Florida State University Libraries

2006

What Do Children Know, When They Know a Word?:

Caroline Phythian-Sence

THE FLORIDA STATE UNIVERSITY

COLLEGE OF ARTS AND SCIENCES

WHAT DO CHILDREN KNOW, WHEN THEY KNOW A WORD?

By

CAROLINE PHYTHIAN-SENCE

A Thesis submitted to the
Department of Psychology
in partial fulfillment of the
requirements for the degree of
Master of Science

Degree Awarded:
Fall Semester, 2006

The members of the Committee approve the thesis of
Caroline Phythian-Sence defended on October 18, 2006

                                                            _____
                                                                Richard K. Wagner
                                                   Professor Directing Thesis

                                                            _____
                                              Christopher Schatschneider
                                                 Committee Member

                                                            _____
                                              Michael P. Kaschak
                                                 Committee Member

The Office of Graduate Studies has verified and approved the above named committee members.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Although word knowledge is often conceptualized as an "all or nothing" phenomenon, the dichotomy of this perspective may not capture what children actually know when they "know" a word. An alternative perspective, that word knowledge is multidimensional, was tested using confirmatory factor analysis. Expressive and receptive definitional knowledge, contextual knowledge, morphological knowledge, and conceptual knowledge were assessed using an adapted version of a protocol designed by Anglin (1993), on eighty-four 4th graders from a midsized, Southeastern city. Confirmatory factor analyses were used to test alternative models of the underlying dimensions of word knowledge. An a priori proposed model, with three dimensions representing morphological knowledge, receptive word knowledge and expressive word knowledge provided an excellent fit to the data. Additional analyses indicated that expressive and receptive vocabulary knowledge were equally related to reading comprehension, and that morphological knowledge was slightly more related to reading comprehension than were expressive and receptive vocabulary knowledge.

WHAT DO CHILDREN KNOW, WHEN THEY *KNOW* A WORD?

A concern of both researchers and practitioners in the fields of education, psychology, communications, and linguistics is the development of a more complete understanding of children's vocabulary knowledge. The importance of vocabulary knowledge has long been acknowledged given its importance to reading comprehension (Stahl, 1983), its predictive value as a subtest on IQ tests (Sternberg, 1987), and its association with school success (Biemiller & Slonim, 2001; Jenkins *et al.*, 1989). Because of these findings researchers have sought to identify variables that may influence vocabulary knowledge, especially as they relate to topics such as test preparedness and intervention. Consequently, much of the research on vocabulary has investigated the effectiveness of different types of vocabulary instruction.

The number of scientifically rigorous studies in vocabulary instruction is small. In fact, the National Reading Panel was not able to conduct a meta-analysis on vocabulary instruction because an insufficient number of studies met the Panel's criteria for inclusion (Report of the National Reading Panel, 2000). In an earlier meta-analysis, Stahl and Fairbanks (1986) found only a small effect size (ES = 0.26, SD= .29, N=17, p<.01) for vocabulary instruction on global measures of vocabulary ability. Whereas a few recent experiments have yielded significant findings for various instructional techniques on word knowledge (see review in Report of the National Reading Panel, 2000) a fundamental question has yet to be answered, "What do children actually know when they *know* what a word means?" Current vocabulary measures generally assess word knowledge as an "all or nothing" phenomenon; this dichotomy may fail to capture more subtle distinctions in word knowledge. Instead of treating word knowledge as a dichotomous phenomenon, researchers should seek to determine the underlying dimensions of vocabulary knowledge; a more complete understanding of word knowledge may have implications for vocabulary instruction and measurement, and may be informative with regards to the relations between word knowledge and comprehension.

Infants and children acquire an enormous number of new words with apparent ease and largely without direct instruction (Tomasello, 2003). Estimates of the number of words developing children acquire range from 2.2 root words a day for children 12 months to 8 years (Biemiller & Slonim, 2001), to 9 new words a day for children aged 18

