collectively and also when the countries were examined separately.

Types of Semantic Themes and Fields – Countries Combined

The collective analyses revealed that the children across the school ages used a wide variety of semantic fields. The only fields that were not used by children in at least one of the school age groups were the *smell* and *taste* fields in the *activity and sensory* theme, the *rail* and *water* fields in the *transport* theme, the *fish* field in the *fauna, flora, and elements* theme, the *tools* field in the *domestic setting* theme, and the *law*, *religion*, and *manufacture* fields in the *institutions and the world* theme.

Three semantic fields were used with high frequency (greater than 20 occurrences per 1000 words) by all of the school age groups. These fields were as follows: *social* and *relational* (*minor lexemes*), and *move* (*human form and function* theme). Other fields were used with high frequency by some of the school age groups and not by others. For instance, the children in School Ages 1 and 2 used the field *feel* (*activity and sensory* theme) 56 and 27 times per 1000 words respectively. In contrast, the children in School Ages 3 and 4 used this field much less frequently. There were only 10 occurrences per 1000 words in School Age 3, and 9 occurrences per 1000 words in School Age 4.

Most of the semantic fields exhibited fluctuating patterns of use. Some of the fields, however, were used with increasing or decreasing frequency across the school ages. The following fields were used with increasing frequency: *social* (*minor lexemes*), *body* (*human form and function* theme), *make*, *happen*, and *touch* (*activity and sensory* theme), and *quantity*, *measurement*, and *location* (*dimensions* theme). Three fields were used with decreasing frequency. These were the *relational* (*minor lexemes*) and the *feel* (*activity and sensory* theme) fields.

Types of Semantic Themes and Fields – Countries Separated

When the children in New Zealand were examined separately from the children in North Carolina, some similarities and differences were evident. Some of the semantic fields that were used with high frequency by children in one school age in New Zealand were not used with the same high frequency by children in the same school age in North Carolina and vice versa. For instance, the children in School Age 1 in New Zealand used the field *have* (*activity and sensory* theme) 47 times per 1000 words. The children in School Age 1 in North Carolina, however, did not use this field at all. Another field that was used very differently by the children in the two countries was the field *sight* (*activity and sensory* theme). There were 119 occurrences per 1000 words of this field in School Age 1 in North Carolina, and only 16 occurrences per 1000 words in School Age 1 in New Zealand.

As was observed in the combined analyses, many of the semantic fields had fluctuating patterns of use across the school ages. Some of the school age differences that were observed in the combined analyses were still apparent when the countries were examined separately. These were the increasing use of the *social* (*minor lexemes*) and the *make* and *happen* (*activity and sensory* theme) fields. The other school age differences were either not apparent at all or they were only apparent in one of the countries. For example, the increasing use of the *location* (*dimensions* theme) field was no longer observed, and the decreasing use of the *feel* (*activity and sensory* theme) field was only observed in North Carolina. Other school age differences were evident that were not observed when the countries were examined collectively. For instance, the *state* (*dimensions* theme) field was used with increasing frequency across the school ages in North Carolina, and the *shows* (*leisure* theme) field was used with decreasing frequency across the school ages in New Zealand.

Syntax and Morphology

Mean Number of T-Units per Writing Sample and Mean Length of T-Unit

The mean number of t-units per writing sample and the mean length of t-unit were calculated for the countries with the school ages combined, and for the school ages and countries separated out. The syntactic and morphological analyses were completed on the same 98 randomly selected writing samples that were analyzed in the previous section. Again, instead of the unit of measurement being the child, as it was in the vocabulary analyses, the unit of measurement for the syntactic and morphological analyses was the writing sample. For this reason, weighting of number of writing days was not carried out.

When the school ages from the two countries were examined collectively, the mean number of t-units per writing sample increased as a function of school age. On average, the children in School Age 1 generated 2.86 t-units per writing sample. This increased to 4.46 at School Age 2, 7.89 at School Age 3, and 12.14 at School Age 4. The mean length of t-unit increased from School Ages 1-3 with an average of 5.26 words in School Age 1, 7.28 in School Age 2, and 7.69 in School Age 3. Interestingly, it then decreased to 6.44 words in School Age 4.

Similar patterns (see Figure 4.5) of increasing writing sample length were evident when the school ages from the two countries were examined separately. For the children in North Carolina, the mean number of t-units per writing sample increased as follows: 3.82 t-units in School Age 1, 6.83 in School Age 2, 10.43 in School Age 3, and 13.71 in School Age 4. The children in School Ages 1-4 in New Zealand tended to generate writing samples that included fewer t-units than the children in North Carolina. In fact, the writing samples generated by children in School Ages 3 and 4 in New Zealand were similar in mean number of t-units to those generated by children in School Ages 2 and 3 in North Carolina. The New Zealand children in School Ages 1-4 wrote an average of 1.91, 2.43, 5.36, and 10.57 t-units respectively.

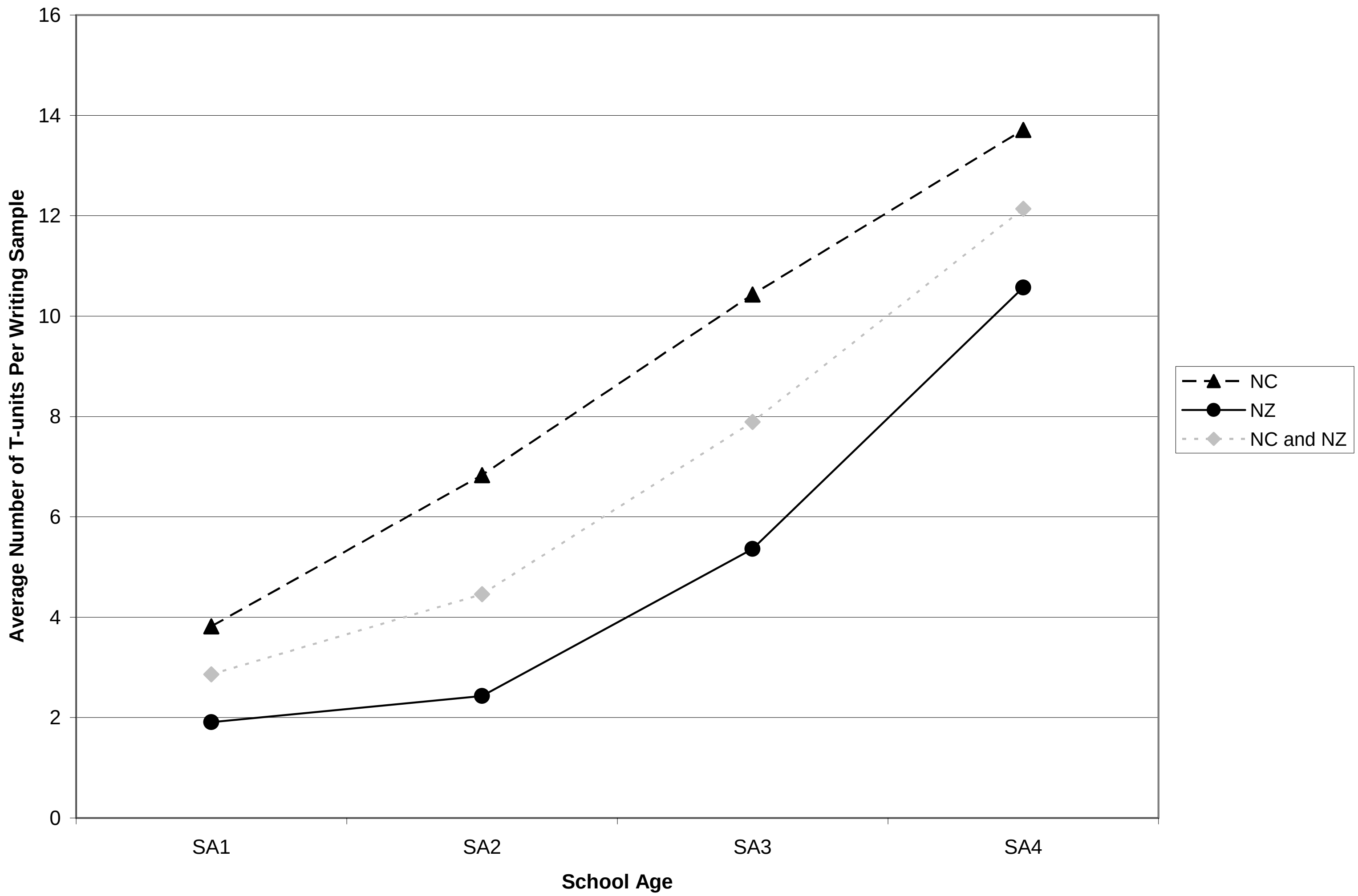

Figure 4.5 Average number of t-units per writing sample for children in School Ages 1-4 in North Carolina, New Zealand, and North Carolina and New Zealand combined.

The pattern of t-unit length when the countries were examined separately (see Figure 4.6) was also similar to the pattern observed when the countries were examined collectively with increases from School Ages 1-3 and then a decrease in School Age 4. For the children in North Carolina, the mean length of t-unit was 4.63 words in School Age 1, 5.79 in School Age 2, 6.37 in School Age 3, and 6.02 in School Age 4. The children in New Zealand tended to write longer t-units. The mean length of t-unit for the children in New Zealand was 5.89 words in School Age 1, 8.56 in School Age 2, 9.00 in School Age 3, and 6.87 in School Age 4.

Stage I Analyses

The complexity and types of Stage I (single word) structures that were used were examined for the countries combined and for the countries separated. When the countries were combined, the mean percentage of t-units including a Stage I structure was 0 in School Age 1. This increased to 5.69 in School Age 2, 6.89 in School Age 3, and 11.63 in School Age 4. When the countries were separated, the same pattern of increasing use was evident for the children in New Zealand. The mean percentages of t-units including a stage I structure in School Ages 1-4 in New Zealand were 0, 0, 8.57, and 9.41 respectively. In North Carolina, the pattern was different. The mean percentage increased from 0 in School Age 1 to 11.37 in School Age 2. It then decreased to 5.22 in School Age 3 before increasing again to 13.85 in School Age 4.

The different types of Stage I structures used were also examined (see Appendix C31). When the countries were examined collectively, the Stage I structures used in at least one of the school age groups were *Minor Vocative*, *Minor Other*, *V* (*Command*), *V* (*Statement*) and *Other* (see Appendix B17 for definitions

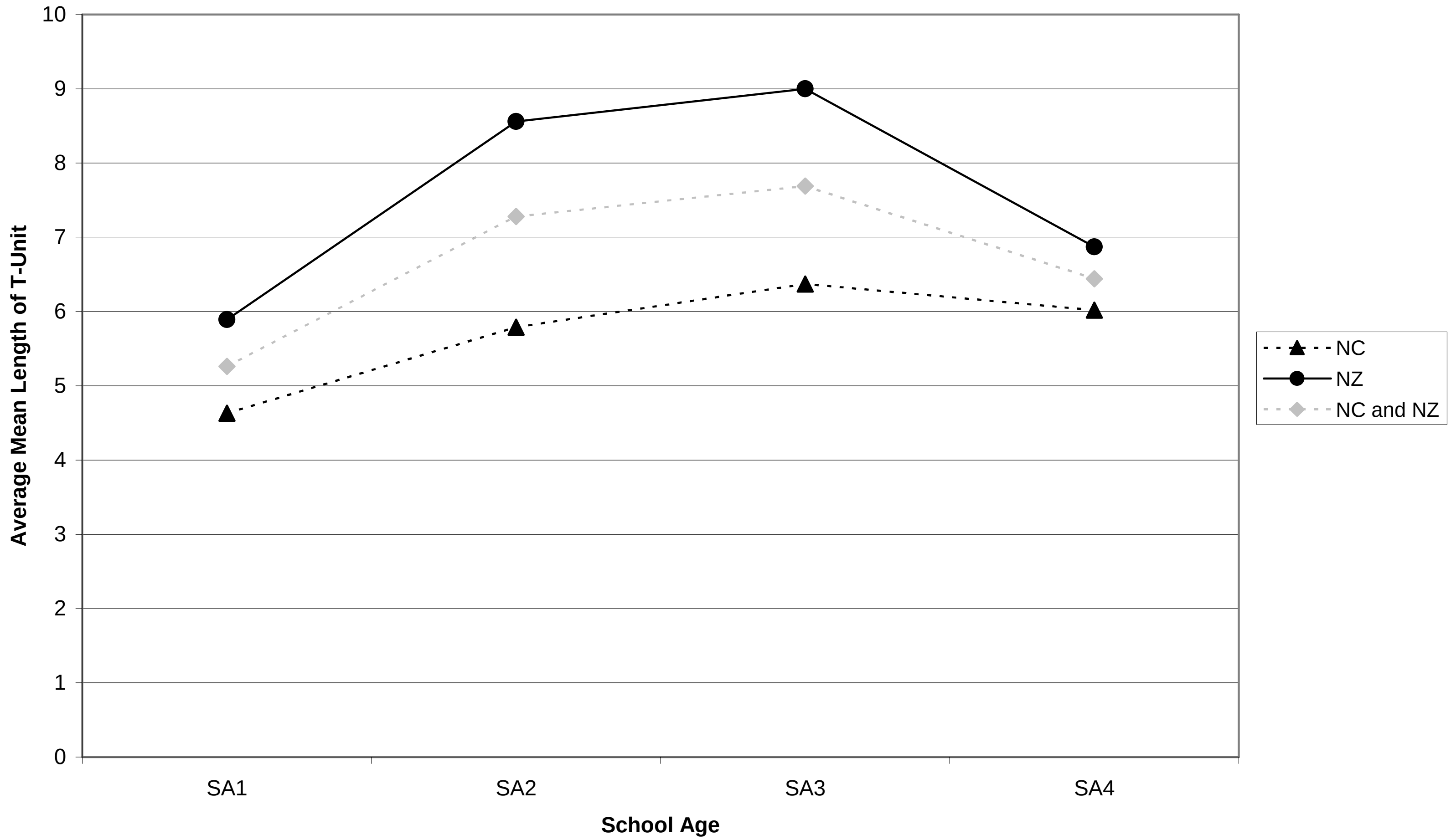

Figure 4.6 Average mean length of t-unit in words for children in School Ages 1-4 in North Carolina, New Zealand, and North Carolina and New Zealand combined.

and examples of Stage I LARSP structures). Three structures, *Minor Response*, *Q*, and *N*, were not used at all. *Minor Other* was the structure used most frequently by children in School Ages 2 to 4. The children in School Age 1 did not use any Stage I structures.

When the countries were examined separately, three Stage I structures were used in at least one of the school age groups in both countries. These structures were *Minor Vocative*, *Minor Other*, and *V* (*Command*). The *V* (*Statement*) structure was used in one of the school age groups in New Zealand and the *Other* structure was used in three of the school age groups in North Carolina. *Minor Other* was the most frequently used Stage I structure in School Ages 2, 3, and 4 in North Carolina and School Ages 3 and 4 in New Zealand. The children in School Age 1 in North Carolina and School Ages 1 and 2 in New Zealand did not use any Stage I structures.

Clause Level Analyses

The clause level analyses included an examination of the complexity and types of clause structures that were used, and the calculation of the summary measure, mean clausal complexity. The analyses were conducted for the school ages with the countries combined, and also for the school ages and countries separated out.

Clause Stages – Countries Combined

When the countries were combined, some general trends in clause-level complexity were apparent. As illustrated in Figure 4.7, clause structures from all the four clause stages were used across the school age groups. The clause structures that tended to be used most frequently were from Stage III. On average, 65% of the clause structures used in School Age 1 were from Stage III. This decreased to 48%

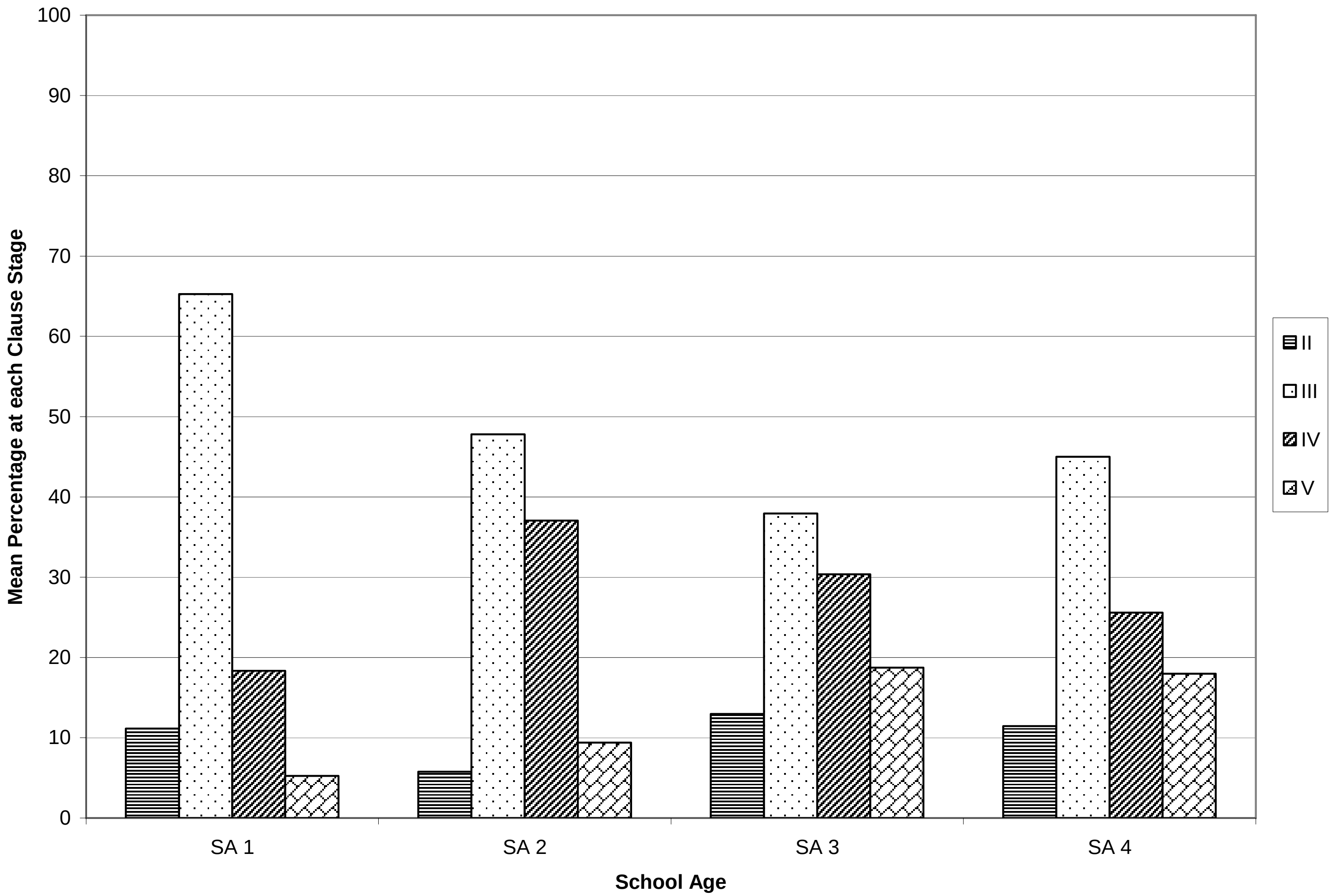

Figure 4.7 Mean percentage of clause structures at each clause stage for children in School Ages 1-4 in North Carolina and New Zealand combined.

in School Age 2 and 38% in School Age 3, before increasing to 45% in School Age 4. Stage II clause structures had fluctuating patterns of use. The mean percentage for Stage IV clause structures doubled from School Age 1 to School Age 2 but then decreased in School Ages 3 and 4. The mean percentage for Stage V clause structures increased from School Ages I to 3, but then decreased slightly in School Age 4. Interestingly, clause structures from the two most advanced stages, Stages IV and V, were typically not used with the highest frequency by children in School Age 4. Stage IV clause structures had the highest mean percentage of use in School Age 2, and Stage V clause structures had the highest percentage of use in School Age 3.

Clause Stages – Countries Separated

When the children in North Carolina and New Zealand were examined separately, some similarities and differences were evident (see Figure 4.8). In North Carolina, all of the school age groups used Stage II to V clause structures. The pattern was the same for School Ages 3 and 4 in New Zealand, however School Age 1 in New Zealand used Stage II to IV clause structures and School Age 2 used Stage III to V clause structures. On average, Stage III clause structures were used most frequently by children in all of the school ages in North Carolina and School Ages 1, 3, and 4 in New Zealand. However, in School Age 2 in New Zealand, the children tended to use stage IV clause structures most frequently.

The patterns of use of the two most advanced stages also highlighted some similarities and differences between the two countries. Stage IV clause structures had the highest mean percentage of use in School Age 2 in New Zealand and School Age 3 in North Carolina. Stage V clause structures had the highest mean

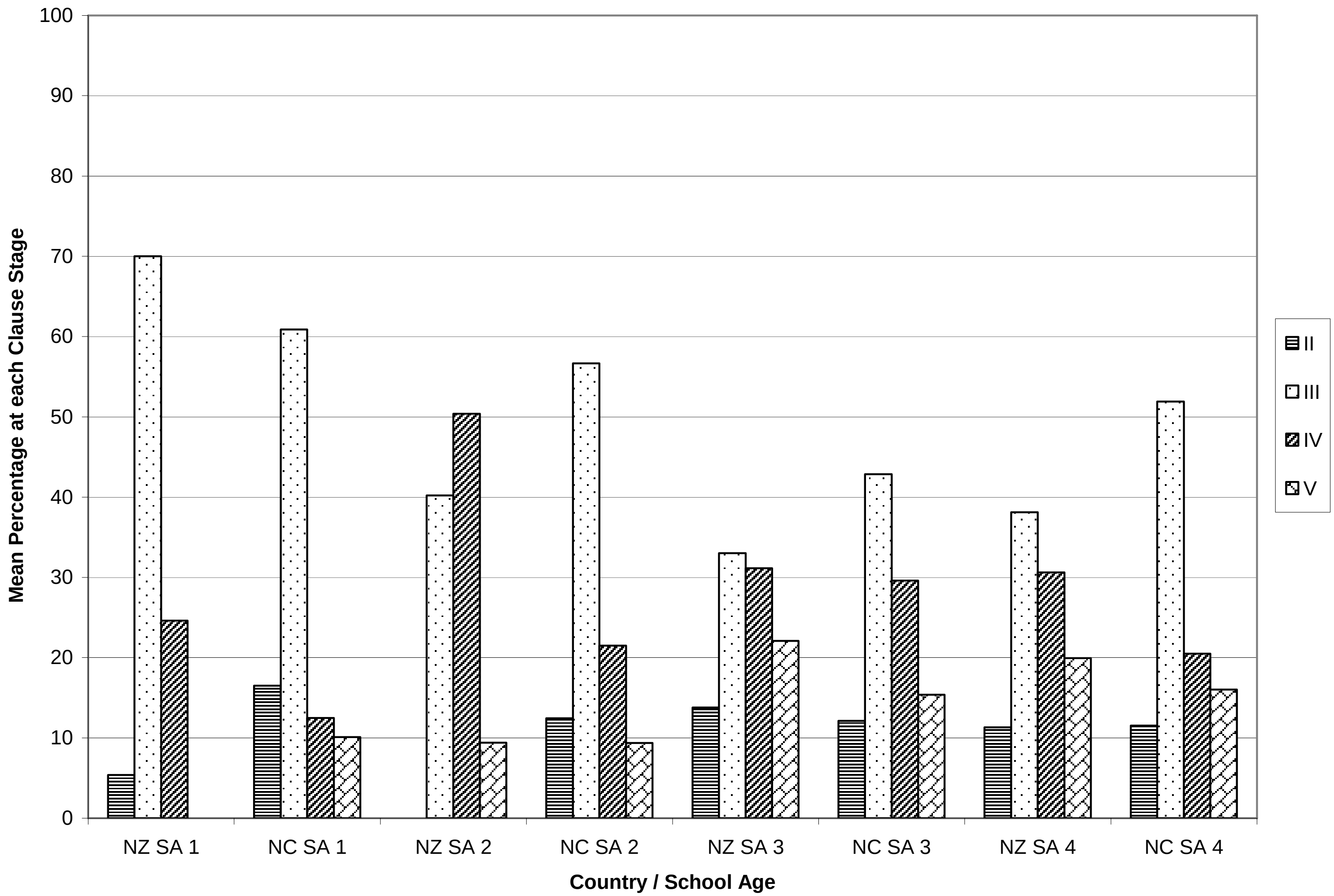

Figure 4.8 Mean percentage of clause structures at each LARSP stage for children in School Ages 1-4 in North Carolina and New Zealand.

percentage of use in School Age 3 in New Zealand and School Age 4 in North Carolina.

Clause Types – Countries Combined

The different clause types used within each LARSP stage were also examined (see Appendices C32-C35). When the countries were combined, only 2 of the 10 Stage II clause types were not used: *SO* and *Other* (see Appendices B18-B21 for definitions and examples of all LARSP clause types). In School Ages 1 to 3, the most frequently used clause type was *SV*. In School Age 4, two clause types were used most frequently: *SV* and *VO*. The Stage III clause types that were used most frequently varied significantly across the school ages. In School Age 1, the most frequently used clause type was *SVO*. In School Age 3, it was *SVA* and in School Age 4, it was *SVC*. In School Age 2, two clause types were used most frequently: *SVC* and *SVO*. The only stage III clause types that were not used were *Do XY* and *Neg XY*.

In Stage IV, the only clause types that were not used were *VS(X)*+ and *Tag*. *SVOA* was used most frequently by children in School Ages 1, 2, and 4, and *Other* was used most frequently by children in School Age 3. Of the 14 Stage V clause types, 7 clause types were used and 7 were not used. The most frequently used clause type in School Ages 1 and 2 was *Sub A 1*. In School Ages 3 and 4, the most frequently used clause type was *PM Cl 1*.

Clause Types – Countries Separated

When the children in North Carolina were examined separately from the children in New Zealand, similar trends in the types of clause structures were apparent. Across the school age groups in both countries, the most frequently used

Stage II clause type was *SV*. The most frequently used Stage III clause type differed depending on the country and school age. There were three clause types that were used most frequently: *SVC* (North Carolina School Age 4, New Zealand School Age 2), *SVO* (North Carolina School Ages 1 and 2, New Zealand School Ages 1, 3, and 4), and *SVA* (North Carolina School Age 3, New Zealand School Age 1).

Apart from the frequent usage of the Stage V clause type *Sub O*, the usage patterns for Stage IV and V clause types were almost identical to those observed when the countries were examined collectively. *SVOA* (North Carolina School Ages 2 and 4, New Zealand School Ages 1, 2, and 3) and *Other* (North Carolina School Age 3, New Zealand School Age 4) were the most frequently used Stage IV clause types, and *Sub A 1* (North Carolina School Ages 1, 3, and 4, New Zealand School Ages 2 and 4), *Sub O* (North Carolina School Age 2), and *PM Cl 1* (North Carolina School Age 3, New Zealand School Age 4) were the most frequently used Stage V clause types.

Clausal Complexity

The mean clausal complexity scores for the two countries combined revealed that clausal complexity increased from School Age 1 (M = 3.18) to School Age 2 (M = 3.50) to School Age 3 (M = 3.55), but that it then decreased in School Age 4 (M = 3.50). The greatest growth occurred between School Ages 1 and 2. The mean scores for all of the school age groups were between 3.18 and 3.55 providing further evidence of the high prevalence of Stage III clause structures.

Growth trajectories for the children in North Carolina mirrored those for the school ages when the two countries were combined. The mean clausal complexity for the children in School Ages 1-4 in North Carolina were 3.16, 3.28, 3.48 and 3.41

respectively. The children in New Zealand exhibited a different growth trajectory when examined separately. Their mean clausal complexity scores increased from 3.19 in School Age 1, to 3.69 in School Age 2, but then decreased to 3.61 in School Age 3, and 3.59 in School Age 4. The mean clausal complexity scores for the children in New Zealand were slightly higher than those in North Carolina across all of the school ages. The New Zealand scores in School Ages 2, 3, and 4 fell above 3.5 indicating a higher usage of Stage IV and V clause structures.

Phrase Level Analyses

The phrases that the children generated were analyzed according to their complexity and type. The summary measure, mean phrasal complexity, was also calculated. Again, the analyses were conducted for the four school ages within and across countries.

Phrase Stages

The patterns of complexity across the school ages were remarkably similar when the analyses were conducted with the two countries combined (see Figure 4.9). Across all of the school age groups, Stage III phrases tended to be used most frequently, followed by Stage II, and finally Stage IV. All of the stages had mild fluctuations in their mean percentage of use. There were no clear school age related differences.

The analyses conducted with the two countries separated (see Figure 4.10) revealed very similar patterns of complexity. In both of the countries, the order of mean percentage of use from most to least for all of the school age groups was Stage III, Stage II, and then Stage IV. Again, all of the stages fluctuated mildly in their mean percentage of use. The only obvious school age-related difference was a

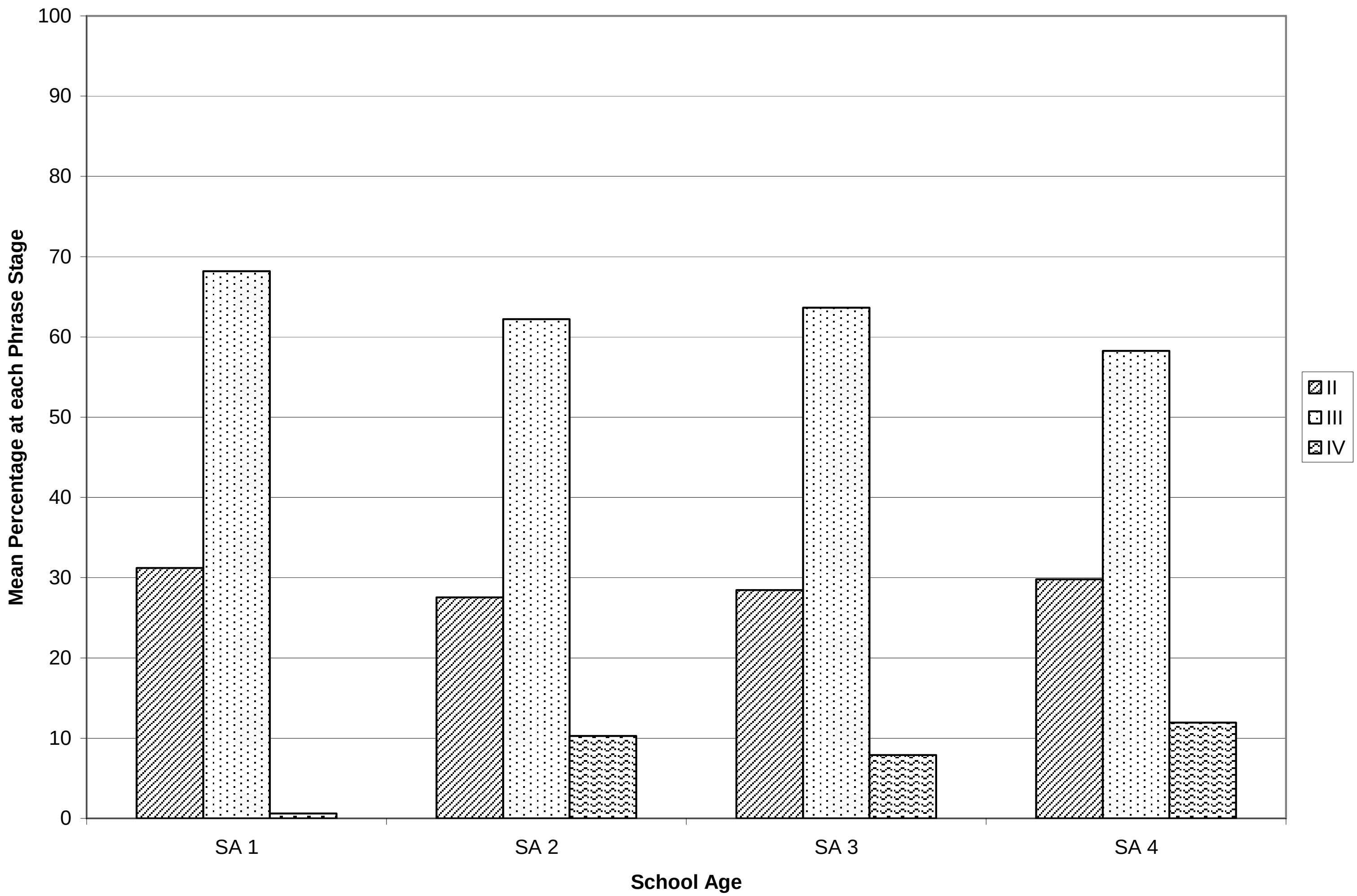

Figure 4.9 Mean percentage of phrase structures at each LARSP stage for children in School Ages 1-4 in North Carolina and New Zealand combined.

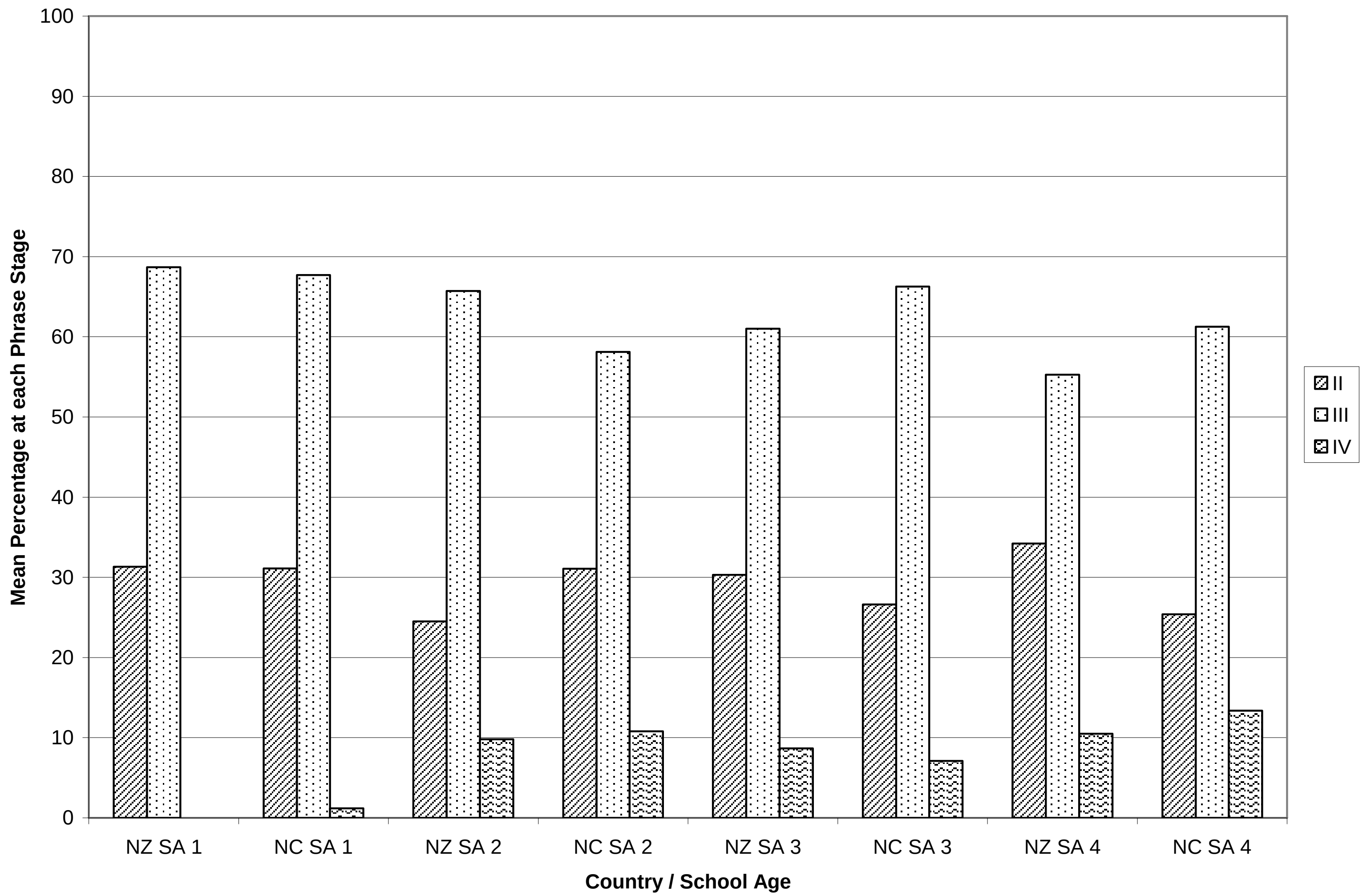

Figure 4.10 Mean percentage of phrase structures at each LARSP stage for children in School Ages 1-4 in North Carolina and New Zealand.

decrease in the use of Stage III phrases in New Zealand. Interestingly, the pattern of use at School Age 1 was almost identical for the two countries. The only difference was that the children in New Zealand did not use any Stage IV phrases, whereas some of the North Carolina children used a few.

Phrase Types

The phrase types used within each LARSP stage were also examined (see Appendices C36-C38). When the countries were combined, all of the Stage II phrase types were used by children in all of the school age groups, all of the Stage III phrase types were used by children in at least one of the school age groups, and all but one (*cX*) of the Stage IV phrase types were used by children in at least one of the school age groups (see Appendices B22-B24 for definitions and examples of all LARSP phrase types). Across all of the school age groups, the most frequently used Stage II and Stage III phrase types were *DN* and *Pron-P* respectively. For Stage IV, the most frequently used phrase types were *XcX* for School Ages 1, 2, and 3, and *NPPrNP* for School Age 4.

When the countries were separated, the patterns for Stage II were similar with the most frequently used phrase type being DN across all groups except for North Carolina School Age 3. The children in North Carolina School Age 3 used the PrN phrase type most frequently instead. All of the groups did not use every phrase type. *AdjN*, *NN*, *VPart*, and *IntX* were used by some groups and not by others. As was observed in the combined findings, all of the phrase types in Stages III and IV were used by children in at least one of the groups except for *cX* in Stage IV. The most frequently used Stage III phrase type was *Pron-P* for all of the groups. For Stage IV, the most frequently use phrase type differed depending on the country and school age. It was *XcX* for School Age 1 in North Carolina and School Ages 2 and 3 in New Zealand, *NPPrNP* for School Age 4 in New Zealand, and *Other* for School Ages 2, 3, and 4 in North Carolina.

Phrasal Complexity

The mean phrasal complexity scores for the two countries combined indicated that phrasal complexity increased from School Age 1 (M = 2.69) to School Age 2 (M = 2.83), but then it dropped slightly in School Age 3 (M = 2.79), before increasing again in School Age 4 (M = 2.82). The greatest growth occurred between School Ages 1 and 2. The mean scores for all of the school age groups were between 2.69 and 2.83. This confirms the finding that there was a high prevalence of Stage III phrase structures, and that there were a greater number of Stage II phrase structures than there were Stage IV phrase structures.

When the two countries were examined separately, it was apparent that the growth trajectories of the children in North Carolina and the children in New Zealand were different. In North Carolina, phrasal complexity increased across the school ages from 2.70 in School Age 1 to 2.80 in School Age 2, 2.81 in School Age 3, and 2.88 in School Age 4. In New Zealand, phrasal complexity increased from 2.69 in School Age 1 to 2.85 in School Age 2. It then decreased, however, to 2.78 in School Age 3 and to 2.76 in School Age 4. The mean phrasal complexity scores for the children in New Zealand and North Carolina were equivalent in School Age 1. In School Age 2 the scores for the children in New Zealand were slightly higher than those in North Carolina, and in School Ages 3 and 4, the scores for the children in North Carolina were slightly higher then those in New Zealand. In both countries, all of the scores fell above 2.5 indicating a high usage of Stage III phrase structures.

Word Level

The usage patterns for the 14 bound morphemes (see Appendix B25 for definitions and examples of all bound morphemes) analyzed at the word level were examined for the countries combined, and also for the countries separated out.

Bound Morpheme Use – Countries Combined

The results of the combined analyses revealed that the use of bound morphemes increased as a function of school age. In School Age 1, 10% of the total words used contained a bound morpheme. This increased to 14% in School Age 2, 20% in School Age 3, and 22% in School Age 4. The children in School Age 3 were the only group that used all 14 types of bound morpheme. The children in School Age 1 used only 5 *(-ing*, *pl*, *-ed(reg)*, *-ed (irreg)*, and *3s (irreg)*). The children in School Age 2 used all except three (*–est*, *-er*, *-ly*) and the children in School Age 4 used all except one (*-est*).

The most frequently used bound morphemes differed across the school age groups (see Figure 4.11). In School Ages 1, 2, and 4, the most frequently used bound morpheme was the irregular simple past tense form (*-ed (irreg)*). In School Age 4, however, it was the irregular third-person singular present tense form (*3s (irreg)*). Other frequently used morphemes included the present progressive form (*–ing*, 22% in School Age 1), the plural form (*pl*, 24% in School Age 1, 17% in School Age 2, 19% in School Age 3, and 24% in School Age 4), and the regular simple past tense form (*-ed (reg)*, 14% in School Age 4).

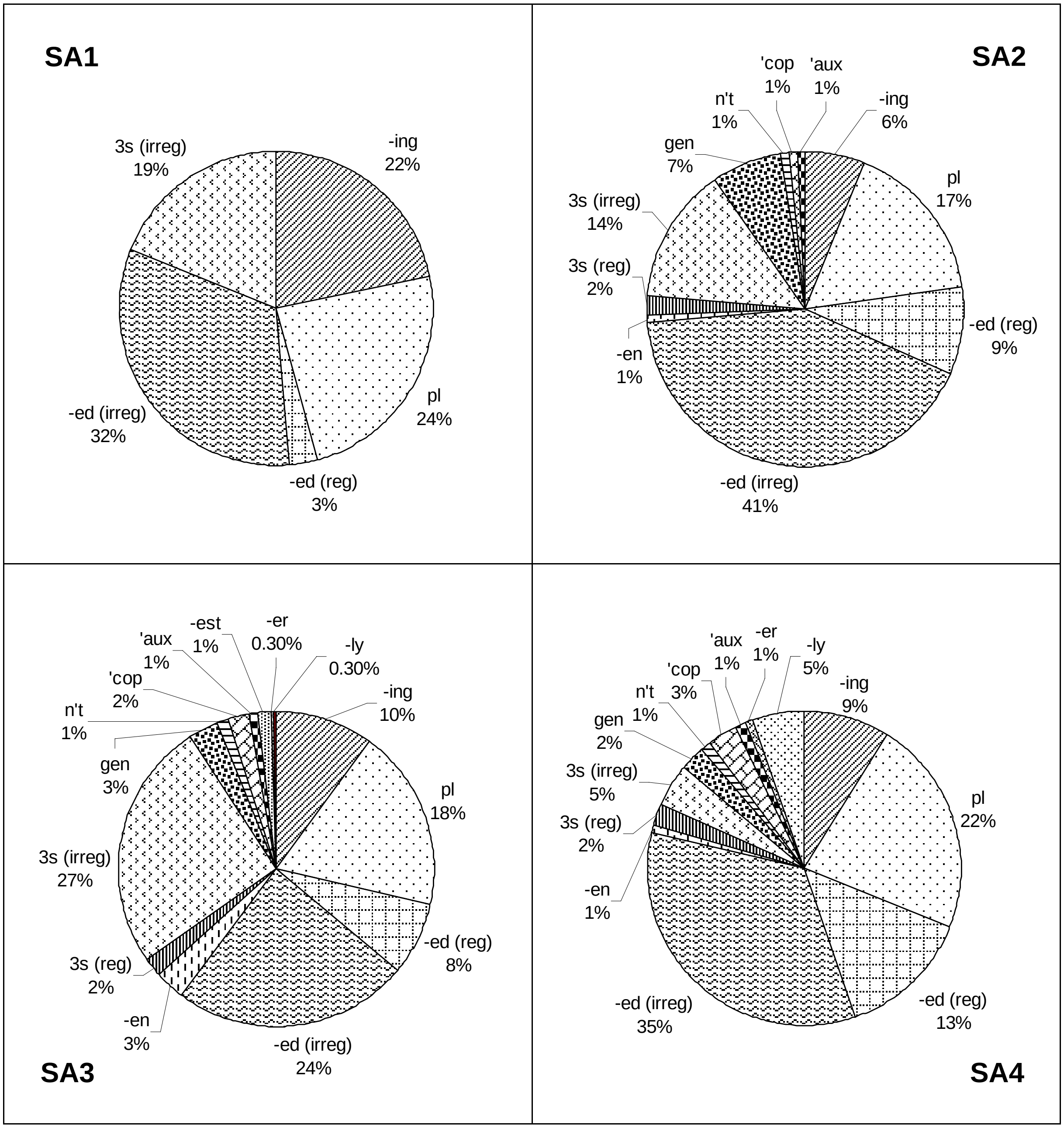

Figure 4.11 Usage patterns for bound morphemes in School Ages 1-4 in North Carolina and New Zealand combined.

Bound Morpheme Use – Countries Separated

The usage patterns for the children in North Carolina and the children in New Zealand were markedly different (see Figures 4.12 and 4.13). In North Carolina, the pattern was similar to that observed in the combined analysis with the children in each of the advancing school ages using a greater percentage of bound morphemes. For these children, the percentage of total words containing a bound morpheme was 5% in School Age 1, 15% in School Age 2, 20% in School Age 3, and 21% in School Age 4. In New Zealand, the percentage of total words containing a bound morpheme was 20% in School Age 1. This was much higher than the 5% observed in North Carolina. Interestingly, the percentage of bound morphemes used in New Zealand then dropped to 13% in School Age 2, before increasing again to 18% in School Age 3 and 24% in School Age 4.

In School Age 1, the North Carolina children used 4 different types of bound morpheme and the New Zealand children used 5. The simple past tense verb form (-*ed (reg)*) was used by the children in New Zealand, but was not used by the children in North Carolina. The type used most frequently by children in School Age 1 in New Zealand was the irregular past tense form (*-ed (irreg)*). In contrast, the type used most frequently by children in the same school age group in North Carolina was the irregular third-person singular present tense form (*3s (irreg)*).

The children in School Age 2 in North Carolina used 10 different types of bound morpheme. They used 3 types that were not used at all by the children in New Zealand (*-en*, *n't*, and *'cop*). The children in New Zealand used 8 different types,

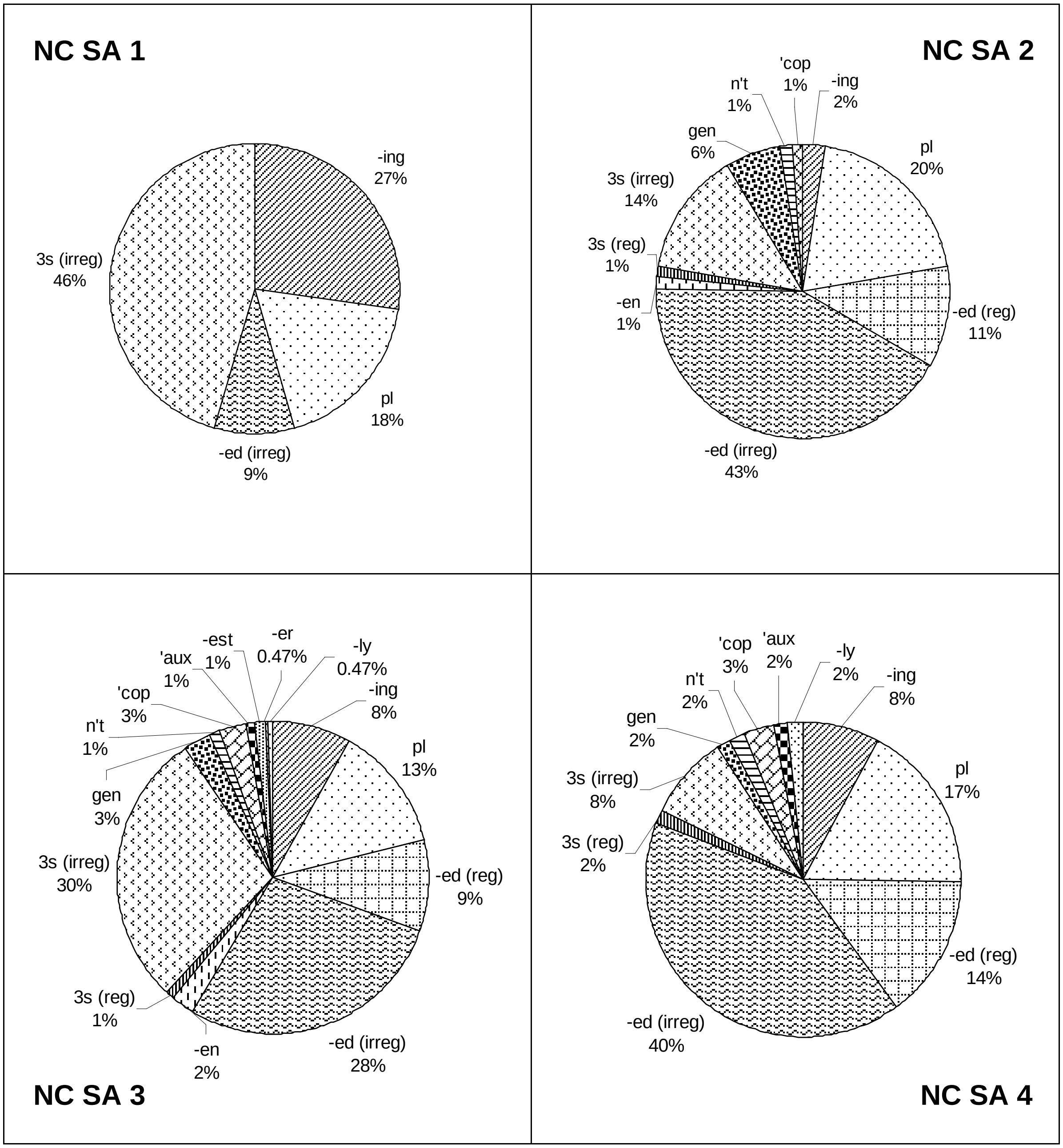

Figure 4.12 Usage patterns for bound morphemes in School Ages 1-4 in North Carolina.

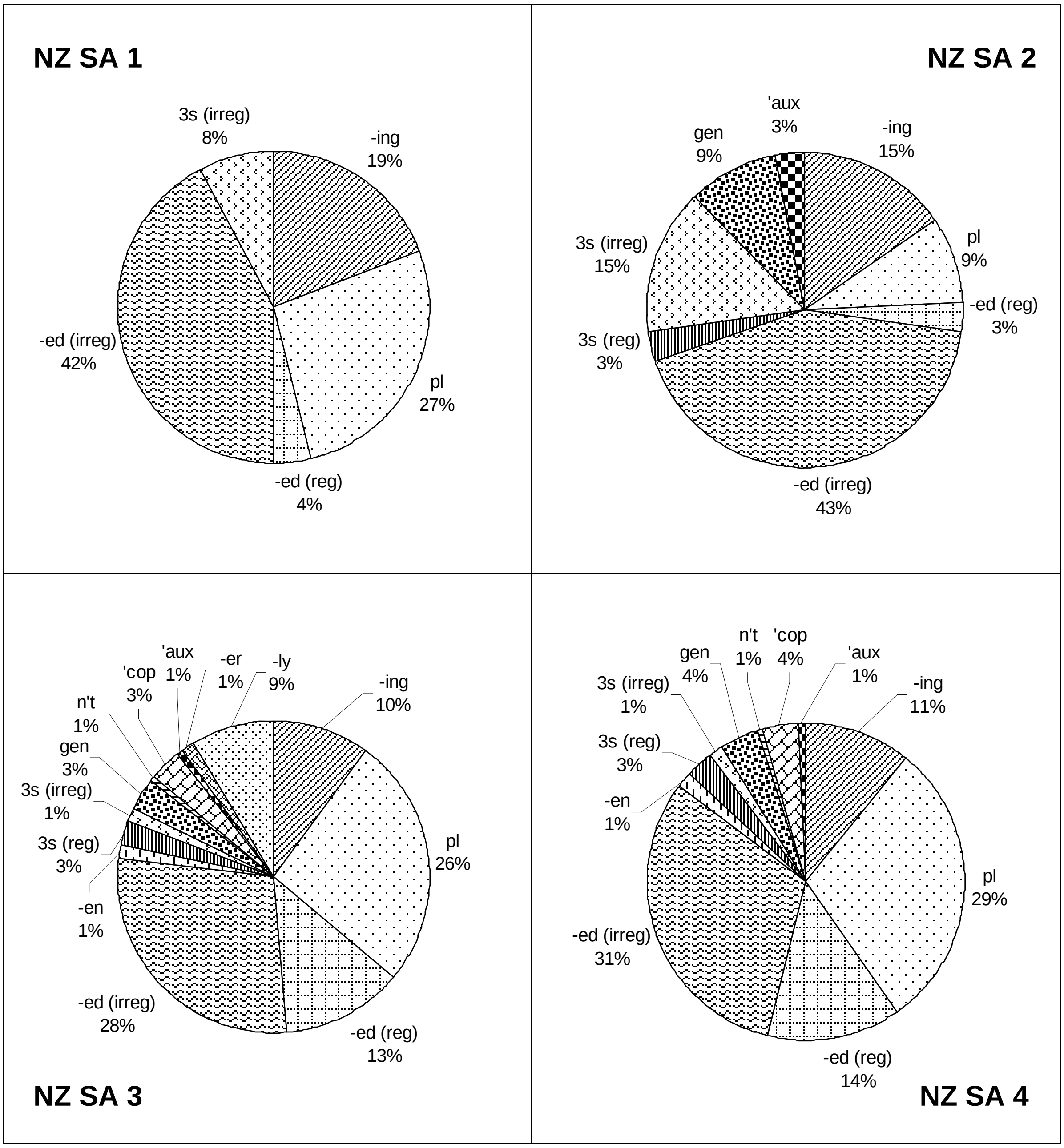

Figure 4.13 Usage patterns for bound morphemes in School Ages 1-4 in New Zealand.

one of which (*‘aux*) was not used by the children in North Carolina. In both North Carolina and New Zealand, the type used most frequently by children in School Age 2 was the irregular simple past tense form (*-ed (irreg)*).