months to 6 years (Carey, 1978). When estimates are segregated by socio economic level, significant and stable differences in vocabulary acquisition rates are evident (Biemiller & Slonim, 2001; Hart & Risley, 1992; Templin, 1957). Templin (1957) estimated vocabulary size in a sample of children aged three through eight, who were classified as having low or high socio economic status. Using the *Ammons Full-Range Picture Vocabulary Test* for children aged three through five, and the *Seashore-Eckerson English Recognition Vocabulary Test* (a multiple choice test) for children aged six to eight, Templin (1957) found that children with low socio economic status have consistently and significantly fewer words in their vocabularies at each age level. Biemiller and Slonim (2001) recently explored vocabulary acquisition rates in a normative and an advantaged population of children, with kindergarteners and second graders providing oral definitions and fourth and fifth grades providing written definitions for words sampled from the *Living Word Vocabulary* (Dale & O'Rourke, 1976). They found stable discrepancies in children in the lowest quartile in vocabulary abilities throughout elementary school. Put simply, children who entered school with low vocabulary abilities remained at a disadvantage throughout elementary school. They estimate that by the second grade children at the lowest quartile of vocabulary ability know approximately 2000 words less than average ability second graders.

Assessments of vocabulary knowledge in average and disadvantaged children reveal quantitative differences, but rarely describe any qualitative differences between these populations. Typically vocabulary or word knowledge is measured in school aged children with multiple choice tests, but research suggests that these tests do not adequately describe what the students know about the words on the test (Anderson & Freebody, 1981). Anderson and Freebody (1981) found that the ability to define a word was not necessary in choosing the correct answer on a multiple choice test; in fact when 5th graders were asked to define words they had previously identified as real words, students knew only 50% of words using a moderate criteria (could provide a partial explanation) and only 20% of words using a stringent criteria (could provide a synonym). Beck, McKeown and Kucan assert (2002) that "if the goal is for students to fully understand and use words, then evaluations based on simple synonym matching or multiple-choice definitions will not tell us if that goal has been reach" (p. 11). Without

knowing what children actually understand when they know a word, it is challenging to develop instructional techniques or interventions that will effectively teach vocabulary. Therefore, when we use multiple choice assessments for vocabulary knowledge, we may only be assessing a partial, or incomplete knowledge of that word's meaning (Curtis, 1987).

Partial word knowledge has been conceptualized by researchers in many ways (e.g., a general sense of a word, a contextually bound word definition), but the term generally suggests that an abstract definition of a word cannot be produced (Anderson & Ortony, 1975; Durso & Shore, 1991; Trembly, 1966). Dale (1965) developed an early conceptualization of word knowledge, with Stages Two and Three referring to incomplete or partial word knowledge. His four stages are:

Stage One: "Never saw it before"

Stage Two: "Heard it, but don't know what it means"

Stage Three: "Recognize it in the context as having something to do with ____"

Stage Four: 'Know it well"

This model suggests that word knowledge is acquired sequentially with subsequent stages implying greater and eventually complete knowledge of that word. Beck, McKeown and Omanson's (1987) "Continuum of Knowledge," though similar to Dale's (1965), includes more subtle differences in word knowledge suggesting that a true understanding of a word is acquired more incrementally:

1. No knowledge
2. General sense such as knowing mendacious has a negative connotation
3. Narrow, context bound knowledge, such as knowing that a radiant bride is a beautifully smiling happy one, but unable to describe an individual in a different context as radiant
4. Having knowledge of a word but not being able to recall it readily enough to use it in appropriate situations
5. Rich, decontextualized knowledge of a word's meaning, its relationship to other words, and its extension to metaphorical uses, such as understanding what someone is doing when they are devouring a book

Durso and Shore (1991) explored partial word knowledge experimentally, arguing that there are very subtle forms of partial word knowledge even for words that subjects identified as previously unknown. Their results suggest that a person may have a general sense of a word even if he or she does not have explicit knowledge of the word or its meaning. Anderson and Ortony (1975) also experimentally explored the concept of general word sense, suggesting that words will have different shades of meanings depending on the context. For the word "piano," in a sentence describing music you would classify its meaning with harmonica, but in a sentence describing its weight you would classify its meaning with heavy rocks. This research implies that words have meanings that are influenced by factors such as context. Furthermore, it suggests that a simple dictionary definition may not convey all of a word's meaning and that an understanding of its meaning may be derived from experiences with that word in different contexts.

The idea that a word's meaning can become more complete from repeated exposures in differing contexts suggests not only that complete word acquisition will not occur in a single encounter, but that there may be aspects of a word's meaning that are not necessarily acquired sequentially. Nagy and Scott (2000) suggest that there is a limit to what a child can learn about a word on one occasion. In other words, children cannot know all there is about a word based on a single instructional experience or encounter. Varied, repeated exposures to a word may be necessary for a complete understanding of a word's meaning (Beck, McKeown & Kucan, 2002). Experience with a word in similar contexts will allow for a more precise understanding of the word in that context, but another aspect of a word's meaning may remain unrefined. In short, a complete understanding of a word is likely derived from experience with that word in both repeated and varied contexts.

Although the aforementioned word conceptualizations suggest that partial knowledge represents a quantitative deficiency in "complete" word knowledge, it is possible that partial word knowledge may refer to word knowledge that can best be conceptualized as qualitatively incomplete.

Cronbach (1942) proposed qualitative differences in word knowledge in perhaps one of the earliest conceptualization in this field. Cronbach's model addresses the notion

that knowing about a word means more than being able to define that word; complete word knowledge includes an understanding of that word's definition, an ability to use that word expressively as well as understand it receptively, along with an understanding of the multiple meanings of that word depending on its context. His categories include:

    A. Generalization: the ability to define a word

    B. Application: the ability to select or recognize situations appropriate to a word

    C. Breadth: knowledge of multiple meanings

    D. Precision: the ability to apply a term correctly to all situations and to recognize inappropriate use

    E. Availability: the actual use of a word in thinking and discourse.

This classification identifies, among other distinctions, that the ability to define a word is different, for example, from knowing how to use the word in an appropriate context. Nagy and Scott (2000) have also created a model of word knowledge similar in some respects to Cronbach's (1942) model. Their dimensions suggest that knowledge of a word is acquired over multiple and varied experiences with that word:

    A. *Incrementality* suggests that word knowledge is a matter of degrees that cannot be constrained to four or five discrete levels, but rather that "one's knowledge of a word can grow on the basis of almost infinitesimally small steps" (p. 271).

    B. *Polysemy* suggests that words have multiple and novel shades of meaning, from very similar to very different; therefore the meaning of a word must be inferred from context (e.g. boardroom, surfboard, ironing board, skateboard).

    C. *Multidimensionality* acknowledges that word knowledge cannot be confined to a continuum; there are different aspects of word knowledge that children acquire which rather than being sequential are relatively independent of each other.

    D. *Interrelatedness* is an understanding of how knowledge of one word influences the understanding of another word. For example, how well a person knows the meaning of whale depends on his/her understanding of mammal

    E. *Heterogeneity* implies that different types of words require different kinds of word knowledge; word knowledge of "it" and "the" are different from word knowledge of hypotenuse. Moreover, this suggests that different types of words may require different kinds of word learning.

Although Nagy and Scott (2000) suggest that aspects of word knowledge are acquired incrementally, they maintain that there are qualitative differences in vocabulary knowledge that are not necessarily gained in a linear fashion; the acquisition of one aspect of word knowledge is not necessarily predictive of which aspect will subsequently be acquired.

Many researchers agree that knowing a word means more than being able to define that word in abstract terms (Stahl, 1983). Stahl (1983) reviews evidence that suggests that "definitional knowledge may be necessary to account for our knowledge of word meanings, but it is not sufficient" (p. 35). What factors in addition to definitional knowledge may be required to account for knowledge of word meanings? Miller (1999) argues that knowing a word also requires an understanding of that word's meaning in various contexts. Anderson and Nagy (1991) suggest that knowing a word's semantic features, though also not sufficient for word knowledge, may be one dimension of knowing what a word means. These aspects of word knowledge, when taken as a cohesive unit, hint at the possibility of several distinct but not necessarily sufficient dimensions of complete word knowledge. As previously stated, word knowledge has generally been approached as an all or nothing phenomenon; a child has either acquired or not acquired a word. But research suggests that children may know something about a word even if a definition for that word is not yet accessible. A new perspective on word knowledge that investigates a child's understanding of a word's definition, its use in context, its morphological characteristics, and its relation to other words, may reveal better what a child knows when he or she has an incomplete or complete understanding of a word. Described below are dimensions representing definitional, contextual, morphological and conceptual word knowledge. While these dimensions describe types of word knowledge that may be considered qualitatively distinct, they still capture the possibility of quantitatively related dimensions of word knowledge.