In School Age 3, the children in North Carolina used all 14 types of bound morpheme. The children in New Zealand used 11 types. They did not use the contracted auxiliary (*‘aux*), the comparative form (*-er*), or the adverb form (*-ly*). The bound morpheme that was used with the highest frequency in North Carolina was the irregular third-person singular present tense form (*3s (irreg)*). In New Zealand, the bound morpheme that was used with the highest frequency was the plural form (*pl*).

The children in School Age 4 in North Carolina used 11 different types of bound morpheme and the children in New Zealand used 13 different types. The children in North Carolina did not use the past participle form (*-en*) or the comparative form (*-er*). The children in both countries did not use the superlative form (*-est*). The type used most frequently by children in School Age 4 in both countries was the irregular simple past tense form (*-ed (irreg)*).

Multivariate Analysis of Variance

The multivariate analysis of variance (MANOVA) procedure was conducted to examine school-age and country related differences in two of the syntactic measures: mean clausal complexity and mean phrasal complexity. Before conducting the analysis, the data were screened to check for violations of the MANOVA assumptions (e.g., normality, homogeneity of variance, multicolinearity, and singularity). The mean clausal complexity variable exhibited problems with normality (negatively skewed). The Shapiro-Wilk test was significant (p <.001) for the children in School Age 1 in New Zealand. Efforts to transform the data did not result in a normal distribution. As a result, the MANOVA was run for children in School Ages 1-4 in North Carolina, but only for children in School Ages 2-4 in New Zealand.

Using Pillai's Trace criterion, the main effects for school age, $F(6,150) = 1.396$, $p = .220$, and for country, $F(2,74) = 2.710$, $p = .073$ were not significant. Furthermore, there was no significant interaction between the two factors, $F(4,150) = .966$, $p = 0.428$. Even though the main effects were not significant, the repeated contrasts for the school age variable were still examined since they were planned a priori and when "the analyst has planned specific comparisons across the categories of an independent variable, the outcome of the omnibus test is typically of no interest or consequence in itself " (Spicer, 2005, p. 157).

Repeated contrasts for the school age variable identified a significant difference in mean phrasal complexity between School Ages 1 and 2 ($p = .025$). There were no significant differences, however, between School Ages 2 and 3 ($p = .551$) and between School Ages 3 and 4 ($p = .662$). There were no significant differences in mean clausal complexity between School Ages 1 and 2 ($p = .191$), School Ages 2 and 3 ($p = .572$), and School Ages 3 and 4 ($p = .724$).

In summary, the results of the MANOVA indicated that there were no country related differences in mean clausal complexity or mean phrasal complexity. There were school-age related differences, however, in mean phrasal complexity. On average, the children in School Age 2 used more complex phrase structures than the children in School Age 1. There were no significant differences in mean phrasal complexity between the children in School Ages 2 and 3, and the children in School

Ages 3 and 4. In addition, there were no significant differences between any of the school age groups in mean clausal complexity and there was no significant interaction between country and school age.

CHAPTER 5: DISCUSSION

This study identified a number of school age and country-related differences in the vocabulary words, semantic themes, and syntactic and morphological structures used by typically developing beginning writers when they compose about self-selected topics. The nature and magnitude of these differences were examined though the generation of descriptive statistics and graphs, and through the application of statistical tests. In this chapter, some of the key findings will be discussed. Particular emphasis will be placed on discussing the implications that the findings have for teaching and supporting children with CCN.

Implications for Children with Complex Communication Needs

Maximizing Efficiency with Core Vocabulary

One of the most important goals for speech-language pathologists, teachers, and other professionals who work with children with CCN is to help the children they support to develop the ability to communicate both efficiently and precisely. In order to achieve this goal, members of AAC teams must make thoughtful decisions about vocabulary selection and language representation. The findings of the current study provide research-based evidence that can be used to help guide AAC teams as they make these important decisions.

In accordance with other studies that have examined the vocabulary of typically developing children (e.g., Beukelman et al., 1989; McGinnis & Beukelman, 1989), this study found that a relatively small core vocabulary is needed to represent significant portions of the language samples produced by typically developing children. In this study, the top 163 words accounted for 70% of the total words used and the top 39 words accounted for 50% of the total words used. These figures are very similar to the figures obtained in the only other study published in the field of AAC that has analyzed writing vocabulary (McGinnis & Beukelman, 1989). In McGinnis and Beukelman's study (1989) which examined the writing samples generated by children in Grades 2-6 given controlled topics, 161 words accounted for 70% of the total sample and 46 words accounted for 50% of the total sample. The identification of a relatively small core vocabulary has important implications for helping children with CCN to become effective AAC communicators. For instance, if there are only 39 words that account for 50% of what children write, then AAC teams can focus on developing children's efficient communication by providing them with fast and easy access to these words.

The most frequently occurring words in this study were compared to the most frequently occurring words in McGinnis and Beukelman's (1989) study. The comparison revealed that there were a number of words that occurred with high frequency in one study that did not occur with the same high frequency in the other study. McGinnis and Beukelman provided frequency information for vocabulary generated in letter writing activities and language arts assignments. The overlap between the top 50 words used in this study and the top 50 words used in these two writing activities was 62% for letter writing activities and 56% for language arts assignments. A total of 25 words (50%) appeared on all three lists.

McGinnis & Beukelman's (1989) study explored the vocabulary used across different language contexts. The current study adds to the research base by examining another language context, self-selected topics, and by exploring the differences that exist in the vocabulary used across school age groups and countries. What is evident from both of these studies, is that providing children with CCN with access to the most frequently occurring words overall, will allow them to express a large amount of what they want to say. If AAC teams develop core vocabularies that change over time taking into consideration a child's school age, country, and the language contexts within which the child communicates, then it is likely that children with CCN will be much closer to being able to meet all of their daily communication needs in an efficient manner.

Maximizing Efficiency with Multiword Sequences

The findings of this study suggest that some multiword sequences may be used with sufficiently high frequency to warrant their storage as whole units in AAC systems. The children in School Ages 1-4 in North Carolina used 19 two-word sequences that occurred at a frequency of greater than 5 per 1000 and the children in School Ages 1-4 in New Zealand used 7. This finding, while highlighting the frequent usage of some multiword sequences, also draws attention to the fact that the usage patterns for multiword sequences were different for the children in the two countries. The children in School Age 1 in North Carolina tended to use multiword sequences as simple sentence frames when generating their stories, e.g, *I see*, *I like*. The vocabulary analyses indicated that they used these multiword sequences upwards of 87 times per 1000 sequences. In contrast, the most frequently occurring two-word sequence in School Age 1 in New Zealand, *I am*, was only used 25 times per 1000 sequences. Multiword sequences were also used less frequently by children in School Ages 2-4 in both countries. These findings again suggest the importance of taking into consideration a child with CCN’s country and school age when making decisions about how best to store vocabulary in a child’s AAC system. For younger children in North Carolina, the findings suggest that access to frequently occurring two-word sequences would support efficient communication, while children in New Zealand of any age would receive limited benefit.

Understanding these country and school age differences was not in the scope of the current study, but it is highly likely that instruction had a direct influence on the findings. For example, the children in School Age 1 in North Carolina were from a school that has a reading/language arts program that relies heavily on easy-to-read little books with controlled vocabulary and predictable sentence frames. Certainly this experience reading books with a limited range of sentence frames could be responsible for the high incidence of those sentence types in the children’s writing.

Cross-Cultural Differences in Language Use

A comprehensive review of the literature suggests that the current study was the first to explore differences in the written language produced by children in two different countries. The language analyses carried out in this study identified some differences between the high frequency words and sequences used by children in North Carolina and those used by children in New Zealand. One example of this was the verb *see*. When the school ages were combined and the writing samples generated by all the children in North Carolina were compared to those generated by all of the children in New Zealand, the verb *see* was ranked 14 in North Carolina, but 90 in New Zealand.

This finding is particularly informative for New Zealand based AAC teams. There are very few, if any, AAC systems that are manufactured in New Zealand. Most of the systems that children receive are imported from other countries, particularly from the United States. When introducing one of these AAC systems to a child in New Zealand, it is likely that AAC teams will be concerned about the appropriateness of the vocabulary prestored in these systems. They may be concerned, for instance, that an AAC system manufactured in the United States says the word *sweater*, when children in New Zealand say *jumper*, or that it says the word *cookie* when children in New Zealand say *biscuit*. AAC teams will benefit from knowing that the differences observed in the fringe vocabulary used by children in the two countries are only part of the problem. This study suggests that there are important modifications to be made to some of the high frequency words as well; not because the children in the two countries use different lexemes, but more because the children exhibit different patterns of use. Dealing with country-related differences in core vocabulary in addition to fringe vocabulary will lead to greater efficiency and precision in AAC communication for children with CCN.

Representing Morphemes in Augmentative and Alternative Communication Systems

The word frequency scores generated through the vocabulary analyses can be used to inform decisions relating to language representation. In AAC systems, it is typical that symbols depicting free morphemes (e.g., go, run, shoe) are the symbols selected for display. As mentioned in Chapter 2, bound morphemes are often not available in children's AAC systems. However, when they are available, they are typically stored separately from free morphemes. Children with CCN are taught to affix bound morphemes to free morphemes when they wish to communicate different parts of speech and different syntactic forms (e.g., past tense verb form, plural noun form). In low-tech communication boards/books, the primary reason for this is space considerations. In more high-tech systems such as those that use dynamic display technology, this is because AAC teams want to increase communication efficiency; more symbols means more pages that children need to navigate through.

An important finding from the current study is the realization that free morphemes may occur less frequently than their derivatives. An example of this is the verb *go*. The words *go*, *going*, and *went* were all in the top 50 words used overall. However, the word *go* received an overall ranking of 39 which was lower than the rankings obtained for *went* and *going* which received rankings of 14 and 17 respectively. The rankings for *go*, *going*, and *went* were even more discrepant when the school ages and countries were examined separately. This finding suggests that AAC teams should consider whether it is always appropriate to represent language using free morphemes. For some children with CCN, it might be more efficient for them to remove bound morphemes when they don't need them, than it is for them to add them when they do. For beginning communicators, it may also be less cognitively challenging.

Supporting Semantic and Syntactic Complexity through Augmentative and Alternative Communication

The findings of the semantic and syntactic analyses also provide information that can assist AAC teams as they make decisions about how best to represent language on a child's AAC system. As discussed in Chapter 2, picture symbols in light-tech communication boards/books and dynamic display systems are typically arranged using one of four approaches to language organization: taxonomic grid displays, schematic grid displays, semantic-syntactic grid displays, or visual scene displays. The findings of this study do not assist AAC teams with figuring out which of these approaches or combination of approaches are best for the children they work with. The findings do, however, help AAC teams to think more critically about how language is arranged within two of these language organization approaches: the taxonomic grid display in which language is organized according to hierarchical semantic categories (Blackstone, 2004), and the semantic-syntactic grid display in which language is displayed according to the parts of speech.

The semantic analyses revealed that the number of different semantic themes used increased significantly between School Ages 1 and 2, and School Ages 3 and 4. The analyses also revealed that the patterns of use of semantic fields differed for the school age groups within each of the two countries. For instance, the children in School Age 1 in New Zealand used the semantic field *have* from the *activity and sensory* theme 47 times per thousand words, but the children in School Age 1 in North Carolina did not use the semantic field at all. These findings suggest that semantic fields should not be treated equally when representing language according to the taxonomic organization system. AAC teams should consider making some semantic fields and the words that fall within these fields more easily accessible than others.

The findings of the syntactic analyses have implications for the semantic-syntactic language organization method. One of the most commonly used semantic-syntactic formats is the Fitzgerald key (Fitzgerald, 1954). In this format, the parts of speech are arranged from left to right in a manner that corresponds to typical sentence order. Bruno’s (2006) version of the Fitzgerald key was already described in Chapter 2. In this format, people words (nouns and pronouns) are presented on the left of the display followed left-to-right by action words (verbs), little words (e.g., articles, prepositions, conjunctions), descriptive words (e.g., adjectives, adverbs), object words, and place words.

In all but one of the groups in this study (New Zealand School Age 2), Stage III syntactic structures were used most frequently. The types of Stage III structures used most frequently differed across the school ages within the two countries. However, the clauses that were used most frequently were always one of three clause types: *SVC*, *SVO*, or *SVA*. These clause structures can be generated using the Fitzgerald key described above, but the arrangement doesn‘t directly support their generation in any way.

The findings of the current study suggest an alternative format may be superior to the Fitzgerald key arrangement as a support for clause construction. In this format, symbols representing the subject in a sentence would be positioned in a column down the left of the display. On the right of those symbols would be a column of symbols representing the verb. Arranged in the column next to the verb symbols would be three rows of symbols representing the complement, the object, and the adverbial. When the children selected one of these symbols the display would change and they would be presented with symbols reflecting the high frequency phrase structures that occur within those clause elements.

The format would provide children with the capacity to also generate frequently occurring Stage II and IV clause structures such as *SV* and *SVOA*. The format may be particularly useful for children who appear to have become stagnant in their syntactic development. It may help support these children to start combining more clausal elements and to expand the types of clause and phrase structures that they produce.

Understanding School Age Differences

In order for AAC teams to be effective at facilitating the communication development of children with CCN, they must take into consideration the cognitive, memory, and physical demands inherent in learning a new expressive form and the impact that these demands can have on the quantity and quality of the language that children produce. This study examined the language of beginning writers in the hope that this would provide speech-language pathologists and other professionals with a window into a comparable learning scenario. Beginning writers are similar to children with CCN in that both groups 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 findings of this study provide support for Kroll (1981) and Bereiter's (1980) models of writing development. As mentioned in Chapter 2, Kroll describes beginning writers as having written language abilities that are far inferior to their spoken language abilities. Beginning writers must learn to support their written language development by drawing on their spoken language resources. Bereiter states that beginning writers cannot focus on higher level written language skills such as planning and content generation because their cognitive resources are consumed with lower level skills like handwriting and spelling. In accordance with these descriptions, the children in School Age 1 in this study exhibited restricted written language abilities.

The writing samples generated by the children in School Age 1 were comprised of fewer total words, fewer different words, and fewer semantic themes than those generated by the children in School Ages 2-4. Furthermore, the children in School Age 1 used fewer t-units and fewer words per t-unit than the children in the other school age groups. The children's mean clausal complexity and mean phrasal complexity scores were also the lowest observed. The performance of children across the school ages on these two measures, however, was surprising. The degree of difference between the four school ages was not as large as was expected at the outset of the investigation. The data were examined in more detail to try and figure out why there was such limited variability. Two potential explanations were identified.

Firstly, some children had mean percentage scores that were extreme. For instance, one child in School Age 3 in North Carolina wrote an ABC story that included 17 postmodifying clauses (e.g., *H is for hat that got squished in the road*). This amount was significantly more than the amount used by other children in School Age 3 who only used between 0 and 3 postmodifying clauses. Extreme scores like these could have skewed the distribution and made the children in the lower school ages appear as though they used more complex clauses than they commonly did.

Another reason might be that the LARSP stages of development become less valid as children develop more advanced language skills. As mentioned in Chapter 3, the LARSP is generally used to assess the spoken language skills of preschool children. It was used in this study because the focus was on examining the language of beginning writers; a population who have written language abilities that are typically inferior to their spoken language abilities and perhaps commensurate with the spoken language abilities of preschool children. It was difficult to determine beforehand whether LARSP would be appropriate for all of the school ages in this study because so few studies have examined the written language abilities of children below the third-grade level.

One of the problems inherent in the LARSP analysis is that some clausal structures are tallied twice. For instance, in the t-unit: *I like my t-shirt because it is colorful*, the subordinate clause *because it is colorful* is tallied at Stage V as *Sub A 1*, and at Stage III as *SVC*. The effects of this problem were evident when the mean percentage scores from School Age 2 were compared to those from School Ages 3 and 4. This comparison revealed that the children in School Age 2 used a greater proportion of Stage III and IV clause structures, but that the children in School Ages 3 and 4 used a greater proportion of Stage I, II, and V clause structures. Possible reasons for the increasing proportion of Stage I and II clause structures in School Ages 3 and 4 were examined. It was found that when children in School Age 2 used Stage II structures, the structures usually comprised an entire t-unit. In contrast, when children in School Ages 3 and 4 used Stage II structures, the structures were frequently subordinate clauses that were embedded within more advanced clause structures. It seems possible that if the analyses had tallied only the most advanced clause structure within each t-unit, then the differences between the school age groups may have been more substantial.

A second problem inherent in the LARSP analysis is that some stages may be more valid than others. Blake et al. (1993) conducted a study in which they used the LARSP analysis to test the validity of the mean length of utterance (MLU) measure. They found that the LARSP stage frequencies were significantly correlated with MLU, but that the correlations were only moderate for Clausal Stage III and Phrasal Stages III and IV. They also examined the correlations between LARSP stage frequencies and chronological age. The stage frequencies were significantly correlated with age, however again, the correlations were only moderate for some stages, namely Clausal Stages III and IV and Phrasal Stage III. The researchers stated that:

> It should be noted that the weaker relationships between both age and the overall language measures and clause 3, clause 4, and phrase 4 constructions make the validity of these LARSP measures somewhat questionable. Thus, although we have used LARSP to determine the grammatical validity of MLU…some of the LARSP measures, namely the middle clausal stages and the highest phrasal stage may be, themselves, less valid than others (p. 150).

Problems like these are not specific to the LARSP analysis. As mentioned in Chapter 2, Kroll (1980) and Bereiter (1980) both acknowledged when presenting their theoretical models of written language development that there a number of weaknesses inherent in models that attempt to delineate developmental stages. Kroll stated that these models can oversimplify development by making it appear “unidimensional and strictly linear” (p. 40).

Despite these problems, stage models of development, including the LARSP analysis can be extremely valuable. Although the LARSP analysis may not have revealed substantial quantitative differences between the written language abilities of children in School Ages 1-4, it did reveal some striking qualitative differences. The findings of some follow-up analyses suggest that one characteristic that set the beginning writers in School Age 1 apart from the children in the other school age groups was a lack of variation in the types of clauses used. The children in School Age 1 used 9 different clause types. In contrast, the children in School Age 2 used 17, and the children in School Ages 3 and 4 used 27.

Another difference between School Age 1 and the other school age groups was the number of children that used advanced clause types. As mentioned in Chapter 4, clause types from Stages IV and V were used across all of the school age groups. However, frequently a smaller percentage of children in School Age 1 used these structures than in the other school age groups. For instance, the clause type *AAXY* was used by 1 (4%) of the 28 children in School Age 1, by 5 (18%) of the 28 children in School Age 2, by 14 (50%) of the 28 children in School Age 3, and by 6 (43%) of the 14 children in School Age 4. Similarly, the clause type *SVOA* was used by 8 (6%) of the 28 children in School Age 1, by 17 (61%) of the 28 children in School Age 2, by 18 (64%) of the 28 children in School Age 3, and by 9 (64%) of the 14 children in School Age 4.

When the clause types from the two countries were examined separately, some differences were evident. The children in School Age 1 in North Carolina predominantly used one clause type (*SVO*) and the children in School Age 1 in New

Zealand predominantly used two (*SVO* and *SVA*). The children in New Zealand used a greater variety of clause structures than the children in North Carolina. They also used a greater number of advanced (Stage IV) clause structures.

In addition to the clause type differences already described, the children in School Age 1 also used a narrow range of phrase structures. They used 16 different types whereas the children in School Age 2 used 22 and the children in School Ages 3 and 4 used 23. Again the children in School Age 1 in North Carolina tended to favor one structure (*Pron*-P). Approximately 75% of the phrase structures used by children in North Carolina were either *Pron-P* or *DN*. In contrast, in New Zealand 75% of the phrase structures were comprised of *PronP*, *DN*, *PrDN*, *PrN*, or *Aux-O*. There was only one Stage IV phrase structure used, *XcX*. It was used by one child in North Carolina.

Additional credence for the observation that beginning writers have written language abilities that are inferior to their spoken language abilities can be obtained by comparing the findings of this study to the findings of another study which also employed LARSP. French (1988) used LARSP to examine the spoken language skills of five 5-year-old children in the United Kingdom. French provides a list of the phrase structures that the children used in order from highest frequency to lowest frequency. When this list is compared to the findings for School Age 1 in this study, some interesting findings are evident. The top 3 phrase types were the same in both studies: *Pron-P*, *DN*, and *Cop*. There were 6 phrase types that were used by the children in French's study that were not used by the children in this study: *Pron-O*, *Neg V*, *cX*, *NPPrNP*, *Neg X*, and *2 Aux*. One of these phrase types was from Stage III (*Pron-O*). The remaining phrase types were from Stage IV.

In French's (1988) study, the proportions of Stage II, Stage III, and Stage IV phrase structures were fairly evenly distributed across the stages: 35%, 35%, and 30% respectively. In this study, however, there were significantly more Stage II (50%) and Stage III (44%) structures, than there were Stage IV (6%) structures. Obviously these two studies were not carried out under identical conditions and therefore any comparisons made between the two need to be interpreted cautiously. Nevertheless, the collective findings of these two studies suggest a substantial discrepancy between the spoken language skills and written language skills of young children.

The finding that many children in School Age 1 used a restricted set of clause and phrase types has important implications for speech-language pathologists and other professionals who work with children with CCN. Some professionals may have unrealistic expectations about the kinds of sentence structures that children with CCN should be able to produce. The findings of this study suggest, that even typically developing children who presumably face very few obstacles in their paths to learning, experience substantial difficulty taking language that is inside their heads and translating it into a novel language form. The findings also suggest that there may be differences in the types and complexity of clause and phrase structures used by children in North Carolina and children in New Zealand. AAC teams in the two countries may need to adjust their expectations accordingly.

Contextual Influences

In studies that attempt to quantify language skills, the effects of context must be taken into consideration (Nelson, 1988) and the findings must always be interpreted with a degree of caution. Contextual influences were evident in the current study across all of the language areas. In the vocabulary analyses, the frequencies of three of the top 150 words, *Halloween*, *Fall*, and *Christmas*, were obviously influenced by the time of year in which the writing samples were collected.

Undoubtedly, there were other high frequency words that were affected by context, however these were more difficult to detect. Some of the less obvious contextual influences became more apparent when the multiword sequences were examined. For instance, the two-word sequence *is for* received a ranking of 1 in School Age 3 in North Carolina. This was because the children in this school age group wrote a large number of alphabet stories (e.g., *A is for ants, B is for bananas, …*). The teachers in two of the participating classrooms had read alphabet stories to the children in their classrooms as part of the language arts curriculum. Reportedly, the children had enjoyed the stories and when it came time for self-selected writing, a number of the children chose to write their own. The alphabet stories also influenced the findings of the syntactic analyses because of the high prevalence of SVA sentence structures.

The fact that context has had an influence on the findings of this study obviously reduces the generalizability of the study's findings. Perhaps the need to minimize contextual influences has led previous researchers to ask children to write on controlled topics. However, asking children to write about self-selected topics was important in the current study because the purpose was to elicit a broader range of vocabulary and language structures. It was also important because when children write about self selected topics, they are not restricted by their background knowledge in the way that they are when they write under more researcher or teacher-directed conditions. The main reason, however, is that writing about self-selected topics shares many characteristics with spoken language, particularly for beginning writers who draw heavily on their spoken language skills as they learn to construct text (Kroll, 1981). This was important since the purpose for conducting this study was to help AAC teams to support the face-to-face communication abilities of children with CCN.

The positive side to the contextual influence described above is that it occurred as a result of instruction. The vocabulary and syntactic structures the children used reflected the instruction that was provided. This demonstrates the impact that teachers and other professionals can have on children's language. Beyond this teacher-reported influence, the country-related differences may have been related to instructional differences more broadly. For instance, the high prevalence of simple sentence frames (e.g, I see, I like) observed in the writing samples generated by children in School Age 1 in North Carolina may be indicative of the type of reading books that children are currently exposed to in United States classrooms. No specific data was collected to support this hypothesis, so it is difficult to determine the exact nature of the instructional differences between the two countries and the amount of influence that the instructional context may have had on the study's findings.

Other Limitations

There are some additional limitations that are inherent in this study that need to be taken into consideration. Firstly, the small number of New Zealand children in School Age 4 (*n* = 7) may have resulted in some distorted findings. For instance, some of the top 25 three word sequences used by the children in School Age 4 in New Zealand may have seemed surprising as they were not sequences that one would expect to occur very frequently in written language. Examples include the sequences *breathing hot flaming* and *flaming hot fire*. It is likely that these sequences received a high ranking largely because there were so few New Zealand children in School Age 4 that participated in the study. In fact, these sequences were only used twice, but because of the small sample size, they received a high ranking.

Another limitation is that there was no control over the amount of time that the children had to write each day. This facilitated the recruitment process as more teachers were willing to participate when they learned that the researcher was not asking them to make any changes to their typical classroom practice. However, it did have an effect on the study’s findings. Many of the measures that were included in the study were weighted which served to counteract the impact of this limitation. However some measures were not, for instance total number of words, total number of different words, and total number of different semantic themes.

The fact that some children generated one sample per day and other children generated one sample over multiple days was also a limitation of the study. This was an anomaly that was unfortunately not predicted prior to data collection. The vocabulary measures included in the study were weighted by number of writing days to reduce the impact that this limitation had on the study’s findings. The syntactic and semantic analyses, however, could not be weighted in this manner since the unit of measurement in these analyses was the writing sample; not the child. Some of the analyses were not affected by this problem because they were weighted by other variables, for instance, the mean percentage of Stage II clause structures was weighted by the total number of clauses produced. However, other measures were affected, for example, mean number of t-units per writing sample. The findings of these analyses should therefore be interpreted with caution.

A limitation specific to the vocabulary analyses became apparent when the vocabulary words that the children used were separated into content words and structure words. There are some English words that can be used as both content words and structure words. For instance, the word *one* can be used to mean the number *one* (content word) and it can also be used to mean the pronoun *one* (structure word). Due to the large volume of writing samples included in the vocabulary analyses, it was not feasible to identify the true meaning of every word. The decision was made to treat all of these words as structure words.

The final limitation is that there were a large number of unintelligible words in the children's writing samples. This was because most of the teachers did not provide translations of children's spelling attempts. Whenever, the researcher was unsure of a word, it was marked with an X and ignored in the analyses.

Future Directions

Such a large sample of children's writing lends itself to a myriad of further analyses. Future research efforts should focus on carrying out more detailed analyses of the three language areas. The children's vocabulary should be analyzed further to examine whether there are correlations between the word frequencies observed in this study and the frequencies found in large corpora of written English. In addition, more sophisticated analyses should be carried out with the multiword sequences. These analyses might include ranking possible slot fillers according to their frequency of use so that they can be stored efficiently in children's AAC systems. Vocabulary analyses might also be used to examine the frequency of words within each of the phrase structures (e.g., prepositions, determiners) identified in the syntactic analyses.

The children's syntax and morphology should be analyzed further with a particular focus on the children in the lowest quartile of syntactic and morphological ability. One important research area would be to investigate the type of errors that young beginning writers make as these errors might share characteristics with the errors made by children who are learning to use AAC.

Future semantic analyses might include examining the patterns of use of the semantic subfields that are available in the PRISM analysis. Semantic analyses should also be used to extend the findings of vocabulary research. Many of the words identified as frequently occurring have more than one meaning. Finding out which meanings occur most frequently will assist AAC teams with making decisions about which symbols to use to best represent words in children with CCN's AAC systems.

The writing samples should also be analyzed to explore other issues that are of relevance to the field of AAC. For instance, examining the frequency of letter use for the whole corpus of words might assist AAC teams and AAC manufacturers to identify keyboard layouts that maximize efficiency for children with CCN. It may be possible to identify keyboard layouts that meet the physical access requirements of different groups of children, for instance, children who can only use one hand or one finger to type as well as children who rely on alternative access systems such as switches. This research and the research efforts described above will lead to increased knowledge in the field of AAC and ultimately should result in improved communication outcomes for children with CCN.

Conclusion

The field of AAC is an exciting field because it is constantly evolving with new technologies being developed at rapid rates. In order to be able to maximize the capabilities of such technologies, however, children with CCN must have access to language that is organized thoughtfully and logically and that supports the development of both efficient and precise communication. This study documented and analyzed 2721 writing samples written by 125 children in North Carolina and 113 children in New Zealand. This study was the first study in the field of AAC to consider the parallels that exist between learning to write and learning to use an AAC system, and the potential application that typical written language development has for children with CCN.

The findings of this study identified school age and cross-cultural differences in the vocabulary words, semantic themes, and syntactic and morphological structures used by typically developing children when they composed about self-selected topics. The school age comparisons highlighted the restricted language abilities of children in the earliest stages of writing development and the country comparisons revealed differences in areas such as core vocabulary and clausal and phrasal diversity.

The wealth of descriptive information obtained through this study will help to educate speech-language pathologists, educators, and other professionals about written language development and the impact that cognitive, memory, and physical demands can have on the quantity and quality of language that children produce. The information will also prompt AAC teams to carefully consider a child's school age and country when they are making decisions about vocabulary selection and language representation. Having an increased understanding of these issues will enable AAC teams to become more successful at supporting children with CCN to overcome the challenges inherent in learning to use AAC and to achieve the ultimate goal of being able to engage in effective communication.

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Appendix A1

Research: Semantics and Vocabulary in Individuals with Complex Communication Needs

Reference	Participants	Procedures	Findings
Berninger & Gans (1986)	9-year-old with CP; severe dysarthria; used touch-sensitive keyboard to communicate; hearing and vision wnl; IQ score in average range on CMMS. 16-year-old with CP; severe dysarthria; accessed keyboard with head wand to communicate; severe HL corrected from age 8, now wnl; IQ score in low average range on modified WAIS-R. 40-year-old with CP; anarthria; accessed electronic communication device with hand pointer; hearing and corrected vision wnl; IQ score in low average range on modified WAIS-R.	Administered PPVT-R.	9-year old exhibited advanced vocabulary skills. 16-year-old and 40-year-old exhibited significantly delayed vocabulary knowledge.

Bishop, Brown, & Robson (1990)	2 groups of young adults: (a) 24 with CP; aged 10-18 years; 12 with anarthria, 12 with severe dysarthria and (b) 24 with CP; normal speech; matched for CA and scores on Raven's Matrices. Children in group (a) had hearing and vision (or corrected vision) wnl and 75% scored below 5th centile on Raven's Matrices.	Administered BPVS.	Participants with anarthria or dysarthria exhibited significantly impaired receptive vocabulary skills relative to matched controls.
Udwin & Yule (1990)	40 children with CP; aged 3;6-9;8 years; severe dysarthria; 1 group learning Blissymbols, the other learning Makaton signs; No significant difference between groups in age, gender, amount of teaching input, or amount of exposure to AAC system. Significant difference between groups in severity of physical disability (1 > 2), nonverbal IQ (1 > 2), and receptive (1 > 2) and expressive (2 > 1) language abilities. 45% of Blissymbol group and 70% of signing group	Assessed receptive and expressive knowledge of signs/symbols taught. First assessed when children had received an average of 10.5 months of symbol/sign training. Progress was then evaluated at 6-month intervals for a total period of 18 months.	Number of signs/symbols acquired increased significantly (p<.01). Progress, however, was slow. Group comparisons revealed only 1 significant difference (p<.05) (% of signs/symbols acquired expressively at initial assessment) when IQ and language comprehension differences were taken into account.

	obtained IQs < 70 on the CMMS; some children in both groups exhibited HL, visual impairment, and/or epilepsy. Note: Due to sample attrition, the measures of change over time in the signing group are based on a sample size of 14 children.		
Harris, Doyle, & Haaf (1996)	5-year-old male with provisional diagnosis of DAS; used PCS (primarily whole message retrieval) and speech to communicate; cognitive skills were wnl but language abilities were moderately impaired.	Provided intervention that focused on teaching child to segment and combine grammatical constituents. Intervention had 4 goal levels. As child advanced through levels, child was required to construct more of verbal turn. Child attended 22 45-minute sessions over 4-month period. Evaluated progress using multiple baseline design across contexts (book reading, structured discourse). Probes measured % of modeled vocabulary and % of correct constituents.	Child developed increased lexical flexibility. In 4 treatment trials, % of correct constituents score was greater than % of modeled vocabulary score, indicating that child used semantically appropriate vocabulary words that had not been previously modeled.

Romski, Sevcik, & Robinson (1996)	12 males with various etiologies; aged 10;7-25;8 years; used SAL to communicate for at least 5 years; hearing and vision wnl; moderate or severe MR; primary language was English; had acquired object permanence and categorization skills needed to complete research task. Participants were classified into 2 groups (beginning or advanced) based on prior symbol achievement.	Investigated fast mapping abilities. In exposure condition, participants were presented with 4 sets of stimuli each consisting of 4 known objects and 1 novel object. Researcher asked participant to “Give me the ___” and simultaneously activated corresponding symbol on SuperWolf. Researcher asked for a known object first and then asked for the novel object. If participant did not point or physically manipulate object, then researcher provided feedback. In the assessment condition, symbol comprehension and production were assessed. Symbol comprehension assessment was similar to exposure condition except no feedback was provided and a novel distractor object and a novel distractor lexigram were added to each stimuli set. For symbol production assessment, researcher asked participant to label object using symbols	7 participants successfully mapped the meanings of ≥ 2 novel symbols. Mean number correct was 0.5 (range 0 -1) for beginning achievement group and 2.9 (range 0-4) for advanced achievement group. Researchers classified participants as either ‘mappers’ (≥ 3 correct in exposure condition, or same 2 correct in exposure and assessment conditions) or ‘nonmappers’. Only 1 participant in advanced group was classified as nonmapper. Symbol achievement was significantly related to mapping status. Mappers generalized their knowledge to production and retained comprehension and production of at least half of the novel symbols for 15 days.

	on SuperWolf. Assessments were administered immediately following exposure condition and were then repeated 1 day and 15 days later.	

Note. Abbreviations: AAC = Augmentative Alternative Communication; CA = Chronological Age; CP = Cerebral Palsy; DAS = Developmental Apraxia of Speech; HL = Hearing Loss; IQ = Intellectual Quotient; MR = Mental Retardation; PCS = Picture Communication Symbol(s); wnl = within normal limits. AAC Devices: SuperWolf (Adamlab, LLC). References: British Picture Vocabulary Test (BPVS, Dunn, Dunn, Whetton, & Pintilie, 1982); Columbia Mental Maturity Scale (CMMS, Burgemeister, Blum, & Lorge, 1972); Peabody Picture Vocabulary Test – Revised (PPVT-R, Dunn & Dunn, 1981); Raven's Progressive Matrices (Raven, 1965); System for Augmenting Language (SAL, Romski & Sevcik, 1996); Wechsler Adult Intelligence Scale – Revised (WAIS-R, Wechsler, 1981).

Appendix A2

Research: Syntax and Morphology in Individuals with Complex Communication Needs

Reference	Participants	Procedures	Findings
Berninger & Gans (1986)	9-year-old with CP; severe dysarthria; used touch-sensitive keyboard to communicate; hearing and vision wnl; IQ score in average range on CMMS. 16-year-old with CP; severe dysarthria; accessed keyboard with head wand to communicate; severe HL corrected from age 8, now wnl; IQ score in low average range on modified WAIS-R. 40-year-old with CP; anarthria; accessed electronic communication device with hand pointer; hearing and corrected vision wnl; IQ score in low average range on modified WAIS-R.	Assessed sentence interpretation using Sentence Structures subtest of CELF and Syntactic Competence subtest of Buschke Tests of Linguistic Competence.	CELF subtest: 9-year-old and 40-year old exhibited age-appropriate performance. 16-year-old exhibited poor performance. Buschke subtest: 9-year-old achieved 90% accuracy. 16- and 40-year-old achieved 40% accuracy.

Kelford Smith, Thurston, Light, Parnes, & O'Keefe (1989)	6 young adults with CP; aged 13-22 years; 5 used Blissymbol displays in combination with other unaided AAC techniques, 1 used speech only; hearing and vision (or corrected vision) wnl; receptive language skills functional for daily needs; spelling skills at 3rd-grade level or higher.	Collected all written output produced at home over 4-week period. Calculated (a) total words, (b) grammatical morphemes, (c) total sentences, and (d) sentence type.	Mean total words ranged from 32–330. Mean total sentences ranged from 2–21. Accuracy of morpheme usage ranged from 80 to 96%. All used simple, compound, and complex sentence structures. 2 primarily used simple sentence structures. Accuracy in sentence formulation ranged from 56–100%. Compound sentences were main source of difficulty.
Bishop, Brown, & Robson (1990)	2 groups of young adults: (a) 24 with CP; aged 10-18 years; 12 with anarthria, 12 with severe dysarthria and (b) 24 with CP; normal speech; matched for CA and scores on Raven's Matrices. Children in group (a) had hearing and vision (or corrected vision) wnl and 75% scored below 5th centile on Raven's Matrices.	Assessed understanding of grammatical structures using TROG.	No significant group differences. Both groups performed well below age level. However, there was considerable individual variability with some participants in both groups exhibiting age-appropriate language skills.
Udwin & Yule (1990)	40 children with CP; aged 3;6-9;8 years; severe dysarthria; 1 group learning Blissymbols, the other learning Makaton signs; No significant difference	Assessed syntactic development of sign/symbol utterances. Obtained 30-minute language sample during semi-structured conversation with researcher	Children demonstrated severe limitations in the average number, length, and complexity of utterances produced. The few multi-term utterances that were produced

	between groups in age, gender, amount of teaching input, or amount of exposure to AAC system. Significant difference between groups in severity of physical disability (1 > 2), nonverbal IQ (1 > 2), and receptive (1 > 2) and expressive (2 > 1) language abilities. 45% of Blissymbol group and 70% of signing group obtained IQs < 70 on the CMMS; some children in both groups exhibited HL, visual impairment, and/or epilepsy. <u>Note</u>: Due to sample attrition, the measures of change over time in the signing group are based on a sample size of 14 children.	that was later transcribed and analyzed. Analyzed: mean number of signs/symbols per utterance (MSLU), frequency and range of grammatical structures (using LARSP), and extent to which multi-term utterances reflected conventional English word order. First assessed when children had received average of 10.5 months of symbol/sign training. Progress was then evaluated at 6-month intervals for a total period of 18 months.	reflected conventional word order. Group comparisons revealed no significant differences when IQ and language comprehension differences were taken into account.
Sutton & Gallagher (1993)	2 adults with CP; male aged 25 and female aged 26; used Blissymbols and alphabet to communicate which they accessed using eye gaze number codes, hearing and vision wnl; IQ quotients on TONI were 65	Participants were taught novel encoding strategy that enabled them to make distinctions between irregular and regular past tense verbs. Strategy use was then assessed in 4 tasks: (a) English verb	Participants' encoding of regular and irregular past tense verbs did not reflect verb class membership. Chance level analyses suggested that participants' responses were not random. However, factors determining

	for male and 88 for female; age-equivalent scores on PPVT-R and TOLD-P ranged from 5.6 to 7.3 for male and 7.4 to 9.8 for female; both received an average rating of at least *good* on 5-point rating scale for language and communication skills, including ratings of *excellent* for understanding of past and future tense.	elicited production task, (b) English verb judgment task, (c) Nonsense verb elicited production task, and (d) Nonsense verb judgment task.	participants' specific usage patterns were unclear.
Soto & Toro-Zambrana (1995)	3 Spanish adults with CP; 2 32-year-old males, 1 26 year-old female; used Blissymbols to communicate; hearing and vision wnl; IQ scores ranged from 33-78.	Collected Blissymbol output produced in 3 tasks: (a) sentence translation, (b) picture interpretation, and (c) conversation.	Participants used a wide variety of morphosyntactic structures.
Harris, Doyle, & Haaf (1996)	5-year-old male with provisional diagnosis of DAS; used PCS (primarily whole message retrieval) and speech to communicate; cognitive skills were wnl but language abilities were moderately impaired.	Provided intervention that focused on teaching child to segment and combine grammatical constituents. Intervention had 4 goal levels. As child advanced through levels, child was required to construct more of verbal turn. Child attended 22 45-minute sessions over 4-month period. Evaluated progress using multiple	Relative to baseline ability, % of correct constituents increased substantially during treatment. Magnitude of treatment effect and degree of generalization was greater for storybook reading than it was for structured discourse.

		baseline design across contexts (book reading, structured discourse). Probes measured % of correct constituents.	
Smith (1996)	5 TD children; aged 3;5-4;7; no history of disabilities; all scored wnl on RAPT.	Children taught to use PCS displays to communicate with puppet that they were told was unable to hear. Children attended 1 60-90 minute group session per week for a total of 10-weeks. Progress was evaluated using a referential communication task that required children to describe pictures using PCS. Prior to producing PCS utterance, examiner identified key features of picture and allowed children to engage in verbal rehearsal.	Youngest child had significant difficulty understanding that she was required to use the symbol display to communicate with puppet. Instead, she engaged in lots of symbol labeling. The PCS utterances produced by the other 4 children were reduced relative to their spoken output. Their utterances were initially analyzed according to speaker-listener boundaries which revealed that 83% of their utterances were single-picture points. These single-picture points were broken down into 4 subgroupings: appropriate elliptical responses, complementary PCS utterances, global PCS utterances, and component PCS utterances. Utterances were then reanalyzed according to vertical sequences. This revealed an equal balance between single-

			and multiple-picture points. Within these sequences, linear word order constraints were often violated.
Nakamura, Newell, Alm, & Waller (1998)	123 university students: 80 Japanese speakers (mean age = 20.94) and 43 English speakers (mean age = 28.2 years).	Students listened to story and answered questions (a) by pointing to PCS on touch screen interface, and (b) using natural speech. Students exposed to 1 of 2 conditions: symbol home page organized in English SVO order or symbol home page organized in Japanese SOV order. Japanese speakers exposed to 1 of 2 additional conditions: access to particles or no access to particles. Analyzed: order of constituents used, number of picture elements used, and number of vocal elements used.	Japanese speakers: 14% in SVO non-particle condition and 3% in SOV non-particle condition used English word order when communicating with PCS. When particles and/or natural speech were available, 100% used Japanese word order or other word order. Students used more symbols in particle condition than non-particle condition. English speakers: All used English word order or other word order. Both Japanese and English speakers used fewer words when communicating with PCS.

Sutton & Morford (1998)	32 TD children; aged 5;9-12;7; native English speakers; no history of speech, language, or hearing impairments.	Children described what they saw in video clip (a) by pointing to PCS on a communication board, and (b) using natural speech. Analyzed order of constituents used.	Significant main effects for modality and age, and significant interaction effect. English word order used more consistently in spoken modality, and used more consistently by older children. Although all participants had mastered SVO word order in spoken English, they did not automatically apply this knowledge during picture communication. Younger children most frequently produced single verbs. Older children most frequently produced OV sequences. At all ages, children pointed to more verbs and objects, than subjects.
Sutton, Gallagher, Morford, & Shahnaz (2000)	43 adults; mean age 25.33; all English speakers, no history of cognitive, language, social, or motor impairments; hearing and vision (or corrected vision) wnl.	Participants presented with series of subject and object relative clause sentence pairs (e.g., “The girl who pushes the clown wears a hat” and “The girl pushes the clown who wears a hat”) accompanied by photographs. Participants asked to reproduce sentences by pointing to PCS on Macaw III	36 participants distinguished between subject and object sentences. Most used English word order when producing object sentences, but used non-English word order when producing subject sentences. Most employed constituent proximity strategy to convey distinction between 2 sentence types.

		communication device. PCS did not include grammatical markers. Analyzed order of constituents used and whether order differed for subject versus object sentences.	
Redmond & Johnston (2001)	4 groups: (a) 4 young adults; 1 had brainstem aneurysm, 3 with CP; aged 11–15 years; anarthria (b) 11 TD children; aged 4-6 years (c) 13 TD children; aged 7-10 years (d) 21 TD adults. In AAC Group, 1 used symbol display, 3 used high-tech devices (Liberator, Dynavox, Lightwriter); scores on CTONI ranged from 67-128; scores on PPVT-III ranged from 62-123. In 2 TD children groups, scores on PPVT-III and CMMS or CTONI were wnl. All TD participants had no history of speech/language delays, LD, or ADD/ADHD. All children had hearing and vision (or corrected vision) wnl. All participants only spoke English.	Administered grammaticality judgment tasks that measured sensitivity to various morphological errors. Researchers first compared performance of 3 TD groups in order to explore developmental trends. Researchers then compared performance of 4 AAC users with 4 TD children matched according to vocabulary age.	Participants in all 4 groups accurately detected most aspect-marking errors (e.g., ‘you are open the box’), agreement violations (e.g., ‘she am throwing the ball’), and tense-marking errors involving irregular verbs (e.g., I catched it’). Participants who used AAC demonstrated greater difficulty detecting tense-marking errors involving regular verbs (e.g., ‘She pull out a toothpick’).

Lund & Light (2003)	2 adults with CP; female aged 30 and male aged 29; both used Liberator and other unaided AAC techniques; standard scores on PPVT-R were 64 for male and 66 for female. Both able to respond to 1-3 step commands and who, what, where, when questions in functional contexts; Male exhibited difficulty understanding complex sentence structures. Female exhibited difficulty understanding how and why questions. Female used simple, compound, and complex sentence structures. Male used simple sentence structures. Both omitted and/or made errors with grammatical morphemes.	Provided intervention that taught specific grammatical skills using direct instruction. Skills taught to female participant were correct word order in adjective phrases and inversion of the auxiliary *did* in *wh*-questions. Skills taught to male participant were use of possessive pronouns and inclusion of *to* when using infinitives as modal verbs. Evaluated progress using multiple baseline design across behaviors. Probes measured % of correct use of targeted grammatical form.	Both participants learned to produce grammatical forms. Female required 52 hours of intervention and male required 20 hours. Male maintained performance at 100% accuracy for 2 months. Female's performance dropped below 80% for both skills. Booster sessions were provided. Thereafter, female maintained performance at $\geq$ 85% accuracy for 2 months (auxiliary inversion) and 5 months (adjective form).
Block-berger & Johnston (2003)	3 groups of children: (a) 20 children with CCN, mean age = 9;3 (b) 20 TD children, mean age = 5;9 and (c) 15 children with delayed receptive language skills, mean age	Administered 3 tasks: (a) comprehension task that required participants to point to pictures, (b) grammaticality judgment task, and (c) written cloze task. Tasks focused on 3	Children with CCN experienced greater difficulty with comprehension task and grammaticality judgment task, and were more likely to omit morphemes in obligatory contexts when writing.

	= 9;4; hearing wnl; primary language English; Average age equivalent scores on PPVT-R similar for 3 groups (6;1-6;2), but performance varied widely in CCN group. In CCN group, 12 children had CP, 8 had other diagnoses; children used variety of aided and unaided AAC techniques.	morphemes: possessive *s*, past tense *–ed*, and third person regular *s*. Written cloze was only administered to children who reportedly were able to independently write or type a brief sentence.	
Sutton, Morford, & Gallagher (2004)	25 adults with CP; aged 23-63; native English speakers, hearing and vision (or corrected vision) wnl; used variety of AAC techniques including Blissymbols, Minspeak, alphabet, and printed words; all had receptive language skills at or above the 6-7-year-old level.	Procedures used were identical to those used in Sutton, Gallagher, Morford, & Shahnaz (2000). However, this study included an interpretation task. For this task, examiner used PCS to construct a series of subject and object relative clause sentence pairs. Participants were asked to choose 1 photograph from an array of 2 that best depicted the symbol utterance. PCS did not include grammatical markers so placement of the relative pronoun *who*, could not be marked. Both subject and object sentences were therefore identical. Analyzed	Only 6 participants distinguished between subject and object sentences > 75% of the time. These participants typically employed constituent proximity strategy to convey distinction between 2 sentence types Overall, participants used 18 different word order patterns. Most frequently occurring word order (75%) was word order that most closely adhered to conventional English. On interpretation task, 19 participants consistently chose 1 interpretation: 15 chose subject and 4 chose object. Out of the 19

	participants’ response patterns.	participants who did not distinguish between subject and object sentences, 13 consistently chose 1 interpretation: 10 chose subject and 3 chose object. Considerable individual variability.

Note. Abbreviations: AAC = Augmentative Alternative Communication; ADD = Attention Deficit Disorder; ADHD = Attention Deficit Hyperactivity Disorder; CA = Chronological Age; CCN = Complex Communication Needs; CP = Cerebral Palsy; DAS = Developmental Apraxia of Speech; HL = Hearing Loss; IQ = Intellectual Quotient; OV = Object-Verb; LD = Learning Disability; PCS = Picture Communication Symbol(s); SOV = Subject-Object-Verb; SVO = Subject-Verb-Object; TD = Typically Developing; wnl = within normal limits. AAC Devices: Dynavox (Dynavox Technologies); Liberator (Prentke Romich Company); Lightwriter (Toby Churchill Ltd); Macaw III (Zygo Industries, Inc). References: Buschke Tests of Linguistic Concepts (Buschke, 1975); Clinical Evaluation of Language Functions (CELF, Semel & Wiig, 1980); Columbia Mental Maturity Scale (CMMS, Burgemeister, Blum, & Lorge, 1972); Comprehensive Test of Nonverbal Intelligence (CTONI, Hammill, Pearson, & Wiederholt, 1996); Language Assessment, Remediation, and Screening Procedure (LARSP, Crystal, Fletcher, & Garman, 1989); Peabody Picture Vocabulary Test – Revised (PPVT-R, Dunn & Dunn, 1981); Peabody Picture Vocabulary Test – III (PPVT-III, Dunn & Dunn, 1997); Raven’s Progressive Matrices (Raven, 1965); Renfrew Action Picture Test (RAPT, Renfrew, 1989); Test for Reception of Grammar (TROG, Bishop, 1983); Test of Language Development – Primary (TOLD-P, Newcomer & Hammill, 1982); Test of Nonverbal Intelligence (TONI, Brown, Sherbenou, & Johnson, 1982); Wechsler Adult Intelligence Scale – Revised (WAIS-R, Wechsler, 1981).

Appendix A3

Research: Vocabulary in Writing

Study	Grades	No. of Children	No. of Samples	No. of Words	Types of Writing
Lorenz (1931)	3	NP	1,678	82,694	Letters, reports, original verse, announcements, book reviews, records, notes, and newspaper articles.
Fitzgerald (1934)	3	NP	1,256	100,840	Letters written in life outside school.
Rinsland (1945)	1-8	100,212	100,212	6,012,359	Personal notes, stories, poems, compositions, exam papers, school newspaper articles, reports.
Hillerich (1978)	2-6	3000	SR	> 380,000	Creative writing.
Smith & Ingersoll (1984)	1-8	>4000	>4000	482,487	Researcher-prompt.

Study	Grades	No. of Children	No. of Samples	No. of Words	Types of Writing
Shapiro & Gunderson (1988)	1	52	NP	9,857	Log books (independent writing), draft books (thematic writing), cooperative stories, skill-associated assignments.
Farr, Kelleher, Lee, & Beverstock (1989)	2-8	21,697	21,697	3,080,831	National and state assessments.

Note. NP = Information not provided in research article; SR = Information not provided in secondary reference: Graham, Harris, & Loynachan (1993).

Appendix B1

Recruitment: North Carolina

School	Teacher	Grade	Class Size	Number Recruit-ed	Percent Recruit-ed	English Language Learners	Children with Disabilities	Children with no Samples	Children that Dictated	Children in Year 5	Partici-pants
A	A1	G1	20	10	50.00	1[a]					9
	A2	G1	19	9	47.37						9
	A3	G2	18	9	50.00	1	1				7
	A4	G2	21	11	52.38	1	1				9
	A5	G3	19	7	36.84			1			6
	A6	G3	19	5	26.32			3			2
B	B1	K	26	6	23.08		2		4		0
	B2	G1	23	8	34.78						8
	B3	G2	20	7	35.00						7
	B4	G2	20	5	25.00						5
	B5	G3	21	5	23.81		2				3
	B6	G3	20	10	50.00		2				8

School	Teacher	Grade	Class Size	Number Recruit-ed	Percent Recruit-ed	English Language Learners	Children with Disabilities	Children with no Samples	Children that Dictated	Children in Year 5	Partici-pants
C	C1	G1	18	7	38.89						7
D	D1	K	19	11	57.89		4				7
	D2	K	18	9	50.00	1					8
	D3	G1	22	15	68.18		4				11
	D4	G1	20	13	65.00						13
	D5	G2	19	6	31.58						6
Total			362	153		4	16	4	4		125

[a]This child was an English language learner and had a disability.