Dimensions of Word Knowledge

Abstract word knowledge (definitional). Word definitions are different from other forms of written and oral language in that they are completely decontextualized; definitions are abstract descriptions of words. Although words are not often separated from a linguistic or written context, a commonly used method for assessing word

knowledge is asking subjects to identify or produce definitions. Identifying a definition often requires the child to evaluate which description, among a selection of descriptions, best represents a word (Kurland & Snow, 1997). Producing a definition, as opposed to identifying a definition, requires more than just providing information about a word's meaning (Snow, 1990). The most complex type of definition that can be produced is a formal definition that conforms to Aristotelian conventions, and includes both a superordinate term and a defining expression or restrictive complement (Kurland & Snow, 1997; Skwarchuk & Anglin, 1997; Snow, 1990; Watson, 1985). In the example, "an island is a body of land surrounded by water," the superordinate term is "body of land," and the restrictive complement is "surrounded by water" (p. 698, Snow, 1990).

Experimental evidence suggests that the content and form of definitions evolve from more concrete and anecdotally based "scenarios" in preschool and early elementary school to more abstract and symbolic, form-based descriptions in later elementary school (Watson, 1985). Age and school experience particularly appear to influence children's definitions (Kurland & Snow, 1997); superordinate terms are included with greater frequency and definitions tend to match more closely with a conventional form (Kurland & Snow, 1997; Watson, 1985). Definitional knowledge is undoubtedly important for school-aged children because it is so frequently utilized in assessments (Skwarchuk & Anglin, 1997), but it may not represent all of what a child knows when he or she knows a word. Anderson and Nagy (1991) argue that when a person looks up a familiar word in a dictionary, there is still "insight gained" in spite of its familiarity; knowing a word well does not necessarily mean knowing an explicit definition for that word (p. 719). Word knowledge that can be conceptualized as abstract word knowledge may represent a complex and refined word knowledge that develops over time or perhaps represents one dimension of word knowledge that is unique but not sufficient for complete word knowledge.

Contextual word knowledge. Contextual word knowledge is of great interest due to its theoretical connection to word acquisition. Because the number of words that children acquire throughout early childhood and into their school years is far greater than the number of words that are directly taught to them from teachers, parents, and peers, researchers surmise that children must be able to acquire word knowledge contextually

through conversations, read-alouds and reading (Leung, 1992; Tomasello, 2003).The majority of research on context as it relates to vocabulary knowledge has sought to explore how children derive abstract meanings for unknown and novel words in various contexts (Fukkink & de Glopper, 1998; Miller, 1999; Werner & Kaplan, 1950). Another branch of research into word contexts has explored contextual word knowledge as it relates to overall word knowledge.

Contextual knowledge suggests that a child is able to receptively or expressively understand a word in the context of a sentence, story or dialogue. In fact, Watson (1985) argues that because context contributes significantly to understanding a word, children do not need to produce an abstract definition of that word in order to understand its meaning. Stahl (1983) defines contextual knowledge as "knowledge of a core concept and of how this concept is realized in different linguistic contexts" (p. 36). This type of word knowledge does not imply that children are able to abstractly define each word within a statement, but rather can understand the words given their context.

Other research on the relation between context and vocabulary knowledge have produced two important findings. The first is that contextually bound word definitions are characteristic of children and adults with low vocabulary levels. Curtis (1987) found that low vocabulary ability children and adults define words within a particular context whereas high vocabulary children and adults define those same words using abstract and decontextualized terms. The second finding suggests that contextually bound word definitions are characteristic of younger children. Werner and Kaplan (1950) presented students with a sentence containing a novel word then asked for a definition of the novel word; subsequent sentences required students to integrate new contextual cues into a more precise word meaning. Their work suggests that the ability to derive an abstract meaning of a word from progressively constraining sentences is developmental, with a shift away from contextually bound definitions towards more abstract definitions arising around age ten or eleven. The concept of contextual word knowledge is therefore rather murky; contextual word knowledge may be a distinct type of word knowledge, may be a characteristic of individuals with lesser vocabulary abilities, or may hint at a developmentally immature understanding of word definitions.

Morphological word knowledge. Nagy (in press) suggests that morphological awareness may influence vocabulary knowledge. In an exploration of the words that children need to learn in school, Nagy and Anderson (1984) argue that because even systematic vocabulary instruction cannot account for the amount of word acquisition that actually occurs in school, additional factors such as an understanding of morphology may contribute to word knowledge. They estimate that the meanings of 60% of unfamiliar words that children encounter can be inferred from the words' morphological dimensions. Interestingly, formal instruction in morphemes and root words is not necessary for morphological awareness; Berko (1958) found that even four year olds, for example, will produce plurals for novel nouns and change the tense of a novel verb. Nagy et al. (2003) used structural equation modeling to assess the relationship of morphological awareness to language and literacy related skills; they suggest that morphological awareness contributes uniquely to oral vocabulary. Morphological awareness may therefore contribute word knowledge.