Appendix B2

Recruitment: New Zealand

School	Teacher	Grade	Class Size	Number Recruit-ed	Percent Recruit-ed	English Language Learners	Children with Disabilities	Children with no Samples	Children that Dictated	Children in Year 5	Partici-pants
E	E1	Y1	18	7	38.89	1					6
	E2	Y1	19	11	57.89		2				9
	E3	Y1/Y2	26	7	26.92						7
F	F1	Y1/Y2	14	5	35.71						5
	F2	Y2	29	16	55.17		1				15
	F3	Y2	29	17	58.62		2				15
	F4	Y2/Y3	28	16	57.14	1	2				13
G	G1	Y1	25	12	48.00		3				9
	G2	Y2	24	15	62.50		2				13
	G3/G4	Y3	24	12	50.00		2	1			9
	G5	Y3	19	10	52.63		1	2			7
	G6	Y4	21	12	57.14			3		4	5
Total				140	276	2	15	6		4	113

Appendix B3

Economic Characteristics: North Carolina

School	Free or Reduced Lunch[a]	Decile[b]	Median Household Income[c]
A	13.5%	9	$47,063[d]
B	20.98%	9	$54,897
C	26.03%	9	$54,897
D	48.63%	5	$40,424

[a]School districts in the United States frequently use this statistic as an indicator of economic disadvantage. The National School Lunch Program is a federally assisted meal program that provides low-cost or free lunches to children from families with incomes below 185 percent of the poverty level. Eligibility is determined based on household size and household income. These statistics were obtained from school districts' websites. [b]The decile rating was generated to facilitate comparison between North Carolina and New Zealand. New Zealand's Ministry of Education uses a decile rating system for school funding purposes. Each decile contains approximately 10% of schools. Schools in decile 1 have the highest proportion of children from low socio-economic backgrounds. Schools in decile 10 have the lowest proportion of these children. Decile ratings incorporate five indicators of socio-economic status including household income, parents' occupation, household crowding, parents' educational qualifications, and parents' receipt of income support. The decile ratings for North Carolina were generated by ranking all of the schools in the state according to the percentage of children who receive free or reduced lunches. Schools in decile 1 have the highest proportion of children receiving free or reduced lunches. Schools in decile 10 have the lowest proportion of these children. [c]Statistics were retrieved from the 2000 Census for the tract that each school is geographically located within. [d]The 2000 Census was conducted prior to the construction of this school and its surrounding neighborhood so this figure should be interpreted with caution.

Appendix B4

Economic Characteristics: New Zealand

School	Decile[a]	Median Household Income[b]
E	7	$35,195[d]
F	7	$44,320[c]
G	10	$66,789[c]

[a]New Zealand's Ministry of Education uses a decile rating system for school funding purposes. Each decile contains approximately 10% of schools. Schools in decile 1 have the highest proportion of children from low socio-economic backgrounds. Schools in decile 10 have the lowest proportion of these children. Decile ratings incorporate five indicators of socio-economic status including household income, parents' occupation, household crowding, parents' educational qualifications, and parents' receipt of income support. The decile ratings were obtained from the following website: www.tki.org.nz. [b]Statistics were retrieved from the 2001 Census. [c]Statistics were retrieved for the area unit that these schools are geographically located within. [d]Statistics were retrieved for the city that this school is geographically located within.

Appendix B5

Teachers: North Carolina

School	Teacher	Grade	Years Experience	Education
A	A1	G1	10	Master’s
	A2	G1	6	Bachelor’s
	A3	G2	2	Bachelor’s
	A4	G2	5	Master’s
	A5	G3	9	Bachelor’s
	A6	G3	5	Bachelor’s
B	B1	G1	7	Bachelor’s
	B2	G2	8	Bachelor’s
	B3	G2	24	Bachelor’s
	B4	G3	10	Master’s
	B5	G3	11	Master’s
C	C1	G1	7	Bachelor’s
D	D1	K	5	Bachelor’s
	D2	K	3	Master’s
	D3	G1	3	Bachelor’s
	D4	G1	10	Bachelor’s
	D5	G2	6	Master’s

Appendix B6

Teachers: New Zealand

School	Teacher	Grade	Years Experience	Education
E	E1	Y1	22	Certificate
	E2	Y1	9	Bachelor's
	E3	Y1/Y2	10	Postgraduate Diploma
F	F1	Y1/Y2	8	Diploma
	F2	Y2	10	Postgraduate Diploma
	F3	Y2	6	Bachelor's
	F4	Y2/Y3	30	Diploma
G	G1	Y1	28	Bachelor's
	G2	Y2	9	Bachelor's
	G3/G4[a]	Y3	12/15	Bachelor's/Bachelor's
	G5	Y3	15	Certificate
	G6	Y4	25	Bachelor's

[a]These teachers co-taught the same class.

Appendix B7

Ethnicity: North Carolina

School	Ethnicity				
	US European	African American	Hispanic	Asian	Other[a]
A	24 (57%)	4 (10%)	1 (2%)	8 (19%)	5 (12%)
B	23 (74%)	5 (16%)	1 (3%)	1 (3%)	1 (3%)
C	5 (71%)	1 (14%)	0	0	1 (14%)
D	38 (84%)	4 (9%)	2 (4%)	0	1 (2%)
Total	90 (72%)	14 (11%)	4 (3%)	9 (7%)	8 (6%)

[a]Other category includes: (a) children who represent ethnic groups other than US European, African American, Hispanic, or Asian, and (b) children who represent more than one ethnic group.

Appendix B8

Ethnicity: New Zealand

School	Ethnicity		
	NZ European	Maori	Other[a]
E	16 (73%)	2 (9%)	4 (18%)
F	22 (46%)	11 (23%)	15 (31%)
G	41 (95%)	1 (2%)	1 (2%)
Total	79 (70%)	14 (12%)	20 (18%)

[a]Other category includes: (a) children who represent ethnic groups other than NZ European or Maori, and (b) children who represent more than one ethnic group.

Appendix B9

Chronological Age: North Carolina

School	School Age							
	SA1		SA2		SA3		SA4	
	N	Mean CA	N	Mean CA	N	Mean CA	N	Mean CA
A	0		18	6;7	16	7;7	8	8;7
B	0		8	6;6	12	7;6	11	8;6
C	0		7	6;4	0		0	
D	14	5;7	25	6;7	6	7;7	0	
Total	14	5;7	58	6;7	34	7;6	19	8;6

Appendix B10

Chronological Age: New Zealand

School	School Age							
	SA1		SA2		SA3		SA4	
	N	Mean CA	N	Mean CA	N	Mean CA	N	Mean CA
E	17	5;6	5	6;7	0		0	
F	6	5;11	30	6;6	12	7;4	0	
G	9	5;5	14	6;6	13	7;8	7	8;4
Total	32	5;7	49	6;6	25	7;6	7	8;4

Appendix B11

Classroom Context Log

Teacher's Name: _______________

School: _______________

Date: _______________

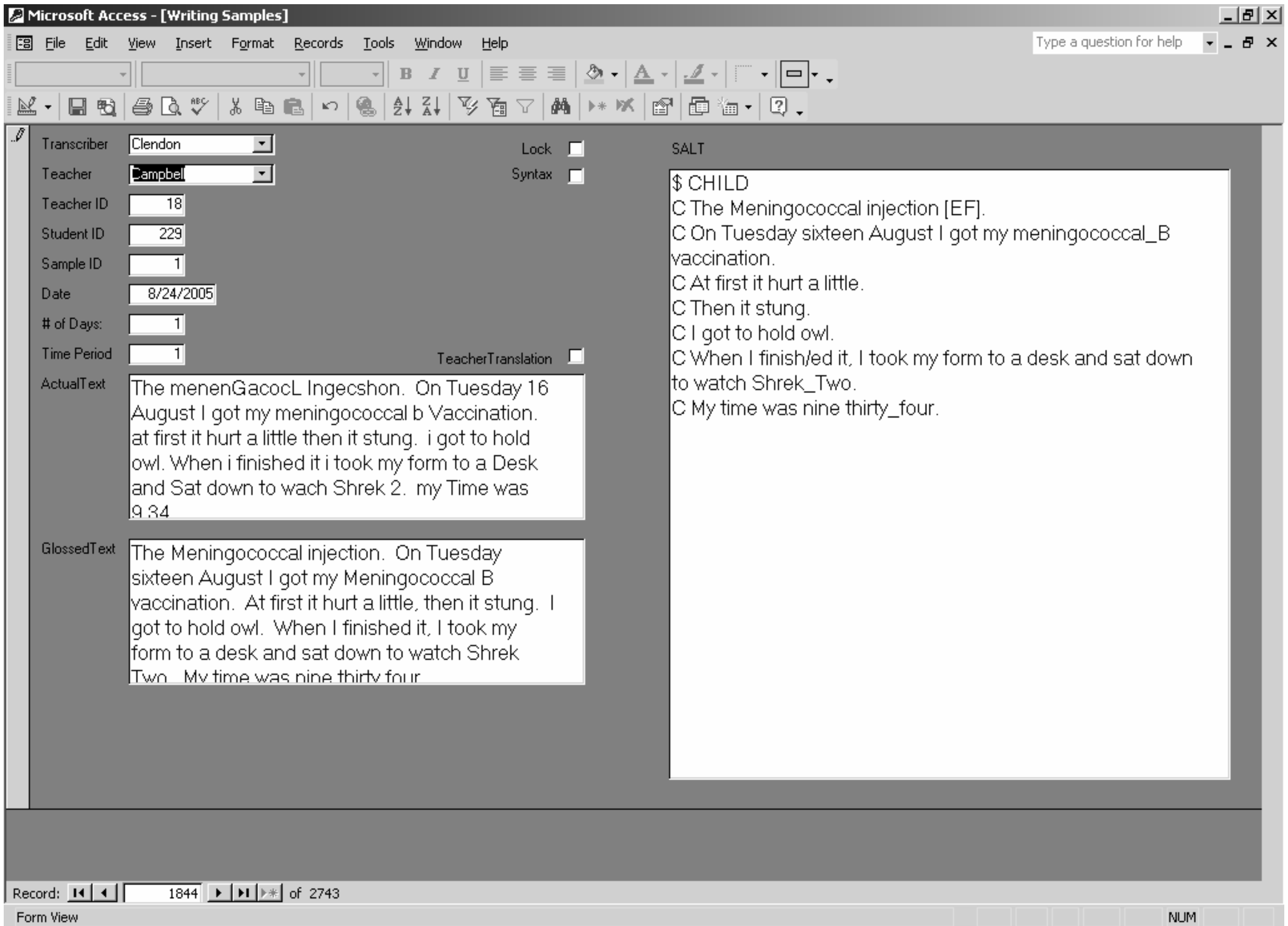
Please describe the events that took place over the past two weeks that may have influenced your students' writing topics:

Classroom Events: [e.g., theme or topic of study; storybooks; fieldtrip]
School Events: [e.g., concert; school fair]

Community Events: [e.g., sports game]
National Events: [e.g., national holiday, news stories]
International Events: [e.g., news stories]

Appendix B12

Microsoft Access Database Form



Appendix B13

Transcription Rules

<u>Data Entry</u>

- Copy and paste from one transcription box to the next to avoid contaminating data.

<u>Actual Text</u>

- Copy exactly what the child wrote. Do not make any corrections.

<u>Glossed</u>

- Correct spelling and punctuation, but do not correct any grammatical deviations, e.g., *he is caming*.
- Convert New Zealand spelling to American spelling, e.g., *colour* → *color*.
- Do not translate Maori or Spanish words.
- Give credit for a bound morpheme if it is represented orthographically or phonologically, e.g., *trickt* is transcribed as *tricked*.
- Place unintelligible words in square brackets

<u>SALT</u>

- Segment sentences into t-units.
- Mark unintelligible words with an X.
- Mark grammatical deviations as errors or omissions using SALT error conventions, e.g., EU = error utterance; EW = error word.
- Mark bound morphemes that were used in error if the error word is a real word, e.g., *Ashley and Tyler were play/ed[EW:play/ing] this game *last night.*

If the error word is not a real word, then do not mark bound morphemes, e.g., *On Wednesday Hannah is caming[EW:come/ing] to my house.*

- Accept both New Zealand English and United States English grammar, e.g., in New Zealand the past tense for the verb *spell* is usually *spelt*. In the United States, however, it is common to use *spelled*.
- Link words that appear as one unit in the Merriam-Webster's 11th Collegiate Dictionary Version 3.0 software program, e.g., *ice_cream*.

  Exception: Some words that do not appear as one unit in the dictionary should still be linked. Rationales for linking these words include:

  ~ The meaning of the words change considerably when they are separated out, e.g., *fairy_bread* does not mean bread with fairies on it. It is a New Zealand word for bread with hundreds and thousands (NZ English) or sprinkles (US English) on top.

  ~ The same concept is represented by one word in the United States and two words in New Zealand or vice versa, e.g., *barette* (US), *hair_clip* (NZ).

  ~ Similar words are treated as one unit in the dictionary, e.g., *hover_copter* is linked because the word *hover craft* is treated as one unit in the dictionary.
- Link names/titles e.g., *PlayStation_Two, Southpoint_Mall*, *Mrs_Clendon*.
- Write numbers out in full.

Appendix B14

Database Checks

- Checked transcriptions that were completed by research assistants.
- Ran writing samples through *freq* function in CLAN and looked for errors, for instance:
  - ~ Double-ups, e.g., *ok*, *okay*.
  - ~ Bound morphemes that had not been marked, e.g., *doing* instead of *do/ing*.
- Ran writing samples through *freq* and *combo* functions in CLAN and examined data to make sure that words that ended with *ing* and *ed* were marked as having bound morphemes when appropriate.
- Ran writing samples through the *check for errors* function in the SALT tools menu.
- Ran writing samples through the *saltin* function in CLAN and checked for errors.

Appendix B15

Modifications Made to SALT files for vocabulary analyses in CLAN

- When linked words contained an omission, the omission was corrected, e.g., *America's_Funniest_*Home_Videos* (the word *Home* was omitted) was corrected to *America's_Funniest_Home_Videos*.
- All words that ended with *ing* or *ed* were collapsed and were not counted separately, e.g., the verb *fishing* in the sentence, *I am fishing,* was analyzed together with the noun in the sentence, *Fishing is fun*.
- When bound morphemes were omitted, only the root word was used in the analysis, e.g., *run/*ing* (*ing* was omitted) was treated as *run*.

Appendix B16

Semantic Themes and Fields

Themes	Human Form & Function	Activity & Sensory	Leisure	Transport	Fauna, Flora, & Elements	Domestic Setting	Dimensions	Institutions and the World
Fields	Man	Move	Sound	Recreation	Animals	Building	Quantity	Government
	Body	Make/Do	Sight	Occasions	Birds	Furniture	Measurement	Law
	Health	Happen	Smell	Shows	Fish	Tools	Size	Education
	Clothing	Live	Taste	Music	Insects	Containers	Shape	Religion
	Food	Have	Touch	Art	Flowers		Time	Business
		Think	Language	Land (road)	Trees		Location	Manufacture
		Feel	Imagination	Land (rail)	Light		State	Space
				Air	Color			World
				Water	Fire			Minerals
				Fuel	Water			Weapons
								Money

Appendix B17

LARSP Stage I – Definitions and Examples

Stage	**Function**	**Type**	**Definition**	**Examples**
I	Minor	Response	Word or word-like unit used as a response	*Yes, No, Mhm*
		Vocative	Word or word-like unit used as a calling signal	*Mommy; Peter*
		Other	Other word or word-like unit. Examples include interjections, and phrases that perform various social functions	*Oh; Yuck; Hello;*
	Command	V	Single verb used as an imperative	*Run; Stop*
	Question	Q	Single question-word	*What; How*
	Statement	V	Single word used as a verb	*Girl; Truck*
		N	Single word used as a noun	*Run; Jumping*
		Other	Single word used as an adjective, adverb, or pronoun	*Small; There; Her*

Appendix B18

LARSP Stage II Clause – Definitions and Examples

Stage	Function	Type	Definition	Examples
II	Command	VX	Imperative verb + 1 other clause element	*Sit here*
	Question	QX	Question-word + 1 other clause element	*Where Becky*
	Statement	SV	Subject + verb	*The baby is crying*
		SO	Subject + object	*Boy kite*
		SC	Subject + complement	*Girl nice*
		Neg X	Negative-word + 1 other clause element	*Not blue*
		AX	Adverbial + 1 other clause element	*There toys*
		VO	Verb + object	*Want cookie*
		VC	Verb + complement	*Am happy*
		Other	Any other 2 element clause	*To me*

Appendix B19

LARSP Stage III Clause – Definitions and Examples

Stage	Function	Type	Definition	Examples
III	Command	VXY	Imperative verb + 2 other clause elements	*Put the dishes away*
		Let XY	Let + 2 other clause elements	*Let me go*
		Do XY	Do + 2 other clause elements	*Don't do that*
	Question	QXY	Question-word +2 other clause elements	*What you doing*
		VS(X)	Subject-verb inversion + 1 other clause element	*Is she away*
	Statement	SVC	Subject + verb + complement	*Renee is a doctor*
		SVO	Subject + verb + object	*They baked the cake*
		SVA	Subject + verb + adverbial	*Lorraine went to the beach*
		Neg XY	Negative-word + 2 other clause elements	*Not go bed*
		VCA	Verb + complement + adverbial	*Is sad now*
		VOA	Verb + object + adverbial	*Drove the car over the hill*
		VOdOi	Verb + direct object + indirect object	*Gave me it*
		Other	Any other 3 element clause	*Went to the supermarket on the bus*

Appendix B20

LARSP Stage IV Clause – Definitions and Examples

Stage	Function	Type	Definition	Examples
IV	Command	+S	Command with the subject expressed	*You come here*
		VXY+	Imperative verb with more than 2 other clause elements	*Put the toys away quickly*
	Question	QVS	Question-word + subject-verb inversion	*Where is Jack*
		QXY+	Question-word + 2 or more other clause elements (no subject-verb inversion)	*Why gone now*
		VS(X)+	Subject-verb inversion + more than 1 other clause element	*Have they eaten the hotdogs already*
		Tag	Verb-subject construction tagged onto the main clause	*Isn't he*
	Statement	SVOA	Subject + verb + object + adverbial	*They kicked the ball over the fence*
		SVCA	Subject + verb + complement + adverbial	*She was ready yesterday*
		SVOdO,	Subject + verb + direct object + indirect object	*James gave me a birthday card*

Stage	Function	Type	Definition	Examples
IV	Statement	SVOC	Subject + verb + object + complement	*He makes me happy*
		AAXY	2 adverbials + 2 other clause elements	*They were going to drive here tonight*
		Other	Any other clause with 4 or more elements	*I went to the opera in the town hall last week*

Appendix B21

LARSP Stage V Clause – Definitions and Examples

Stage	Function	Type	Definition	Examples
V	Command	Coord	2 clauses with imperative verbs linked by a coordinating conjunction	*Sit here and eat your dinner*
		Other	1 clause with an imperative verb + any other type of coordination	*Come over here when you get the chance*
	Question	Coord	2 clauses with question-words linked by a coordinating conjunction	*When did he arrive and why is he sad*
		Other	1 clause with a question-word + any other type of coordination	*What did you do after the football game*
	Statement	Coord 1	2 clauses linked by a coordinating conjunction	*I like to play soccer and I like to go horseback riding*
		Coord 1+	More than 2 clauses linked by a coordinating conjunction	*I stopped and I ate some lunch and I played my Game Boy*

Stage	Function	Type	Definition	Examples
V	Statement	Sub A 1	Subordinate clause containing an adverbial	*I like my t-shirt because it is colorful*
		Sub A 1+	More than 1 subordinate clause containing an adverbial	*I don't like to go running when it is hot and when it is raining*
		Sub S	Subordinate clause containing a subject	*What I said was important*
		Sub C	Subordinate clause containing a complement	*That is what I wanted*
		Sub O	Subordinate clause containing an object	*Dad knew what I wanted*
		Comparative	Clause containing a grammatical marker of comparison	*He is as big as a house*
		PM Cl 1	Post-modifying clause	*The only sound that you could hear was the tap dripping*
		PM Cl 1+	More than 1 post-modifying clause	*That's the car which you drove and which was bumped*

Appendix B22

LARSP Stage II Phrase – Definitions and Examples

Stage	**Type**	**Definition**	**Example**
II	DN	Determiner + noun	*The dog*
	AdjN	Adjective + noun	*Big house*
	NN	Noun + noun	*Railway station*
	PrN	Preposition + noun	*for John*
	VV	Verb + verb	*Make run*
	Vpart	Verb + particle	*Sit down*
	Int X	Intensifier + 1 other clause element	*Really hot*
	Other	Any other phrase with two elements	*In that*

Appendix B23

LARSP Stage III Phrase – Definitions and Examples

Stage	Type	Definition	Example
III	DAdjN	Determiner + adjective + noun	*The blue car*
	AdjAdjN	Adjective + adjective + noun	*Beautiful pink flower*
	PrDN	Preposition + determiner + noun	*Under the table*
	Pron-P	Personal pronoun	*<u>I</u> like vegetables*
	Pron-O	Other pronoun	*I want <u>that</u>*
	Cop	Copula	*She <u>is</u> happy*
	Aux-M	Modal auxiliary verb	*He <u>can</u> run fast*
	Aux-O	Other auxiliary verb	*He <u>has</u> gone away*
	Other	Any other phrase with 3 elements	*The girl's friend*

Appendix B24

LARSP Stage IV Phrase – Definitions and Examples

Stage	Type	Definition	Example
IV	NPPrNP	2 nouns phrases linked by a preposition	*The man in a hat*
	PRDAdjN	Preposition + determiner + adjective + noun	*In the blue box*
	cX	Coordinating conjunction + 1 other clause element	*And the girl*
	XcX	2 phrases linked by a coordinating conjunction	*Broccoli and cauliflower*
	Neg V	Negative-word + verb	*He <u>isn't running</u> fast*
	Neg X	Negative-word + 1 other clause element	*He has a truck, <u>not a car</u>*
	2 Aux	2 auxiliary verbs	*I <u>have been</u> running*
	Other	Any other phrase with 4 or more elements	*A big red fire engine*

Appendix B25

LARSP Bound Morphemes – Definitions and Examples

Type	**Definition**	**Example**
-ing	Present progressive form	*running*
pl	Plural form	*bananas*
-ed (reg)	Regular simple past tense form	*jumped*
-ed (irreg)	Irregular simple past tense form	*flew*
-en	Past participle form	*taken*
3s (reg)	Regular third person singular present tense form	*walks*
3s (irreg)	Irregular third person singular present tense form	*is*
gen	Genitive form	*boy's*
n't	Contracted negative form	*can't*
'cop	Contracted copula	*I'm happy*
'aux	Contracted auxiliary	*I'm swimming*
-est	Superlative form	*biggest*
-er	Comparative form	*bigger*
-ly	Adverb form	*quickly*

Appendix C1

150 Most Frequently Occurring Words [Frequency per 1000 words]

Word	F	Word	F	Word	F	Word	F	Word	F
I	61.38	went	9.15	one	5.94	love	4.37	time	2.71
the	39.93	me	7.91	they	5.66	because	4.19	up	2.65
and	39.30	he	7.58	had	5.62	there	4.07	out	2.59
a	32.12	going	7.51	you	5.31	said	4.05	all	2.58
to	31.51	are	7.30	am	5.14	her	3.98	his	2.57
my	28.84	of	7.15	when	5.10	dad	3.87	can	2.54
is	21.99	she	6.89	at	5.06	house	3.71	today	2.54
it	19.39	for	6.73	mom	4.89	play	3.67	birthday	2.53
we	16.95	see	6.54	that	4.83	be	3.13	some	2.52
was	16.34	then	6.54	but	4.73	day	3.10	too	2.52
like	12.06	have	6.42	so	4.57	get	3.02	do	2.50
in	10.87	got	6.11	fun	4.55	will	3.01	has	2.50
on	10.54	with	5.95	go	4.55	were	2.99	not	2.50

Word	F	Word	F	Word	F	Word	F	Word	F
friend	2.44	name	1.66	them	1.32	cat	1.13	party	1.00
very	2.43	dog	1.63	ball	1.29	know	1.13	blue	0.99
school	2.30	this	1.62	car	1.29	as	1.12	could	0.99
two	2.24	good	1.61	people	1.28	back	1.12	playing	0.99
came	2.23	I'm	1.48	next	1.27	Halloween	1.12	red	0.99
sister	2.23	down	1.47	put	1.24	just	1.12	room	0.99
did	2.13	cool	1.46	three	1.24	want	1.11	Saturday	0.97
our	2.10	what	1.40	it's	1.22	their	1.10	eat	0.94
brother	2.05	best	1.39	first	1.20	nice	1.08	last	0.94
home	1.98	him	1.39	game	1.19	about	1.07	yesterday	0.94
big	1.96	from	1.34	new	1.19	make	1.06	family	0.93
played	1.94	made	1.34	if	1.18	other	1.06	think	0.93
saw	1.89	friends	1.33	lots	1.18	Fall	1.03	us	0.93
little	1.88	night	1.33	lot	1.17	Christmas	1.00	into	0.91
after	1.77	really	1.32	end	1.14	once	1.00	over	0.90

Word	F	Word	F	Word	F	Word	F	Word	F
cousin	0.89	by	0.86	now	0.86	don't	0.85	weekend	0.84
favorite	0.87	didn't	0.86	off	0.86	hair	0.85	also	0.83

Note. F = frequency; No shading = content words; Shading = structure words.

Appendix C2

Frequency and Rank of 50 Most Frequently Occurring Words Overall – Usage Patterns for School Ages 1-4 with North Carolina and New Zealand Combined

[Frequency per 1000 words]

Overall (Countries and School Ages Combined)			SA 1		SA 2		SA 3		SA 4	
Word	**F**	**R**	**F**	**R**	**F**	**R**	**F**	**R**	**F**	**R**
I	61.38	1	139.04	1	65.37	1	45.31	1	28.45	4
the	39.93	2	35.94	5	39.53	3	39.42	2	46.69	1
and	39.30	3	28.82	8	43.22	2	39.00	3	35.02	2
a	32.12	4	61.54	2	29.14	6	27.82	5	30.75	3
to	31.51	5	31.92	7	30.91	5	33.68	4	26.26	5
my	28.84	6	34.33	6	32.71	4	25.56	6	20.01	6
is	21.99	7	28.82	9	24.01	7	20.90	7	11.78	11
it	19.39	8	21.93	10	21.04	8	18.83	8	12.71	10
we	16.95	9	9.87	14	19.10	9	17.05	10	15.01	8
was	16.34	10	6.66	22	16.88	10	17.62	9	18.86	7
like	12.06	11	36.74	4	14.33	11	5.32	32	3.13	51
in	10.87	12	6.20	24	10.95	12	10.83	13	14.90	9
on	10.54	13	7.12	20	10.84	13	11.41	11	9.69	14
went	9.15	14	10.22	13	9.59	14	8.70	14	8.03	16
me	7.91	15	8.27	16	9.37	15	7.39	16	3.75	42
he	7.58	16	2.53	45	8.43	17	7.01	18	10.84	13

Overall (Countries and School Ages Combined)			SA 1		SA 2		SA 3		SA 4	
Word	F	R	F	R	F	R	F	R	F	R
going	7.51	17	10.56	12	7.96	19	6.95	20	4.90	32
are	7.30	18	7.35	18	8.87	16	6.50	22	3.96	38
of	7.15	19	3.21	35	6.51	24	7.78	15	11.05	12
she	6.89	20	4.82	27	7.51	21	6.15	28	8.86	15
for	6.73	21	2.30	51	3.77	46	11.34	12	6.77	19
see	6.54	22	49.60	3	1.94	77	1.43	99	1.46	102
then	6.54	23	0.34	336	8.21	18	6.47	23	6.15	27
have	6.42	24	7.46	17	6.76	23	6.66	21	3.44	46
got	6.11	25	4.02	30	6.90	22	5.70	30	6.36	24
with	5.95	26	7.35	19	5.57	31	6.18	27	5.32	30
one	5.94	27	0.92	138	5.77	29	7.01	19	7.61	17
they	5.66	28	0.69	177	5.90	27	6.47	24	6.57	21
had	5.62	29	3.79	32	5.96	26	5.48	31	6.46	22
you	5.31	30	2.41	49	4.35	40	7.17	17	5.42	29
am	5.14	31	13.09	11	5.74	30	3.44	44	1.25	112
when	5.10	32	0.80	156	5.32	33	6.34	26	4.06	37
at	5.06	33	6.89	21	5.41	32	4.14	36	5.11	31
mom	4.89	34	5.05	26	6.02	25	3.82	38	3.96	39
that	4.83	35	1.49	79	3.83	45	6.34	25	6.67	20
but	4.73	36	1.95	64	3.83	44	6.05	29	6.36	23

Overall (Countries and School Ages Combined)			SA 1		SA 2		SA 3		SA 4	
Word	F	R	F	R	F	R	F	R	F	R
so	4.57	37	1.15	107	4.82	35	4.46	35	7.09	18
fun	4.55	38	5.86	25	5.85	28	3.38	45	2.29	67
go	4.55	39	3.90	31	4.44	38	4.97	33	4.17	36
love	4.37	40	4.36	28	7.57	20	1.78	81	0.83	182
because	4.19	41	8.27	15	4.27	41	3.25	48	3.23	49
there	4.07	42	1.26	95	4.57	37	3.76	40	5.73	28
said	4.05	43	0.57	206	4.35	39	3.95	37	6.36	25
her	3.98	44	1.72	70	3.44	49	4.52	34	6.25	26
dad	3.87	45	2.64	41	4.99	34	3.25	49	2.81	57
house	3.71	46	6.43	23	4.05	42	2.64	59	3.44	47
play	3.67	47	4.36	29	4.80	36	2.64	60	2.19	69
be	3.13	48	1.84	66	2.80	53	3.51	43	4.27	34
day	3.10	49	1.15	101	2.77	54	3.79	39	3.86	40
get	3.02	50	1.03	116	2.91	51	3.54	42	3.54	45

Note. F = frequency; R = rank.

Appendix C3

Frequency and Rank of 50 Most Frequently Occurring Words Overall – Usage Patterns for North Carolina and New Zealand with School Ages 1-4 Combined

[Frequency per 1000 words]

Overall (Countries and School Ages Combined)			North Carolina		New Zealand	
Word	**F**	**R**	**F**	**R**	**F**	**R**
I	61.38	1	62.91	1	58.34	1
the	39.93	2	40.88	2	38.04	3
and	39.30	3	31.46	4	54.83	2
a	32.12	4	33.28	3	29.83	5
to	31.51	5	29.07	6	36.34	4
my	28.84	6	29.60	5	27.33	6
is	21.99	7	21.33	7	23.30	7
it	19.39	8	20.04	8	18.12	8
we	16.95	9	17.65	10	15.58	9
was	16.34	10	18.51	9	12.03	12
like	12.06	11	14.54	11	7.13	20
in	10.87	12	11.11	12	10.40	14
on	10.54	13	9.23	13	13.14	11
went	9.15	14	8.58	15	10.29	15
me	7.91	15	7.21	20	9.28	19
he	7.58	16	8.00	17	6.75	22

Overall (Countries and School Ages Combined)			North Carolina		New Zealand	
Word	F	R	F	R	F	R
going	7.51	17	3.86	42	14.74	10
are	7.30	18	5.91	23	10.05	16
of	7.15	19	7.33	19	6.78	21
she	6.89	20	5.49	28	9.67	17
for	6.73	21	7.68	18	4.83	31
see	6.54	22	9.02	14	1.63	90
then	6.54	23	8.56	16	2.54	58
have	6.42	24	4.91	34	9.42	18
got	6.11	25	5.91	24	6.50	24
with	5.95	26	5.68	27	6.47	25
one	5.94	27	6.86	21	4.10	37
they	5.66	28	6.44	22	4.10	38
had	5.62	29	5.82	25	5.22	27
you	5.31	30	4.77	37	6.36	26
am	5.14	31	2.39	60	10.61	13
when	5.10	32	5.49	29	4.31	35
at	5.06	33	4.26	40	6.64	23
mom	4.89	34	5.05	33	4.55	33
that	4.83	35	5.79	26	2.92	53
but	4.73	36	4.88	35	4.45	34

Overall (Countries and School Ages Combined)			North Carolina		New Zealand	
Word	**F**	**R**	**F**	**R**	**F**	**R**
so	4.57	37	5.11	32	3.51	48
fun	4.55	38	4.39	39	4.87	30
go	4.55	39	4.84	36	3.96	40
love	4.37	40	5.23	30	2.68	55
because	4.19	41	3.82	43	4.90	29
there	4.07	42	4.40	38	3.41	49
said	4.05	43	5.14	31	1.88	72
her	3.98	44	3.60	45	4.73	32
dad	3.87	45	4.05	41	3.51	47
house	3.71	46	3.54	46	4.03	39
play	3.67	47	3.61	44	3.79	43
be	3.13	48	2.93	51	3.51	46
day	3.10	49	3.47	47	2.36	62
get	3.02	50	2.74	54	3.58	45

Note. F = frequency; R = rank.

Appendix C4

Frequency and Rank of 50 Most Frequently Occurring Words Overall – Usage Patterns for School Ages 1-4 in North Carolina [Frequency per 1000 words]

Overall (Countries and School Ages Combined)			NC SA 1		NC SA 2		NC SA 3		NC SA 4	
Word	**F**	**R**	**F**	**R**	**F**	**R**	**F**	**R**	**F**	**R**
I	61.38	1	194.01	1	69.24	1	44.72	1	29.24	4
the	39.93	2	31.43	7	41.93	2	40.47	2	43.56	1
and	39.30	3	4.42	24	34.51	4	32.02	4	34.71	2
a	32.12	4	91.36	3	27.14	6	30.11	5	30.05	3
to	31.51	5	18.42	9	28.49	5	32.82	3	26.32	5
my	28.84	6	32.17	6	35.73	3	26.00	6	20.97	6
is	21.99	7	35.12	5	21.51	8	21.89	7	12.93	11
it	19.39	8	25.29	8	22.03	7	19.61	9	13.28	10
we	16.95	9	1.47	87	20.29	9	18.86	10	15.26	8
was	16.34	10	3.19	40	19.15	10	20.40	8	19.34	7
like	12.06	11	67.53	4	18.15	11	5.23	30	3.03	52
in	10.87	12	2.70	45	11.65	12	10.69	12	14.68	9
on	10.54	13	1.72	74	9.47	15	10.41	13	9.20	15
went	9.15	14	0.49	234	9.16	16	9.62	14	8.27	16
me	7.91	15	6.39	12	8.29	17	7.56	18	3.84	40
he	7.58	16	0.49	190	8.12	18	7.98	16	11.30	12
going	7.51	17	1.47	79	3.23	45	4.67	35	4.66	33

Overall (Countries and School Ages Combined)			NC SA 1		NC SA 2		NC SA 3		NC SA 4	
Word	F	R	F	R	F	R	F	R	F	R
are	7.30	18	5.89	13	7.16	19	5.51	29	3.61	45
of	7.15	19	2.46	55	6.81	21	7.52	19	10.60	13
she	6.89	20	1.23	100	4.32	40	5.79	27	9.90	14
for	6.73	21	0.25	300	3.18	47	14.24	11	6.87	22
see	6.54	22	102.65	2	2.40	64	1.49	97	1.05	149
then	6.54	23	*	*	11.56	13	7.84	17	6.41	26
have	6.42	24	1.96	67	5.28	31	5.70	28	3.38	47
got	6.11	25	0.25	313	6.63	23	5.98	26	6.52	24
with	5.95	26	2.70	50	5.45	30	6.44	22	5.82	29
one	5.94	27	*	*	6.33	24	8.36	15	7.80	17
they	5.66	28	*	*	6.68	22	7.38	20	6.52	25
had	5.62	29	0.49	187	6.02	26	6.21	24	6.87	23
you	5.31	30	2.70	51	4.80	38	4.99	32	5.13	31
am	5.14	31	4.42	23	2.75	55	2.05	72	1.28	107
when	5.10	32	0.25	443	6.15	25	6.30	23	4.19	37
at	5.06	33	3.93	29	4.84	36	3.31	45	5.24	30
mom	4.89	34	2.70	47	6.81	20	3.92	40	4.31	35
that	4.83	35	0.74	154	4.97	35	7.10	21	7.11	19
but	4.73	36	0.74	126	3.71	42	6.12	25	6.87	21
so	4.57	37	1.72	76	5.19	32	4.71	34	7.45	18

Overall (Countries and School Ages Combined)			NC SA 1		NC SA 2		NC SA 3		NC SA 4	
Word	**F**	**R**	**F**	**R**	**F**	**R**	**F**	**R**	**F**	**R**
fun	4.55	38	5.65	17	5.72	29	3.55	42	2.33	66
go	4.55	39	4.17	28	5.02	33	5.09	31	4.08	38
love	4.37	40	5.89	14	9.55	14	2.24	69	0.82	191
because	4.19	41	13.51	10	3.49	43	2.66	54	3.03	51
there	4.07	42	0.98	118	5.02	34	3.73	41	6.06	28
said	4.05	43	*	*	5.89	28	4.95	33	6.06	27
her	3.98	44	0.74	140	2.31	66	4.15	38	6.99	20
dad	3.87	45	0.98	108	5.93	27	3.13	49	2.80	58
house	3.71	46	5.16	19	4.01	41	2.66	56	3.73	43
play	3.67	47	4.67	22	4.80	37	2.66	57	2.33	67
be	3.13	48	2.21	57	2.14	72	3.22	48	4.66	32
day	3.10	49	*	*	3.18	46	4.15	37	4.19	36
get	3.02	50	0.49	182	2.97	52	2.52	58	3.73	42

Note. F = frequency; R = rank; The * symbol signifies that the word was not by any children in the school age group.

Appendix C5

Frequency and Rank of 50 Most Frequently Occurring Words Overall – Usage Patterns for School Ages 1-4 in New Zealand [Frequency per 1000 words]

Overall (Countries and School Ages Combined)			NZ SA 1		NZ SA 2		NZ SA 3		NZ SA 4	
Word	F	R	F	R	F	R	F	R	F	R
I	61.38	1	90.77	1	58.62	1	46.59	2	21.78	5
the	39.93	2	39.89	4	35.36	3	37.15	3	73.27	1
and	39.30	3	50.24	2	58.39	2	54.02	1	37.62	2
a	32.12	4	35.36	6	32.62	5	22.89	6	36.63	3
to	31.51	5	43.77	3	35.13	4	35.54	4	25.74	4
my	28.84	6	36.22	5	27.45	7	24.60	5	11.88	12
is	21.99	7	23.29	7	28.36	6	18.78	7	1.98	108
it	19.39	8	18.97	9	19.31	8	17.17	8	7.92	15
we	16.95	9	17.25	12	17.03	9	13.15	10	12.87	10
was	16.34	10	9.70	18	12.93	13	11.65	13	14.85	8
like	12.06	11	9.70	17	7.68	21	5.52	27	3.96	53
in	10.87	12	9.27	20	9.73	18	11.14	14	16.83	6
on	10.54	13	11.86	14	13.23	11	13.55	9	13.86	9
went	9.15	14	18.76	10	10.34	17	6.73	20	5.94	35
me	7.91	15	9.92	16	11.25	15	7.03	18	2.97	78
he	7.58	16	4.31	32	8.97	20	4.92	32	6.93	21
going	7.51	17	18.54	11	16.20	10	11.85	11	6.93	20

Overall (Countries and School Ages Combined)			NZ SA 1		NZ SA 2		NZ SA 3		NZ SA 4	
Word	**F**	**R**	**F**	**R**	**F**	**R**	**F**	**R**	**F**	**R**
are	7.30	18	8.62	21	11.86	14	8.63	16	6.93	18
of	7.15	19	3.88	36	6.01	26	8.33	17	14.85	7
she	6.89	20	7.98	22	13.08	12	6.93	19	*	*
for	6.73	21	4.10	34	4.79	33	5.12	30	5.94	31
see	6.54	22	3.02	46	1.14	110	1.31	119	4.95	41
then	6.54	23	0.65	220	2.36	59	3.51	49	3.96	61
have	6.42	24	12.29	13	9.35	19	8.73	15	3.96	52
got	6.11	25	7.33	24	7.38	22	5.12	31	4.95	40
with	5.95	26	11.43	15	5.78	28	5.62	26	0.99	385
one	5.94	27	1.72	81	4.79	34	4.12	40	5.94	32
they	5.66	28	1.29	100	4.56	37	4.52	36	6.93	25
had	5.62	29	6.68	27	5.85	27	3.92	41	2.97	74
you	5.31	30	2.16	65	3.57	47	11.85	12	7.92	17
am	5.14	31	20.70	8	10.95	16	6.43	21	0.99	145
when	5.10	32	1.29	104	3.88	45	6.43	22	2.97	91
at	5.06	33	9.49	19	6.39	24	5.92	23	3.96	46
mom	4.89	34	7.12	25	4.64	36	3.61	47	0.99	271
that	4.83	35	2.16	62	1.82	77	4.72	34	2.97	85
but	4.73	36	3.02	43	4.03	43	5.92	24	1.98	95
so	4.57	37	0.65	211	4.18	38	3.92	44	3.96	58

Overall (Countries and School Ages Combined)			NZ SA 1		NZ SA 2		NZ SA 3		NZ SA 4	
Word	**F**	**R**	**F**	**R**	**F**	**R**	**F**	**R**	**F**	**R**
fun	4.55	38	6.04	28	6.08	25	3.01	54	1.98	102
go	4.55	39	3.67	38	3.42	48	4.72	33	4.95	39
love	4.37	40	3.02	44	4.11	42	0.80	187	0.99	259
because	4.19	41	3.67	37	5.63	29	4.52	35	4.95	38
there	4.07	42	1.51	93	3.80	46	3.82	45	2.97	86
said	4.05	43	1.08	127	1.67	82	1.81	91	8.91	14
her	3.98	44	2.59	52	5.40	31	5.32	28	*	*
dad	3.87	45	4.10	33	3.35	49	3.51	48	2.97	68
house	3.71	46	7.55	23	4.11	41	2.61	66	0.99	238
play	3.67	47	4.10	35	4.79	35	2.61	67	0.99	306
be	3.13	48	1.51	86	3.95	44	4.12	38	0.99	156
day	3.10	49	2.16	58	2.05	66	3.01	53	0.99	186
get	3.02	50	1.51	89	2.81	55	5.72	25	1.98	103

Note. F = frequency; R = rank; The * symbol signifies that the word was not by any children in the school age group.

Appendix C6

25 Most Frequently Occurring Two Word Sequences – School Ages 1-4 with North Carolina and New Zealand Combined [Frequency per 1000 sequences]

Rank	SA 1		SA 2		SA 3		SA 4	
	Sequence	F	Sequence	F	Sequence	F	Sequence	F
1	I see	60.13	I like	14.00	is for	7.68	in the	5.96
2	see a	50.71	going to	8.56	going to	7.34	going to	5.47
3	I like	43.61	I love	7.47	it was	7.34	went to	5.23
4	I am	16.37	it was	7.07	went to	5.37	it was	4.99
5	it is	15.21	I am	6.74	in the	4.47	was a	3.77
6	going to	11.59	went to	6.67	and I	4.29	I went	3.53
7	I went	9.71	and I	6.57	to the	4.25	to the	3.53
8	like my	9.56	I went	6.30	I went	4.17	of the	3.28
9	went to	9.42	it is	5.74	on the	4.17	to be	2.92
10	and I	9.13	in the	5.67	I was	4.10	and I	2.80
11	like the	8.84	to the	5.57	I am	3.84	there was	2.80
12	to the	8.11	I got	4.91	I like	3.50	and the	2.55

Rank	SA 1		SA 2		SA 3		SA 4	
	Sequence	F	Sequence	F	Sequence	F	Sequence	F
13	like to	7.82	my mom	4.71	my mom	3.09	I got	2.55
14	am going	7.24	then we	4.48	we went	2.91	my mom	2.43
15	I have	4.93	and my	4.25	it is	2.72	the end	2.43
16	because it	4.64	on the	4.08	to go	2.65	we went	2.43
17	it was	4.49	I was	3.82	and my	2.61	had a	2.19
18	my mom	4.35	am going	3.78	I have	2.50	to go	2.07
19	have a	4.20	my dad	3.72	was a	2.42	a lot	1.95
20	we are	3.91	we are	3.72	had a	2.39	on the	1.95
21	I love	3.77	I have	3.52	have a	2.31	to my	1.95
22	and it	3.48	me and	3.48	I got	2.31	at the	1.82
23	I got	3.48	she is	3.29	when I	2.31	go to	1.82
24	my sister	3.19	to play	3.22	go to	2.27	I had	1.82
25	to go	3.19	is a	3.19	am going	2.20	I was	1.82

Note. F = frequency.

Appendix C7

25 Most Frequently Occurring Three Word Sequences – School Ages 1-4 with North Carolina and New Zealand Combined [Frequency per 1000 sequences]

Rank	SA 1		SA 2		SA 3		SA 4	
	Sequence	**F**	**Sequence**	**F**	**Sequence**	**F**	**Sequence**	**F**
1	I see a	67.81	I went to	5.77	I went to	3.17	I went to	2.75
2	I like my	12.67	I am going	4.62	I am going	2.59	there was a	2.60
3	I like the	11.50	am going to	4.41	am going to	2.54	going to be	2.46
4	I like to	10.33	went to the	3.34	is going to	2.05	we went to	1.88
5	I went to	9.94	I like to	3.21	are going to	2.01	went to the	1.88
6	I am going	9.55	are going to	3.09	we went to	1.87	I'm going to	1.45
7	am going to	8.96	we are going	2.56	went to the	1.83	is going to	1.45
8	because it is	5.65	I got a	2.27	going to be	1.52	once upon a	1.30
9	I have a	4.87	I love my	2.10	passed it to	1.47	upon a time	1.30
10	went to the	4.68	and she is	1.98	we are going	1.47	a lot of	1.01
11	see a leaf	3.90	I have a	1.90	a lot of	1.25	a time there	1.01
12	going to the	3.51	I love to	1.77	going to have	1.21	going to have	1.01

Rank	SA 1		SA 2		SA 3		SA 4	
	Sequence	F	Sequence	F	Sequence	F	Sequence	F
13	I got a	3.12	I like the	1.69	it was fun	1.21	went to my	1.01
14	I like me	3.12	is going to	1.69	to go to	1.12	and I got	0.87
15	like to play	3.12	me and my	1.65	it was a	1.03	and she said	0.87
16	we are going	2.92	like to play	1.61	me and my	0.98	I had a	0.87
17	are going to	2.73	it was fun	1.32	it was time	0.94	so so so	0.87
18	like my mommy	2.53	I like my	1.28	mom and dad	0.89	then I went	0.87
19	like the sun	2.53	then we went	1.28	one day I	0.85	time there was	0.87
20	see a bat	2.34	we went to	1.24	there was a	0.85	to go to	0.87
21	see a dog	2.34	I had a	1.20	to have a	0.85	after that we	0.72
22	and it was	2.14	there was a	1.20	I had a	0.80	are going to	0.72
23	I like playing	2.14	going to have	1.15	I like to	0.80	had to go	0.72
24	I see the	2.14	going to play	1.11	then we went	0.80	I got to	0.72
25	is going to	2.14	it was a	1.11	my mom and	0.76	it was a	0.72

Note. F = frequency.

Appendix C8

25 Most Frequently Occurring Two Word Sequences –North Carolina and New Zealand with School Ages 1-4 Combined [Frequency per 1000 sequences]

Rank	North Carolina		New Zealand	
	Sequence	F	Sequence	F
1	I like	28.49	going to	16.23
2	I see	17.54	I am	12.22
3	see a	14.51	and I	9.16
4	it was	14.35	went to	8.14
5	went to	10.38	I went	7.89
6	it is	9.85	am going	7.56
7	I love	9.69	to the	6.70
8	in the	9.32	it was	5.36
9	is for	8.42	we are	5.23
10	I went	8.38	in the	5.19
11	to the	8.30	I like	5.03
12	my mom	8.18	it is	4.91
13	I was	7.89	she is	4.86
14	going to	7.48	are going	4.70
15	and I	7.15	on the	4.70
16	then we	6.99	I got	4.62
17	like to	6.58	I have	4.09
18	on the	6.38	and she	3.97

Rank	North Carolina		New Zealand	
	Sequence	**F**	**Sequence**	**F**
19	was a	6.05	and we	3.92
20	my dad	5.97	and my	3.68
21	we went	5.89	have a	3.56
22	I got	5.81	and it	3.19
23	to go	5.81	my mom	3.07
24	I am	5.36	I had	2.98
25	and my	5.27	me and	2.94

Note. F = frequency.

Appendix C9

25 Most Frequently Occurring Three Word Sequences – North Carolina and New Zealand with School Ages 1-4 Combined [Frequency per 1000 sequences]

Rank	North Carolina		New Zealand	
	Sequence	F	Sequence	F
1	I see a	17.28	I am going	8.94
2	I like to	7.01	am going to	8.64
3	I went to	6.47	I went to	7.41
4	I like the	4.74	are going to	5.23
5	I like my	4.44	we are going	4.10
6	went to the	4.25	went to the	3.61
7	we went to	3.36	is going to	2.86
8	like to play	2.72	and she is	2.72
9	I love my	2.67	I got a	2.72
10	there was a	2.62	going to have	2.67
11	me and my	2.57	going to the	2.42
12	going to be	2.52	I have a	2.22
13	is going to	2.47	and I got	1.68
14	I love to	2.37	and it was	1.63
15	it was a	2.22	I had a	1.53
16	then we went	2.17	it was fun	1.53
17	I have a	2.12	and we are	1.48
18	a lot of	2.07	going to play	1.48

Rank	North Carolina		New Zealand	
	Sequence	**F**	**Sequence**	**F**
19	it is fun	2.07	and I am	1.38
20	because it is	2.02	in the weekend	1.38
21	I am going	2.02	going to be	1.28
22	it was fun	2.02	and my brother	1.14
23	am going to	1.93	to have fun	1.14
24	to go to	1.93	I'm going to	1.09
25	are going to	1.63	the weekend I	1.09

Note. F = frequency.

Appendix C10

25 Most Frequently Occurring Two Word Sequences – School Ages 1-4 in North Carolina

[Frequency per 1000 sequences]

Rank	NC SA 1		NC SA 2		NC SA 3		NC SA 4	
	Sequence	F	Sequence	F	Sequence	F	Sequence	F
1	I see	134.42	I like	18.99	is for	11.31	in the	5.72
2	see a	113.87	I love	9.99	it was	8.40	it was	5.45
3	I like	87.11	it was	7.99	went to	5.77	went to	5.45
4	it is	25.77	then we	6.42	I was	4.78	going to	5.17
5	like my	19.25	went to	5.63	going to	4.61	was a	3.95
6	like the	18.60	it is	5.57	I went	4.39	I went	3.54
7	like to	15.99	in the	5.52	in the	4.39	of the	3.27
8	because it	9.46	my mom	5.42	on the	4.17	to be	3.13
9	a leaf	6.53	to the	5.42	to the	3.95	and I	2.99
10	the sun	6.53	I went	5.10	my mom	3.79	there was	2.99
11	I love	6.20	I was	4.84	and I	3.62	to the	2.86
12	a dog	5.87	my dad	4.73	I like	3.62	I got	2.72

Rank	NC SA 1		NC SA 2		NC SA 3		NC SA 4	
	Sequence	F	Sequence	F	Sequence	F	Sequence	F
13	I am	5.87	and I	4.37	we went	3.35	the end	2.72
14	like me	5.55	like to	4.37	was a	3.08	my mom	2.59
15	is cool	4.89	and my	4.21	one day	3.02	we went	2.59
16	is fun	4.57	I got	4.21	the ball	2.80	and the	2.31
17	my mommy	4.57	to play	3.52	to go	2.75	had a	2.31
18	to go	4.57	on the	3.42	had a	2.69	to go	2.31
19	to play	4.57	we went	3.37	it is	2.53	a lot	2.18
20	I will	4.24	was a	3.26	I have	2.47	one day	2.04
21	a bat	3.92	I am	3.21	my dad	2.42	then I	2.04
22	a bus	3.92	to go	3.21	I am	2.31	to my	2.04
23	a cat	3.59	going to	3.10	to my	2.31	and a	1.91
24	a flower	3.59	is a	3.05	I got	2.25	and she	1.91
25	a box	3.26	I have	3.00	and my	2.20	at the	1.91

Note. F = frequency.

Appendix C11

25 Most Frequently Occurring Three Word Sequences – School Ages 1-4 in North Carolina

[Frequency per 1000 sequences]

Rank	NC SA 1		NC SA 2		NC SA 3		NC SA 4	
	Sequence	F	Sequence	F	Sequence	F	Sequence	F
1	I see a	167.71	I like to	4.95	I went to	3.05	I went to	2.76
2	I like my	28.43	I went to	4.35	passed it to	2.19	there was a	2.76
3	I like the	26.51	went to the	3.23	we went to	2.19	going to be	2.59
4	I like to	23.13	I love my	3.04	went to the	1.79	we went to	2.11
5	because it is	13.01	I love to	2.77	is going to	1.72	is going to	1.62
6	see a leaf	9.64	I like the	2.51	going to be	1.59	went to the	1.62
7	I like me	7.71	like to play	2.51	a lot of	1.46	a lot of	1.14
8	like my mommy	6.27	me and my	2.11	it was fun	1.46	going to have	1.14
9	like the sun	6.27	then we went	1.72	it was a	1.33	I'm going to	1.14
10	like to play	6.27	I have a	1.65	are going to	1.26	once upon a	1.14
11	see a bat	5.78	I like my	1.65	one day I	1.26	upon a time	1.14
12	see a dog	5.78	I am going	1.52	me and my	1.19	went to my	1.14

Rank	NC SA 1		NC SA 2		NC SA 3		NC SA 4	
	Sequence	**F**	**Sequence**	**F**	**Sequence**	**F**	**Sequence**	**F**
13	it is cool	5.30	am going to	1.45	there was a	1.19	a time there	0.97
14	like to go	5.30	I got a	1.45	we are going	1.19	and I got	0.97
15	see a bus	5.30	it is fun	1.45	I like to	1.13	and she said	0.97
16	see a cat	5.30	we went to	1.45	it was time	1.06	so so so	0.97
17	see a flower	5.30	then we had	1.39	to go to	1.06	then I went	0.97
18	I see the	4.82	is the best	1.32	then we went	1.00	to go to	0.97
19	it is fun	4.82	it was a	1.32	in the fall	0.93	after that we	0.81
20	see a box	4.82	when I was	1.25	it to me	0.93	are going to	0.81
21	see a pumpkin	4.82	I saw a	1.19	I am going	0.86	had to go	0.81
22	like my daddy	4.34	mom and dad	1.19	my mom and	0.86	I got to	0.81
23	I like playing	3.86	the next day	1.19	the other team	0.86	I had a	0.81
24	I will bring	3.86	then we got	1.19	we had a	0.86	it was a	0.81
25	see a farm	3.86	there was a	1.19	am going to	0.80	time there was	0.81

Note. F = frequency.