Wysocki and Jenkins (1987) argue that there are developmental effects on morphological awareness which may limit the child's ability to effectively utilize morphological cues in deriving word meanings. Morphological awareness in generally categorized under the broader term metalinguistic awareness, suggesting that morphological awareness requires children to consciously think and manipulate word dimensions. Nagy et al. (2003) and Nagy and Scott (2000) suggest that manipulation of morphology requires sophisticated metalinguistic skills which appear to be developmental; age and/or verbal ability may therefore influence a child's aptitude in using and creating definitions. Like abstract word knowledge, and contextual word knowledge, there is evidence that suggests that morphological awareness may be a unique contributor to word knowledge or may be an aspect of word knowledge that is developmental in nature.

Conceptual or relational word knowledge. O'Rourke (1974) extensively reviewed word acquisition and suggested that a student can increase his or her vocabulary by using conceptual relations such as categorization, synonymy, and antonymy. His research implies that word meaning is largely relations among words. Educational researchers have sought to utilize the relations among words in instructional techniques

such as the keyword method, semantic mapping and semantic feature analysis. With semantic mapping, for example, teachers graphically relate novel words to a familiar thematic concept, thereby activating students' familiar experiences and concepts (Johnson et al., 1986). While vocabulary assessments routinely utilize forms of conceptual word knowledge as a means of assessing vocabulary ability, how this dimension of word knowledge is related to partial or complete word knowledge is yet to be determined.

Questions about dimensions

Although researchers have suggested that word knowledge may not be captured in a dictionary definition, is word knowledge best conceptualized as dimensional? Are abstract, contextual, morphological and conceptual word knowledge unique contributors to an overall word knowledge? This study proposes that a multidimensional model comprised of abstract, contextual, morphological and conceptual knowledge will better represent the construct of word knowledge. Furthermore, because word knowledge is closely related to comprehension, this study asks, are different dimensions of word knowledge differentially related to comprehension?

Vocabulary and Comprehension

Vocabulary and comprehension are closely related; in order to understand what you are reading or hearing you need to know what the words you are reading or hearing mean. Research in this field over the past fifty years has yielded correlations between vocabulary and comprehension that range from 0.3 to 0.8 and appear to be influenced by factors such as age, test format, and the type of word knowledge that is assessed (Tannenbaum *et al.*, in press). But current research is still defining *how* vocabulary and comprehension are related. Anderson and Freebody (1981) suggest three possible hypotheses. The general aptitude hypothesis suggests that reading comprehension and vocabulary are related because both are manifestations of an underlying general intelligence. The general knowledge hypothesis suggests that intelligence and comprehension are related because both are manifestations of conceptual knowledge. Finally, the instrumentalist hypothesis suggests that vocabulary knowledge has a direct affect on reading comprehension because knowing more words will allow students to understand more of what they read.

Stahl and Fairbanks (1986) argue that this last hypothesis is the most interesting to researchers because it suggests that vocabulary interventions will affect reading comprehension. Although studies that have searched for a causal relationship between vocabulary instruction/ intervention and reading comprehension have provided mixed results, meta-analyses conducted by Stahl and Fairbanks (1986) support a causal relation. They find that compared to a no-exposure control group, there was an effect size of 0.97 (SD = .81, N= 41, p< .01, range 0-3.07) for word-specific comprehension measures (the assessment tested comprehension on words taught during the vocabulary intervention), and 0.30 (SD .22, N= 15, p< .01) for global measures of comprehension measures (the assessment did not specifically test target words in comprehension).

Beck and colleagues (Beck & McKeown, 1991; Beck et al., 2002; Beck et al., 1987) have suggested that in order for vocabulary instruction to effect comprehension, words need to be learned deeply in meaningful, contextually based ways (Tannenbaum et al., in press). They find that when vocabulary instruction provides students with information beyond a simple definition and includes experiences with words in multiple and varied contexts, gains are made in both vocabulary knowledge and comprehension. This research suggests that for gains to be made in comprehension students need to know both definitional and contextual knowledge about a word.

Carlisle (in press) reviewed the relation between morphological awareness as a part of word study programs and reading comprehension. She argues that while the findings are mixed across studies, it appears that instruction in morphological awareness, embedded within a larger vocabulary or word study program, may influence reading comprehension. Is morphological awareness as a dimension of word knowledge, predictive of reading comprehension? Additionally, are the aforementioned types of word knowledge (abstract, contextual, morphological and conceptual) necessary or sufficient to account for variance in comprehension ability? Are different dimensions of vocabulary knowledge differentially related to comprehension?