Appendix C12

25 Most Frequently Occurring Two Word Sequences – School Ages 1-4 in New Zealand

[Frequency per 1000 sequences]

Rank	NZ SA 1		NZ SA 2		NZ SA 3		NZ SA 4	
	Sequence	F	Sequence	F	Sequence	F	Sequence	F
1	I am	24.76	going to	17.89	going to	13.10	to the	9.11
2	going to	20.33	I am	12.77	I am	7.07	going to	7.97
3	I went	16.94	and I	10.34	and I	5.68	in the	7.97
4	went to	16.42	went to	8.45	am going	5.33	the joker	6.83
5	and I	15.38	I went	8.36	it was	5.10	all the	5.69
6	to the	12.77	am going	8.18	to the	4.87	and we	5.69
7	am going	12.51	she is	7.55	in the	4.64	and the	4.56
8	I like	8.86	we are	6.92	went to	4.52	go to	4.56
9	I have	7.04	and she	6.74	on the	4.17	in a	4.56
10	we are	7.04	are going	6.29	I went	3.71	my cousin	4.56
11	it is	6.78	I got	6.11	and my	3.48	on the	4.56
12	it was	6.52	it is	6.02	are going	3.25	said in	4.56

Rank	NZ SA 1		NZ SA 2		NZ SA 3		NZ SA 4	
	Sequence	**F**	**Sequence**	**F**	**Sequence**	**F**	**Sequence**	**F**
13	and it	6.25	in the	5.93	I like	3.25	the vikings	4.56
14	have a	5.99	to the	5.84	it is	3.13	along line	3.42
15	I got	5.99	I like	5.48	and we	2.90	come for	3.42
16	I did	5.47	it was	5.48	when I	2.90	could hear	3.42
17	my mom	5.47	on the	5.21	have a	2.78	down the	3.42
18	to my	5.21	and we	4.59	to have	2.78	fold along	3.42
19	got a	4.69	I have	4.41	and a	2.67	I went	3.42
20	are going	4.43	me and	4.41	I was	2.67	I'm going	3.42
21	on the	4.43	and my	4.32	we are	2.67	like a	3.42
22	and we	3.91	I had	3.78	go to	2.55	my little	3.42
23	I had	3.91	he is	3.69	I have	2.55	of the	3.42
24	I saw	3.65	have a	3.60	I got	2.44	the car	3.42
25	in the	3.65	my mom	3.51	she is	2.44	the cars	3.42

Note. F = frequency.

Appendix C13

25 Most Frequently Occurring Three Word Sequences – School Ages 1-4 in New Zealand

[Frequency per 1000 sequences]

Rank	NZ SA 1		NZ SA 2		NZ SA 3		NZ SA 4	
	Sequence	F	Sequence	F	Sequence	F	Sequence	F
1	I went to	16.03	I am going	9.77	am going to	6.14	I'm going to	3.90
2	I am going	15.37	am going to	9.33	I am going	6.14	said in a	3.90
3	am going to	14.72	I went to	8.12	are going to	3.55	went to the	3.90
4	went to the	7.85	are going to	7.24	I went to	3.41	breathing hot flaming	2.60
5	I have a	6.54	we are going	5.82	is going to	2.73	could see the	2.60
6	going to the	5.56	and she is	5.05	going to have	2.46	down along line	2.60
7	I got a	5.23	I got a	3.62	we are going	2.05	fold along lines	2.60
8	we are going	4.91	went to the	3.51	went to the	1.91	going to the	2.60
9	are going to	4.58	is going to	2.96	when I was	1.77	hot flaming fire	2.60
10	and it was	3.60	going to have	2.85	mom and dad	1.64	I could see	2.60
11	is going to	3.60	going to play	2.74	going to the	1.50	I went to	2.60
12	going to have	3.27	I have a	2.30	too many pies	1.50	in the weekend	2.60

Rank	NZ SA 1		NZ SA 2		NZ SA 3		NZ SA 4	
	Sequence	F	Sequence	F	Sequence	F	Sequence	F
13	and we are	2.94	very very very	2.30	going to be	1.36	like a screeching	2.60
14	I did play	2.94	and I got	2.20	I'm going to	1.36	my little brother	2.60
15	and I am	2.62	going to the	2.09	on Saturday I	1.36	once upon a	2.60
16	did play with	2.62	I had a	2.09	going to do	1.23	said the joker	2.60
17	I saw a	2.62	in the weekend	1.98	to go to	1.23	see my cousin	2.60
18	and I got	2.29	it was fun	1.98	to have a	1.23	stepped on a	2.60
19	it was fun	2.29	and we are	1.87	we went to	1.23	stunt car race	2.60
20	to the park	2.29	to have fun	1.87	and my brother	1.09	the droids said	2.60
21	we are having	2.29	and I am	1.65	and when it	1.09	the stunt car	2.60
22	and I did	1.96	and it was	1.65	my little sister	1.09	the waves was	2.60
23	and I like	1.96	going to be	1.43	the next day	1.09	the weekend I	2.60
24	going to a	1.96	today I am	1.43	the weekend I	1.09	these are the	2.60
25	I am playing	1.96	and I like	1.32	when it is	1.09	to see my	2.60

Note. F = frequency.

Appendix C14

25 Most Frequently Occurring Two Word Sequences – School Ages 1-4 with North Carolina and New Zealand Combined [Frequency per 1000 sequences]

Overall (Countries and School Ages Combined)			SA 1		SA 2		SA 3		SA 4	
Sequence	**F**	**R**	**F**	**R**	**F**	**R**	**F**	**R**	**F**	**R**
I like	11.37	1	43.61	3	14.00	1	3.50	12	0.36	328
going to	8.04	2	11.59	6	8.56	2	7.34	2	5.47	2
It was	6.69	3	4.49	17	7.07	4	7.34	3	4.99	4
went to	6.28	4	9.42	9	6.67	6	5.37	4	5.23	3
I see	6.01	5	60.13	1	0.56	170	0.04	7315	*	*
I am	5.96	6	16.37	4	6.74	5	3.84	11	1.34	37
and I	5.53	7	9.13	10	6.57	7	4.29	6	2.80	10
I went	5.52	8	9.71	7	6.30	8	4.17	8	3.53	6
to the	5.09	9	8.11	12	5.57	11	4.25	7	3.53	7
it is	5.01	10	15.21	5	5.74	9	2.72	15	1.22	49

Overall (Countries and School Ages Combined)			SA 1		SA 2		SA 3		SA 4	
Sequence	**F**	**R**	**F**	**R**	**F**	**R**	**F**	**R**	**F**	**R**
see a	4.95	11	50.71	2	0.17	821	0.07	2684	*	*
in the	4.92	12	2.17	42	5.67	10	4.47	5	5.96	1
I love	3.93	13	3.77	21	7.47	3	1.12	70	0.24	670
my mom	3.81	14	4.35	18	4.71	13	3.09	13	2.43	14
on the	3.76	15	2.90	29	4.08	16	4.17	9	1.95	20
I got	3.54	16	3.48	23	4.91	12	2.31	22	2.55	13
I was	3.43	17	1.01	103	3.82	17	4.10	10	1.82	25
am going	3.15	18	7.24	14	3.78	18	2.20	25	0.49	182
and my	3.04	19	1.74	59	4.25	15	2.61	17	1.09	59
I have	2.95	20	4.93	15	3.52	21	2.50	18	0.73	116
is for	2.86	21	*	*	*	*	7.68	1	*	*
we are	2.80	22	3.91	20	3.72	20	2.05	29	0.97	81
then we	2.75	23	0.29	631	4.48	14	1.90	32	1.22	53

Overall (Countries and School Ages Combined)			SA 1		SA 2		SA 3		SA 4	
Sequence	**F**	**R**	**F**	**R**	**F**	**R**	**F**	**R**	**F**	**R**
my dad	2.73	24	2.17	45	3.72	19	2.16	26	1.46	33
to go	2.59	25	3.19	25	2.56	35	2.65	16	2.07	18

Note. F = frequency; R = rank; The * symbol signifies that the word was not used by any children in the School Age group.

Appendix C15

25 Most Frequently Occurring Three Word Sequences – School Ages 1-4 with North Carolina and New Zealand Combined [Frequency per 1000 sequences]

Overall (Countries and School Ages Combined)			SA 1		SA 2		SA 3		SA 4	
Sequence	F	R	F	R	F	R	F	R	F	R
I see a	5.98	1	67.81	1	0.12	760	*	*	*	*
I went to	4.79	2	9.94	5	5.77	1	3.17	1	2.75	1
I am going	3.78	3	9.55	6	4.62	2	2.59	2	0.43	69
am going to	3.64	4	8.96	7	4.41	3	2.54	3	0.58	31
went to the	2.71	5	4.68	10	3.34	4	1.83	7	1.88	5
I like to	2.57	6	10.33	4	3.21	5	0.80	23	0.29	220
are going to	2.37	7	2.73	17	3.09	6	2.01	5	0.72	22
we are going	1.89	8	2.92	16	2.56	7	1.47	10	0.14	5791
is going to	1.84	9	2.14	25	1.69	14	2.05	4	1.45	7
I like the	1.81	10	11.50	3	1.69	13	0.27	183	*	*

Overall (Countries and School Ages Combined)			SA 1		SA 2		SA 3		SA 4	
Sequence	F	R	F	R	F	R	F	R	F	R
I like my	1.74	11	12.67	2	1.28	18	0.27	182	*	*
we went to	1.52	12	0.78	137	1.24	20	1.87	6	1.88	4
I have a	1.50	13	4.87	9	1.90	11	0.71	29	0.14	2660
I got a	1.46	14	3.12	13	2.27	8	0.54	44	0.43	71
going to be	1.31	15	0.39	257	0.99	33	1.52	8	2.46	3
it was fun	1.23	16	1.56	43	1.32	17	1.21	13	0.72	26
going to have	1.23	17	1.95	32	1.15	23	1.21	12	1.01	12
there was a	1.16	18	0.39	425	1.20	22	0.85	20	2.60	2
me and my	1.12	19	0.39	362	1.65	15	0.98	16	0.29	269
I love my	1.07	20	1.36	49	2.10	9	0.22	241	*	*
going to the	1.07	21	3.51	12	1.03	28	0.71	28	0.58	35
to go to	1.00	22	1.75	38	0.78	47	1.12	14	0.87	20
like to play	1.00	23	3.12	15	1.61	16	0.13	610	0.14	3235

Overall (Countries and School Ages Combined)			SA 1		SA 2		SA 3		SA 4	
Sequence	**F**	**R**	**F**	**R**	**F**	**R**	**F**	**R**	**F**	**R**
it was a	0.99	24	0.58	167	1.11	25	1.03	15	0.72	25
I had a	0.99	25	0.97	72	1.20	21	0.80	22	0.87	16

Note. F = frequency; R = rank; The * symbol signifies that the word was not used by any children in the School Age group.

Appendix C16

25 Most Frequently Occurring Two Word Sequences – North Carolina and New Zealand with School Ages Combined [Frequency per 1000 sequences]

Overall (Countries and School Ages Combined)			North Carolina		New Zealand	
Sequence	**F**	**R**	**F**	**R**	**F**	**R**
I like	11.37	1	14.63	1	5.03	11
going to	8.04	2	3.84	14	16.23	1
It was	6.69	3	7.37	4	5.36	8
went to	6.28	4	5.33	5	8.14	4
I see	6.01	5	9.01	2	0.16	768
I am	5.96	6	2.75	24	12.22	2
and I	5.53	7	3.67	15	9.16	3
I went	5.52	8	4.30	10	7.89	5
to the	5.09	9	4.26	11	6.70	7
it is	5.01	10	5.06	6	4.91	12
see a	4.95	11	7.45	3	0.08	2300
in the	4.92	12	4.79	8	5.19	10
I love	3.93	13	4.98	7	1.88	41
my mom	3.81	14	4.20	12	3.07	23
on the	3.76	15	3.27	18	4.70	15
I got	3.54	16	2.98	22	4.62	16
I was	3.43	17	4.05	13	2.21	32

Overall (Countries and School Ages Combined)			North Carolina		New Zealand	
Sequence	**F**	**R**	**F**	**R**	**F**	**R**
am going	3.15	18	0.88	95	7.56	6
and my	3.04	19	2.71	25	3.68	20
I have	2.95	20	2.37	26	4.09	17
is for	2.86	21	4.32	9	*	*
we are	2.80	22	1.55	50	5.23	9
then we	2.75	23	3.59	16	1.10	82
my dad	2.73	24	3.07	20	2.08	38
to go	2.59	25	2.98	23	1.84	43

Note. F = frequency; R = rank; The * symbol signifies that the word was not used by any children in the School Age group.

Appendix C17

Frequency and Rank of 25 Most Frequently Occurring Three Word Sequences

Overall –Usage Patterns in North Carolina and New Zealand with School Ages

1-4 Combined [Frequency per 1000 sequences]

Overall (Countries and School Ages Combined)			North Carolina		New Zealand	
Sequence	F	R	F	R	F	R
I see a	5.98	1	9.10	1	0.05	7271
I went to	4.79	2	3.41	3	7.41	3
I am going	3.78	3	1.07	21	8.94	1
am going to	3.64	4	1.01	23	8.64	2
went to the	2.71	5	2.24	6	3.61	6
I like to	2.57	6	3.69	2	0.44	105
are going to	2.37	7	0.86	25	5.23	4
we are going	1.89	8	0.73	31	4.10	5
is going to	1.84	9	1.30	13	2.86	7
I like the	1.81	10	2.50	4	0.49	88
I like my	1.74	11	2.34	5	0.59	67
we went to	1.52	12	1.77	7	1.04	29
I have a	1.50	13	1.12	17	2.22	12
I got a	1.46	14	0.81	28	2.72	9
going to be	1.31	15	1.33	12	1.28	21
it was fun	1.23	16	1.07	22	1.53	16

Overall (Countries and School Ages Combined)			North Carolina		New Zealand	
Sequence	**F**	**R**	**F**	**R**	**F**	**R**
going to have	1.23	17	0.47	65	2.67	10
there was a	1.16	18	1.38	10	0.74	44
me and my	1.12	19	1.35	11	0.69	49
I love my	1.07	20	1.40	9	0.44	106
going to the	1.07	21	0.36	94	2.42	11
to go to	1.00	22	1.01	24	0.99	30
like to play	1.00	23	1.43	8	0.20	375
it was a	0.99	24	1.17	15	0.64	59
I had a	0.99	25	0.70	33	1.53	15

Note. F = frequency; R = rank; The * symbol signifies that the word was not used by any children in the School Age group.

Appendix C18

Frequency and Rank of 25 Most Frequently Occurring Two Word Sequences Overall –Usage Patterns in School

Ages 1-4 in North Carolina [Frequency per 1000 sequences]

Overall (Countries and School Ages Combined)			NC SA 1		NC SA 2		NC SA 3		NC SA 4	
Sequence	F	R	F	R	F	R	F	R	F	R
I like	11.37	1	87.11	3	18.99	1	3.62	12	0.41	296
going to	8.04	2	0.65	190	3.10	23	4.61	5	5.17	4
It was	6.69	3	1.96	53	7.99	3	8.40	2	5.45	2
went to	6.28	4	0.65	261	5.63	5	5.77	3	5.45	3
I see	6.01	5	134.42	1	0.84	107	0.05	5186	*	*
I am	5.96	6	5.87	13	3.21	21	2.31	22	1.36	39
and I	5.53	7	1.31	75	4.37	13	3.62	11	2.99	9
I went	5.52	8	0.65	199	5.10	10	4.39	6	3.54	6
to the	5.09	9	2.28	44	5.42	9	3.95	9	2.86	11
it is	5.01	10	25.77	4	5.57	6	2.53	19	1.36	42

Overall (Countries and School Ages Combined)			NC SA 1		NC SA 2		NC SA 3		NC SA 4	
Sequence	**F**	**R**	**F**	**R**	**F**	**R**	**F**	**R**	**F**	**R**
see a	4.95	11	113.87	2	0.21	742	0.11	1834	*	*
in the	4.92	12	0.33	587	5.52	7	4.39	7	5.72	1
I love	3.93	13	6.20	11	9.99	2	1.48	46	0.14	2575
my mom	3.81	14	2.94	33	5.42	8	3.79	10	2.59	14
on the	3.76	15	0.98	135	3.42	18	4.17	8	1.63	31
I got	3.54	16	0.33	557	4.21	16	2.25	24	2.72	12
I was	3.43	17	0.33	571	4.84	11	4.78	4	1.77	30
am going	3.15	18	0.65	166	1.21	74	0.71	131	0.54	159
and my	3.04	19	0.65	167	4.21	15	2.20	25	0.95	74
I have	2.95	20	2.28	41	3.00	25	2.47	20	0.54	183
is for	2.86	21	*	*	*	*	11.31	1	*	*
we are	2.80	22	*	*	1.84	48	1.76	38	0.95	90
then we	2.75	23	*	*	6.42	4	2.20	26	1.23	55

Overall (Countries and School Ages Combined)			NC SA 1		NC SA 2		NC SA 3		NC SA 4	
Sequence	**F**	**R**	**F**	**R**	**F**	**R**	**F**	**R**	**F**	**R**
my dad	2.73	24	0.65	224	4.73	12	2.42	21	1.36	43
to go	2.59	25	4.57	18	3.21	22	2.75	17	2.31	18

Note. F = frequency; R = rank; The * symbol signifies that the word was not used by any children in the School Age group.

Appendix C19

Frequency and Rank of 25 Most Frequently Occurring Three Word Sequences Overall – Usage Patterns in School

Ages 1-4 in North Carolina [Frequency per 1000 sequences]

Overall (Countries and School Ages Combined)			NC SA 1		NC SA 2		NC SA 3		NC SA 4	
Sequence	F	R	F	R	F	R	F	R	F	R
I see a	5.98	1	167.71	1	0.13	959	*	*	*	*
I went to	4.79	2	0.96	131	4.35	2	3.05	1	2.76	1
I am going	3.78	3	0.96	118	1.52	12	0.86	21	0.49	64
am going to	3.64	4	0.48	219	1.45	13	0.80	25	0.65	26
went to the	2.71	5	*	*	3.23	3	1.79	4	1.62	6
I like to	2.57	6	23.13	4	4.95	1	1.13	15	0.32	193
are going to	2.37	7	*	*	0.59	64	1.26	10	0.81	20
we are going	1.89	8	*	*	0.59	84	1.19	14	0.16	5164
is going to	1.84	9	*	*	0.92	31	1.72	5	1.62	5
I like the	1.81	10	26.51	3	2.51	6	0.20	355	*	*

Overall (Countries and School Ages Combined)			NC SA 1		NC SA 2		NC SA 3		NC SA 4	
Sequence	F	R	F	R	F	R	F	R	F	R
I like my	1.74	11	28.43	2	1.65	11	0.40	113	*	*
we went to	1.52	12	*	*	1.45	16	2.19	3	2.11	4
I have a	1.50	13	2.41	37	1.65	10	0.80	28	0.16	2374
I got a	1.46	14	*	*	1.45	14	0.40	110	0.49	66
going to be	1.31	15	*	*	0.73	47	1.59	6	2.59	3
it was fun	1.23	16	0.48	582	0.92	32	1.46	8	0.65	31
going to have	1.23	17	*	*	0.13	820	0.60	46	1.14	8
there was a	1.16	18	*	*	1.19	25	1.19	13	2.76	2
me and my	1.12	19	*	*	2.11	8	1.19	12	0.32	239
I love my	1.07	20	1.45	74	3.04	4	0.33	154	*	*
going to the	1.07	21	0.48	380	0.40	147	0.33	148	0.32	165
to go to	1.00	22	1.93	70	0.86	38	1.06	17	0.97	18
like to play	1.00	23	6.27	10	2.51	7	0.20	390	0.16	2896

Overall (Countries and School Ages Combined)			NC SA 1		NC SA 2		NC SA 3		NC SA 4	
Sequence	F	R	F	R	F	R	F	R	F	R
it was a	0.99	24	*	*	1.32	19	1.33	9	0.81	24
I had a	0.99	25	*	*	0.66	56	0.80	27	0.81	23

Note. F = frequency; R = rank; The * symbol signifies that the word was not used by any children in the School Age group.

Appendix C20

Frequency and Rank of 25 Most Frequently Occurring Two Word Sequences Overall – Usage Patterns in School

Ages 1-4 in New Zealand [Frequency per 1000 sequences]

Overall (Countries and School Ages Combined)			NZ SA 1		NZ SA 2		NZ SA 3		NZ SA 4	
Sequence	**F**	**R**	**F**	**R**	**F**	**R**	**F**	**R**	**F**	**R**
I like	11.37	1	8.86	8	5.48	15	3.25	13	*	*
going to	8.04	2	20.33	2	17.89	1	13.10	1	7.97	2
It was	6.69	3	6.52	12	5.48	16	5.10	5	1.14	349
went to	6.28	4	16.42	4	8.45	4	4.52	8	3.42	28
I see	6.01	5	0.78	162	0.09	3004	*	*	*	*
I am	5.96	6	24.76	1	12.77	2	7.07	2	1.14	317
and I	5.53	7	15.38	5	10.34	3	5.68	3	1.14	137
I went	5.52	8	16.94	3	8.36	5	3.71	10	3.42	19
to the	5.09	9	12.77	6	5.84	14	4.87	6	9.11	1
it is	5.01	10	6.78	11	6.02	12	3.13	14	*	*

Overall (Countries and School Ages Combined)			NZ SA 1		NZ SA 2		NZ SA 3		NZ SA 4	
Sequence	**F**	**R**	**F**	**R**	**F**	**R**	**F**	**R**	**F**	**R**
see a	4.95	11	0.26	1608	0.09	4276	*	*	*	*
in the	4.92	12	3.65	25	5.93	13	4.64	7	7.97	3
I love	3.93	13	1.82	57	3.15	29	0.35	396	1.14	324
my mom	3.81	14	5.47	17	3.51	25	1.62	51	1.14	413
on the	3.76	15	4.43	21	5.21	17	4.17	9	4.56	11
I got	3.54	16	5.99	15	6.11	11	2.44	24	1.14	320
I was	3.43	17	1.56	73	2.07	44	2.67	20	2.28	51
am going	3.15	18	12.51	7	8.18	6	5.33	4	*	*
and my	3.04	19	2.61	38	4.32	21	3.48	11	2.28	35
I have	2.95	20	7.04	9	4.41	19	2.55	23	2.28	50
is for	2.86	21	*	*	*	*	*	*	*	*
we are	2.80	22	7.04	10	6.92	8	2.67	21	1.14	691
then we	2.75	23	0.52	395	1.17	88	1.28	69	1.14	609

Overall (Countries and School Ages Combined)			NZ SA 1		NZ SA 2		NZ SA 3		NZ SA 4	
Sequence	**F**	**R**	**F**	**R**	**F**	**R**	**F**	**R**	**F**	**R**
my dad	2.73	24	3.39	29	1.98	47	1.62	50	2.28	56
to go	2.59	25	2.08	53	1.44	69	2.44	27	*	*

Note. F = frequency; R = rank; The * symbol signifies that the word was not used by any children in the School Age group.

Appendix C21

Frequency and Rank of 25 Most Frequently Occurring Three Word Sequences Overall – Usage Patterns in School

Ages 1-4 in New Zealand [Frequency per 1000 sequences]

Overall (Countries and School Ages Combined)			NZ SA 1		NZ SA 2		NZ SA 3		NZ SA 4	
Sequence	**F**	**R**	**F**	**R**	**F**	**R**	**F**	**R**	**F**	**R**
I see a	5.98	1	*	*	0.11	3297	*	*	*	*
I went to	4.79	2	16.03	1	8.12	3	3.41	4	2.60	11
I am going	3.78	3	15.37	2	9.77	1	6.14	2	*	*
am going to	3.64	4	14.72	3	9.33	2	6.14	1	*	*
went to the	2.71	5	7.85	4	3.51	8	1.91	8	3.90	3
I like to	2.57	6	1.64	34	0.33	254	0.14	2844	*	*
are going to	2.37	7	4.58	9	7.24	4	3.55	3	*	*
we are going	1.89	8	4.91	8	5.82	5	2.05	7	*	*
is going to	1.84	9	3.60	11	2.96	9	2.73	5	*	*
I like the	1.81	10	1.31	49	0.33	253	0.41	136	*	*

Overall (Countries and School Ages Combined)			NZ SA 1		NZ SA 2		NZ SA 3		NZ SA 4	
Sequence	F	R	F	R	F	R	F	R	F	R
I like my	1.74	11	1.96	26	0.66	81	*	*	*	*
we went to	1.52	12	1.31	67	0.88	55	1.23	19	*	*
I have a	1.50	13	6.54	5	2.30	12	0.55	83	*	*
I got a	1.46	14	5.23	7	3.62	7	0.82	37	*	*
going to be	1.31	15	0.65	149	1.43	23	1.36	13	1.30	254
it was fun	1.23	16	2.29	19	1.98	18	0.68	56	1.30	338
going to have	1.23	17	3.27	12	2.85	10	2.46	6	*	*
there was a	1.16	18	0.65	236	1.21	34	0.14	5150	1.30	591
me and my	1.12	19	0.65	203	0.88	50	0.55	92	*	*
I love my	1.07	20	1.31	50	0.55	112	*	*	*	*
going to the	1.07	21	5.56	6	2.09	15	1.50	11	2.60	8
to go to	1.00	22	1.64	37	0.66	95	1.23	17	*	*
like to play	1.00	23	0.98	90	0.11	3899	*	*	*	*

Overall (Countries and School Ages Combined)			NZ SA 1		NZ SA 2		NZ SA 3		NZ SA 4	
Sequence	**F**	**R**	**F**	**R**	**F**	**R**	**F**	**R**	**F**	**R**
it was a	0.99	24	0.98	87	0.77	63	0.41	144	*	*
I had a	0.99	25	1.64	33	2.09	16	0.82	39	1.30	296

Note. F = frequency; R = rank; The * symbol signifies that the word was not used by any children in the School Age group.

Appendix C22

Minor Lexemes – Usage Patterns for Children in School Ages 1-4 in North Carolina, New Zealand, and North Carolina and New Zealand Combined

[Frequency per 1000 words]

Country/School Age	Social	Relational	Avoidance
NC SA1	13.27	500.00	0.00
NC SA 2	28.25	472.69	1.88
NC SA 3	37.39	495.69	0.00
NC SA 4	59.58	476.65	6.44
NZ SA1	38.76	519.38	0.00
NZ SA 2	54.47	556.42	0.00
NZ SA 3	53.55	516.64	0.00
NZ SA 4	70.42	416.28	1.56
SA1	22.54	507.04	0.00
SA 2	36.80	500.00	1.27
SA 4	43.83	504.04	0.00
SA 4	65.08	446.03	3.97

Appendix C23

Human Form and Function Theme – Usage Patterns for Children in School Ages 1-4 in North Carolina, New Zealand, and North Carolina and New Zealand Combined [Frequency per 1000 words]

Country/School Age	Semantic Fields				
	Man	**Body**	**Health**	**Clothing**	**Food**
NC SA1	4.42	0.00	0.00	0.00	13.27
NC SA 2	37.66	3.77	1.88	30.13	7.53
NC SA 3	29.72	2.88	0.00	4.79	4.79
NC SA 4	27.38	1.61	0.00	0.00	28.99
NZ SA1	7.75	0.00	7.75	15.50	15.50
NZ SA 2	42.80	0.00	0.00	7.78	11.67
NZ SA 3	41.97	5.79	0.00	4.34	14.47
NZ SA 4	37.56	7.82	1.56	1.56	3.13
SA1	5.63	0.00	2.82	5.63	14.08
SA 2	39.34	2.54	1.27	22.84	8.88
SA 4	34.60	4.04	0.00	4.61	8.65
SA 4	32.54	4.76	0.79	0.79	15.87

Appendix C24

Activity and Sensory Theme – Usage Patterns for Children in School Ages 1-4 in North Carolina, New Zealand, and North Carolina and New Zealand Combined [Frequency per 1000 words]

Country/ School Age	Semantic Fields													
	Move	Make	Happen	Live	Have	Think	Feel	Sound	Sight	Smell	Taste	Touch	Lang-uage	Imagin-ation
NC SA1	17.70	0.00	0.00	0.00	0.00	8.85	79.65	4.42	119.47	0.00	0.00	0.00	0.00	0.00
NC SA 2	43.31	5.65	5.65	1.88	32.02	5.65	28.25	15.07	11.30	0.00	0.00	1.88	16.95	22.60
NC SA 3	32.60	16.30	8.63	0.00	19.18	3.84	13.42	4.79	4.79	0.00	0.00	0.00	43.14	16.30
NC SA 4	35.43	20.93	16.10	0.00	24.15	1.61	9.66	4.83	6.44	0.00	0.00	1.61	20.93	4.83
NZ SA1	69.77	0.00	0.00	0.00	46.51	0.00	15.50	0.00	15.50	0.00	0.00	0.00	7.75	0.00
NZ SA 2	38.91	7.78	0.00	0.00	23.35	0.00	23.35	0.00	3.89	0.00	0.00	0.00	0.00	7.78
NZ SA 3	28.94	11.58	7.24	1.45	34.73	2.89	4.34	0.00	8.68	0.00	0.00	7.24	15.92	0.00
NZ SA 4	40.69	18.78	9.39	3.13	9.39	7.82	7.82	26.60	12.52	0.00	0.00	6.26	29.73	12.52

Country/ School Age	Semantic Fields													
	Move	Make	Happen	Live	Have	Think	Feel	Sound	Sight	Smell	Taste	Touch	Lang-uage	Imagin-ation
SA1	36.62	0.00	0.00	0.00	16.90	5.63	56.34	2.82	81.69	0.00	0.00	0.00	2.82	0.00
SA 2	41.88	6.35	3.81	1.27	29.19	3.81	26.65	10.15	8.88	0.00	0.00	1.27	11.42	17.77
SA 4	31.14	14.42	8.07	0.58	25.37	3.46	9.80	2.88	6.34	0.00	0.00	2.88	32.30	9.80
SA 4	38.10	19.84	12.70	1.59	16.67	4.76	8.73	15.87	9.52	0.00	0.00	3.97	25.40	8.73

Appendix C25

Leisure Theme – Usage Patterns for Children in School Ages 1-4 in North Carolina, New Zealand, and North Carolina and New Zealand Combined

[Frequency per 1000 words]

Country/School Age	Semantic Fields				
	Recreation	Occasions	Shows	Music	Art
NC SA1	17.70	17.70	0.00	8.85	0.00
NC SA 2	22.60	24.48	1.88	0.00	0.00
NC SA 3	53.69	16.30	0.00	0.00	0.00
NC SA 4	43.48	1.61	4.83	0.00	0.00
NZ SA1	38.76	7.75	23.26	0.00	0.00
NZ SA 2	11.67	19.46	3.89	3.89	0.00
NZ SA 3	14.47	8.68	2.89	0.00	0.00
NZ SA 4	18.78	0.00	0.00	0.00	1.56
SA1	25.35	14.08	8.45	5.63	0.00
SA 2	19.04	22.84	2.54	1.27	0.00
SA 4	38.06	13.26	1.15	0.00	0.00
SA 4	30.95	0.79	2.38	0.00	0.79

Appendix C26

Transport Theme – Usage Patterns for Children in School Ages 1-4 in North Carolina, New Zealand, and North Carolina and New Zealand Combined

[Frequency per 1000 words]

Country/School Age	Semantic Fields				
	Road	**Rail**	**Air**	**Water**	**Fuel**
NC SA1	8.85	0.00	0.00	0.00	0.00
NC SA 2	0.00	0.00	0.00	0.00	0.00
NC SA 3	8.63	0.00	0.96	0.00	0.00
NC SA 4	3.22	0.00	0.00	0.00	0.00
NZ SA1	0.00	0.00	0.00	0.00	0.00
NZ SA 2	0.00	0.00	0.00	0.00	0.00
NZ SA 3	0.00	0.00	0.00	0.00	0.00
NZ SA 4	15.65	0.00	0.00	0.00	3.13
SA1	5.63	0.00	0.00	0.00	0.00
SA 2	0.00	0.00	0.00	0.00	0.00
SA 4	5.19	0.00	0.58	0.00	0.00
SA 4	9.52	0.00	0.00	0.00	1.59

Appendix C27

Fauna, Flora, and Elements Theme – Usage Patterns for Children in School Ages 1-4 in North Carolina, New Zealand, and North Carolina and New Zealand Combined [Frequency per 1000 words]

Country/School Age	Semantic Fields									
	Animals	**Birds**	**Fish**	**Insects**	**Flowers**	**Trees**	**Light**	**Color**	**Fire**	**Water**
NC SA1	30.97	0.00	0.00	4.42	0.00	26.55	0.00	13.27	0.00	0.00
NC SA 2	22.60	0.00	0.00	0.00	0.00	0.00	3.77	3.77	0.00	1.88
NC SA 3	6.71	0.00	0.00	0.00	0.96	2.88	0.00	8.63	0.00	0.00
NC SA 4	4.83	0.00	0.00	1.61	0.00	4.83	0.00	4.83	0.00	0.00
NZ SA1	7.75	0.00	0.00	23.26	15.50	0.00	7.75	7.75	0.00	0.00
NZ SA 2	31.13	3.89	0.00	0.00	0.00	0.00	0.00	11.67	0.00	0.00
NZ SA 3	30.39	5.79	0.00	0.00	1.45	24.60	0.00	7.24	0.00	0.00
NZ SA 4	9.39	1.56	0.00	0.00	0.00	0.00	9.39	0.00	12.52	0.00

Country/School Age	Semantic Fields									
	Animals	**Birds**	**Fish**	**Insects**	**Flowers**	**Trees**	**Light**	**Color**	**Fire**	**Water**
SA1	22.54	0.00	0.00	11.27	5.63	16.90	2.82	11.27	0.00	0.00
SA 2	25.38	1.27	0.00	0.00	0.00	0.00	2.54	6.35	0.00	1.27
SA 4	16.15	2.31	0.00	0.00	1.15	11.53	0.00	8.07	0.00	0.00
SA 4	7.14	0.79	0.00	0.79	0.00	2.38	4.76	2.38	6.35	0.00

Appendix C28

Domestic Setting Theme – Usage Patterns for Children in School Ages 1-4 in North Carolina, New Zealand, and North Carolina and New Zealand Combined

[Frequency per 1000 words]

Country/School Age	Semantic Fields			
	Building	Furniture	Tools	Containers
NC SA1	4.42	0.00	0.00	4.42
NC SA 2	13.18	3.77	0.00	1.88
NC SA 3	8.63	4.79	0.00	0.00
NC SA 4	4.83	3.22	0.00	0.00
NZ SA1	0.00	0.00	0.00	7.75
NZ SA 2	3.89	3.89	0.00	0.00
NZ SA 3	8.68	2.89	0.00	0.00
NZ SA 4	7.82	0.00	0.00	1.56
SA1	2.82	0.00	0.00	5.63
SA 2	10.15	3.81	0.00	1.27
SA 4	8.65	4.04	0.00	0.00
SA 4	6.35	1.59	0.00	0.79

Appendix C29

Dimensions Theme – Usage Patterns for Children in School Ages 1-4 in North Carolina, New Zealand, and North Carolina and New Zealand Combined

[Frequency per 1000 words]

Country/ School Age	Semantic Fields						
	Quantity	Measure -ment	Size	Shape	Time	Location	State
NC SA1	8.85	0.00	0.00	0.00	0.00	0.00	13.27
NC SA 2	7.53	0.00	11.30	0.00	24.48	13.18	15.07
NC SA 3	31.64	3.84	5.75	2.88	34.52	11.51	21.09
NC SA 4	56.36	8.05	0.00	0.00	37.04	9.66	24.15
NZ SA1	7.75	0.00	0.00	7.75	31.01	7.75	23.26
NZ SA 2	11.67	3.89	3.89	0.00	50.58	3.89	15.56
NZ SA 3	18.81	2.89	8.68	5.79	27.50	11.58	27.50
NZ SA 4	42.25	1.56	6.26	0.00	25.04	15.65	40.69
SA1	8.45	0.00	0.00	2.82	11.27	2.82	16.90
SA 2	8.88	1.27	8.88	0.00	32.99	10.15	15.23
SA 4	26.53	3.46	6.92	4.04	31.72	11.53	23.64
SA 4	49.21	4.76	3.17	0.00	30.95	12.70	32.54

Appendix C30

Institutions and the World Theme – Usage Patterns for Children in School Ages 1-4 in North Carolina, New Zealand, and North Carolina and New Zealand Combined [Frequency per 1000 words]

Country/ School Age	Semantic Fields										
	Govern- ment	Law	Educ- ation	Religion	Business	Manu- facture	Space	World	Minerals	Weapons	Money
NC SA1	0.00	0.00	0.00	0.00	0.00	0.00	13.27	30.97	0.00	0.00	0.00
NC SA 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.88	1.88	0.00	0.00
NC SA 3	0.96	0.00	20.13	0.00	0.00	0.00	0.00	7.67	0.00	0.00	0.00
NC SA 4	1.61	0.00	1.61	0.00	0.00	0.00	0.00	9.66	0.00	0.00	1.61
NZ SA1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NZ SA 2	0.00	0.00	0.00	0.00	7.78	0.00	0.00	7.78	3.89	0.00	15.56
NZ SA 3	1.45	0.00	5.79	0.00	1.45	0.00	0.00	4.34	0.00	2.89	0.00
NZ SA 4	1.56	0.00	1.56	0.00	0.00	0.00	1.56	7.82	1.56	7.82	0.00

Country/ School Age	Semantic Fields										
	Govern-ment	Law	Educ-ation	Religion	Business	Manu-facture	Space	World	Minerals	Weapons	Money
SA1	0.00	0.00	0.00	0.00	0.00	0.00	8.45	19.72	0.00	0.00	0.00
SA 2	0.00	0.00	0.00	0.00	2.54	0.00	0.00	3.81	2.54	0.00	5.08
SA 4	1.15	0.00	14.42	0.00	0.58	0.00	0.00	6.34	0.00	1.15	0.00
SA 4	1.59	0.00	1.59	0.00	0.00	0.00	0.79	8.73	0.79	3.97	0.79

Appendix C31

Stage I Structures - Frequencies for Children in School Ages 1-4 in North Carolina, New Zealand, and North Carolina and New Zealand Combined

Country/ School Age	Minor			Command	Question	Statement			Total Clauses
	Response	Vocative	Other	V	Q	V	N	Other	
NC SA 1	0	0	0	0	0	0	0	0	62
NC SA 2	0	3	4	0	0	0	0	1	110
NC SA 3	0	2	2	0	0	0	0	2	248
NC SA 4	0	0	9	1	0	0	0	6	147
NZ SA 1	0	0	0	0	0	0	0	0	23
NZ SA 2	0	0	0	0	0	0	0	0	47
NZ SA 3	0	1	4	0	0	0	0	0	151
NZ SA 4	0	3	5	2	0	1	0	0	144

Country/ School Age	Minor			Command	Question	Statement			Total Clauses
	Response	Vocative	Other	V	Q	V	N	Other	
SA 1	0	0	0	0	0	0	0	0	85
SA 2	0	3	4	0	0	0	0	1	157
SA 3	0	3	6	0	0	0	0	2	399
SA 4	0	3	14	3	0	1	0	6	291

Note. Minor: Response = word or word-like unit used as a response; Vocative = word or word-like unit used as a calling signal; Other = other word or word-like unit, e.g., interjections and phrases that perform various social functions. Command: Verb = single word used as an imperative verb; Question: Q = single question-word. Statement: V = single word used as a verb; N = single word used as a noun; Other = single word used as an adjective, adverb, or pronoun.

Appendix C32

Stage II Clause Structures - Frequencies for Children in School Ages 1-4 in North Carolina, New Zealand, and North Carolina and New Zealand Combined

Country/ School Age	Command	Question	Statement								Total Clauses
	VX	QX	SV	SO	SC	Neg X	AX	VO	VC	Other	
NC SA 1	0	0	8	0	0	0	0	0	0	0	62
NC SA 2	0	0	7	0	1	0	3	1	0	0	110
NC SA 3	3	0	21	0	1	0	11	1	0	0	248
NC SA 4	1	0	6	0	0	0	5	7	0	0	147
NZ SA 1	0	0	2	0	0	0	0	0	0	0	23
NZ SA 2	0	0	0	0	0	0	0	0	0	0	47
NZ SA 3	0	1	7	0	1	0	6	4	0	0	151
NZ SA 4	2	0	5	0	0	1	4	4	1	0	144

Country/ School Age	Command	Question	Statement								Total Clauses
	VX	QX	SV	SO	SC	Neg X	AX	VO	VC	Other	
SA 1	0	0	10	0	0	0	0	0	0	0	85
SA 2	0	0	7	0	1	0	3	1	0	0	157
SA 3	3	1	28	0	2	0	17	5	0	0	399
SA 4	3	0	11	0	0	1	9	11	1	0	291

Note. Command: VX = imperative verb + 1 other clause element. Question: QX = question-word + 1 other clause element. Statement: SV = subject + verb; SO = subject + object; SC = subject + complement; Neg X = negative-word + 1 other clause element; AX = adverbial + 1 other clause element; VO = verb + object; VC = verb + complement; Other = any other 2 element clause.

Appendix C33

Stage III Clause Structures - Frequencies for Children in School Ages 1-4 in North Carolina, New Zealand, and North Carolina and New Zealand Combined

Country/ School Age	Command			Question		Statement								Total Clauses
	VXY	Let XY	Do XY	QXY	VS(X)	SVC	SVO	SVA	Neg XY	VCA	VOA	VOdOi	Other	
NC SA 1	0	0	0	0	0	6	35	0	0	0	0	0	0	62
NC SA 2	0	1	0	0	1	19	21	11	0	0	0	0	0	110
NC SA 3	4	0	0	0	0	27	18	46	0	2	3	0	4	248
NC SA 4	1	0	0	1	2	24	15	7	0	0	0	0	0	147
NZ SA 1	0	0	0	0	0	3	7	7	0	0	0	0	0	23
NZ SA 2	0	0	0	0	0	8	6	4	0	0	0	1	0	47
NZ SA 3	0	0	0	0	0	13	19	15	0	0	1	0	1	151
NZ SA 4	0	0	0	0	1	13	18	15	0	0	1	0	6	144

Country/ School Age	Command			Question		Statement								Total Clauses
	VXY	Let XY	Do XY	QXY	VS(X)	SVC	SVO	SVA	Neg XY	VCA	VOA	VOdOi	Other	
SA 1	0	0	0	0	0	9	42	7	0	0	0	0	0	85
SA 2	0	1	0	0	1	27	27	15	0	0	0	1	0	157
SA 3	4	0	0	0	0	40	37	61	0	2	4	0	5	399
SA 4	1	0	0	1	3	37	33	22	0	0	1	0	6	291

Note. VXY = imperative verb + 2 other clause elements; Let XY = let + 2 other clause elements; Do XY = do + 2 other clause elements; QXY = question-word + 2 other clause elements; VS(X) = subject-verb inversion + 1 other clause element; SVC = subject + verb + complement; SVO = subject + verb + object; SVA = subject + verb + adverbial; Neg XY = negative-word + 2 other clause elements; VCA = verb + complement + adverbial; VOA = verb + object + adverbial; VOdOi = verb + direct object + indirect object; Other = any other 3 element clause.

Appendix C34

Stage IV Clause Structures - Frequencies for Children in School Ages 1-4 in North Carolina, New Zealand, and North Carolina and New Zealand Combined

Country/ School Age	Command		Question		Statement								Total Clauses
	+S	VXY+	QVS	QXY+	VS(X+)	Tag	SVOA	SVCA	SVOdOi	SVOC	AAXY	Other	
NC SA 1	0	0	0	0	0	0	7	0	0	0	0	0	62
NC SA 2	0	0	0	0	0	0	14	0	0	0	5	6	110
NC SA 3	1	0	0	1	0	0	0	15	10	1	0	17	248
NC SA 4	0	1	0	0	0	0	17	6	1	0	4	5	147
NZ SA 1	0	0	0	0	0	0	2	0	0	0	1	1	23
NZ SA 2	0	0	0	0	0	0	7	6	1	0	3	4	47
NZ SA 3	0	0	1	0	0	0	14	2	1	0	11	9	151
NZ SA 4	0	0	0	0	0	0	9	3	1	1	6	10	144

Country/ School Age	Command		Question				Statement						Total Clauses
	+S	VXY+	QVS	QXY+	VS(X+)	Tag	SVOA	SVCA	SVOdOi	SVOC	AAXY	Other	
SA 1	0	0	0	0	0	0	9	0	0	0	1	1	85
SA 2	0	0	0	0	0	0	21	6	1	0	8	10	157
SA 3	1	0	1	1	0	0	14	17	11	1	11	26	399
SA 4	0	1	0	0	0	0	26	9	2	1	10	15	291

Note. Command: S+ = command with the subject expressed; VXY+ = imperative verb + more than 2 other elements. Question: QVS = question-word + subject-verb inversion; QXY+ = question-word + 2 or more other clause elements (no subject-verb inversion); VS(X) = subject-verb inversion + more than 1 other clause element; Tag = verb-subject construction tagged onto main clause. Statement: SVOA = subject + verb + object + adverbial; SVCA = subject + verb + complement + adverbial; SVOdOi = subject + verb + direct object + indirect object; SVOC = subject + verb + object + complement; AAXY = 2 adverbials + 2 other clause elements; Other = any other clause with 4 or more elements.

Appendix C35

Stage V Clause Structures - Frequencies for Children in School Ages 1-4 in North Carolina, New Zealand, and North Carolina and New Zealand Combined

Country/ School Age	Command		Question		Statement										Total Clauses
	Coord	Other	Coord	Other	Coord 1	Coord 1+	Sub A 1	Sub A 1+	Sub S	Sub C	Sub O	Com-parative	PM Cl 1	PM CL 1+	
NC SA 1	0	0	0	0	0	0	5	0	0	0	0	0	1	0	62
NC SA 2	0	0	0	0	2	0	4	0	0	0	4	0	2	0	110
NC SA 3	0	0	0	0	7	0	16	0	1	0	2	0	25	0	248
NC SA 4	0	0	0	0	3	1	11	0	0	0	4	1	8	0	147
NZ SA 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23
NZ SA 2	0	0	0	0	1	0	6	0	0	0	0	0	0	0	47
NZ SA 3	0	0	0	0	9	0	17	0	0	0	2	0	12	0	151
NZ SA 4	0	0	0	0	4	1	5	0	0	0	10	0	12	0	144

Country/ School Age	Command		Question		Statement										Total Clauses
	Coord	Other	Coord	Other	Coord 1	Coord 1+	Sub A 1	Sub A 1+	Sub S	Sub C	Sub O	Com-parative	PM Cl 1	PM CL 1+	
SA 1	0	0	0	0	0	0	5	0	0	0	0	0	1	0	85
SA 2	0	0	0	0	3	0	10	0	0	0	4	0	2	0	157
SA 3	0	0	0	0	16	0	33	0	1	0	4	0	37	0	399
SA 4	0	0	0	0	7	2	16	0	0	0	14	1	20	0	291

Note. Command: Coord = 2 clauses with imperative verbs linked by a coordinating conjunction; Other = 1 clause with an imperative verb + any other type of coordination. Question: Coord = 2 clauses with question-words linked by a coordinating conjunction; Other = 1 clause with a question-word + any other type of coordination. Statement: Coord 1 = 2 clauses linked by a coordinating conjunction; Coord 1+ = more than 2 clauses linked by a coordinating conjunction; Sub A 1 = subordinate clause containing an adverbial; Sub A 1+ = more than 1 subordinate clause containing an adverbial; Sub S = subordinate clause containing a subject; Sub C = subordinate clause containing a complement; Sub O = subordinate clause containing an object; Comparative = clause containing a grammatical marker of comparison; PM Cl 1 = post-modifying clause; PM Cl 1+ = more than 1 post-modifying clause.

Appendix C36

Stage II Phrase Structures - Frequencies for Children in School Ages 1-4 in North Carolina, New Zealand, and North Carolina and New Zealand Combined

Country/ School Age	DN	AdjN	NN	PrN	VV	Vpart	Int X	Other	Total Phrases
NC SA 1	29	0	1	1	4	0	1	3	112
NC SA 2	35	1	1	5	5	9	3	2	210
NC SA 3	40	10	2	47	10	10	7	8	436
NC SA 4	31	7	3	8	2	6	7	10	261
NZ SA 1	7	1	1	6	3	1	0	1	57
NZ SA 2	13	0	0	6	3	3	0	2	117
NZ SA 3	30	2	4	12	16	6	5	9	295
NZ SA 4	41	3	5	12	2	14	8	10	262

Country/ School Age	DN	AdjN	NN	PrN	VV	Vpart	Int X	Other	Total Phrases
SA1	36	1	2	7	7	1	1	4	169
SA 2	48	1	1	11	8	12	3	4	327
SA 3	70	12	6	59	26	16	12	17	731
SA 4	72	10	8	20	4	20	15	20	523

Note. DN = determiner + noun; AdjN = adjective + noun; NN = noun + noun; PrN = preposition + noun; VV = verb + verb; Vpart = verb + particle; IntX = intensifier + 1 other phrase element; Other = any other two element phrase.

Appendix C37

Stage III Phrase Structures - Frequencies for Children in School Ages 1-4 in North Carolina, New Zealand, and North Carolina and New Zealand Combined

Country/ School Age	DAdjN	AdjAdjN	PrDN	Pron-P	Pron-O	Cop	Aux-M	Aux-O	Other	Total Phrases
NC SA 1	0	0	0	57	0	7	4	1	3	112
NC SA 2	3	0	15	66	3	20	4	4	7	210
NC SA 3	13	1	33	87	12	77	7	18	22	436
NC SA 4	10	1	19	73	12	26	2	10	7	261
NZ SA 1	2	0	6	20	0	3	0	5	1	57
NZ SA 2	2	0	8	37	1	14	5	5	5	117
NZ SA 3	8	2	28	78	5	24	6	16	15	295
NZ SA 4	7	2	18	49	7	18	6	12	15	262

Country/ School Age	DAdjN	AdjAdjN	PrDN	Pron-P	Pron-O	Cop	Aux-M	Aux-O	Other	Total Phrases
SA1	2	0	6	77	0	10	4	6	4	169
SA 2	5	0	23	103	4	34	9	9	12	327
SA 3	21	3	61	165	17	101	13	34	37	731
SA 4	17	3	37	122	19	44	8	22	22	523

Note. DAdjN = determiner + adjective + noun; AdjAdjN = adjective + adjective + noun; PrDN = preposition + determiner + noun; Pron-P = personal pronoun; Pron-O = other type of pronoun; Cop = copula; Aux-M = modal auxiliary verb; Aux-O = other type of auxiliary verb; Other = any other 3 element phrase.

Appendix C38

Stage IV Phrase Structures - Frequencies for Children in School Ages 1-4 in North Carolina, New Zealand, and North Carolina and New Zealand Combined

Country/School Age	NPPrNP	PRDAdjN	cX	XcX	Neg V	Neg X	2 Aux	Other	Total Phrases
NC SA 1	0	0	0	1	0	0	0	0	112
NC SA 2	3	2	0	8	2	0	1	11	210
NC SA 3	8	2	0	7	3	1	0	11	436
NC SA 4	6	1	0	6	3	0	0	11	261
NZ SA 1	0	0	0	0	0	0	0	0	57
NZ SA 2	1	0	0	8	0	0	0	4	117
NZ SA 3	3	0	0	14	3	0	0	9	295
NZ SA 4	12	10	0	5	1	1	0	4	262

Country/School Age	NPPrNP	PRDAdjN	cX	XcX	Neg V	Neg X	2 Aux	Other	Total Phrases
SA1	0	0	0	1	0	0	0	0	169
SA 2	4	2	0	16	2	0	1	15	327
SA 3	11	2	0	21	6	1	0	20	731
SA 4	18	11	0	11	4	1	0	15	523

Note. NPPrNP = 2 noun phrases linked by a preposition; PrDAdjN = preposition + determiner + adjective + noun; cX = coordinating conjunction + 1 other phrase element; XcX = 2 phrasal elements linked by a coordinating conjunction; Neg V = negative + verb ; Neg X = negative + 1 other phrase element; 2 Aux = 2 auxiliary verbs; Other = any other phrase with 4 or more elements.

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