Overview of Present Study

Vocabulary research has generally focused on estimates of acquisition rates and the effectiveness of various instructional techniques while neglecting to answer the most fundamental question, "What does it mean to know a word?" Drawing from research that

has examined possible aspects of word knowledge, a dimensional model of word knowledge was explored. The dimensions included an abstract dimension, a contextual dimension, a morphological dimension and a conceptual or relational dimension. Additionally, because vocabulary knowledge has been categorized as either expressive or receptive, additional models tested these dimensions. Researchers have also long explored the relation between vocabulary knowledge and comprehension (Stahl & Fairbanks, 1986). Interestingly it appears that certain dimensions of vocabulary knowledge may be necessary for gains in comprehension (e.g. Beck et al., 2002) hinting at the possibility that dimensions of word knowledge may be differentially related to comprehension.

A study of word knowledge was conducted on fourth graders in order to assess whether or not there exist dimensions that go beyond the typical categorizations as abstract, decontextualized and dichotomous. Furthermore, in order to better understand the correlation between vocabulary and reading comprehension, this study explored the relation between the best fit word knowledge model, and comprehension.

METHOD

Participants

Eighty-four fourth grade students from two schools (one public, one parochial) in a mid-sized Southeastern city, participated in this study; these students were a part of a larger study that has been conducted longitudinally with these students since spring, 2004. The sample contained 46 girls (54.8%) and 38 boys (45.2%), and was representative of the ethnic composition of the city (72.6% Caucasian, 22.6% African American, 3% Hispanic). All participating children (1) returned a permission form signed by a parent or legal guardian (Appendix A), (2) agreed to participate in the assessment when approached by the evaluator, and (3) spoke and articulated English well enough for the evaluator to transcribe dictation accurately. No child was excluded on the basis of disability.

Assessment of Comprehension

Gray Oral Reading Tests- Fourth Edition (GORT-4). This assessment is an individually administered, standardized test of oral reading ability. The GORT-4 allows for the calculation of scores for rate, fluency, accuracy and comprehension in addition to the overall oral reading ability score. The student reads short passages aloud and then answers five comprehension questions for each passage. The comprehension subscale was utilized in analyses for this study.

Passage Completion from the *Woodcock Reading Mastery Tests- Revised* (WRMT-R). This assessment is an individually administered, standardized test of reading comprehension. The student silently reads a cloze sentence and then supplies an appropriate answer. As the test progresses, the cloze sentences become embedded within paragraphs.

Listening Comprehension from the *Woodcock Johnson Test of Achievement- Three* (WJ III). This assessment is an individually administered, standardized test of oral comprehension. The evaluator reads aloud cloze sentences and the student provides appropriate answers. As the test progresses, the cloze sentences become longer and more complex.

Experimental silent reading passages (Appendix B). This assessment in an individually administered, experimenter created test of reading comprehension. It was created by Dr. Rashotte and Dr. Wagner for use in the larger comprehension study, of which this study is only one component. It is comprised of two narrative and two expository texts of approximately two paragraphs length each. The stories were drawn from grade appropriate texts, and also checked for grade appropriateness. Students are timed as they silently read each passage and then answer orally five comprehension questions (two literal, two inferential and one summary question) for each passage.

Assessment of Vocabulary

Word knowledge protocol (Appendix C). This protocol is an evaluator developed assessment that has been adapted from Anglin (1993) and is designed to target four dimensions of word knowledge (abstract, contextual, morphological and conceptual) expressively and receptively.

Protocol development. The words utilized in this assessment were selected from the *MRC Psycholinguistic Database* (Wilson, 1987). This database of words is unlike a dictionary in that it provides syntactical and psychologically relevant information about words, rather than meanings. Word characteristics that are available include concreteness, imageability, frequency, and age of acquisition, among other variables. Initially, all standard words (non-foreign, non-archaic, etc.) that were acquired before age eleven were included. Words were excluded initially for not having an antonym, and later for not having antonyms or synonyms that were acquired at approximately the same age as the target word. Additional words were excluded because they were not root words, or could not be simplified into a root word for later morphological analysis.

The assessment protocol was developed for thirty-six words, of which thirteen were chosen for inclusion (one example and twelve test items). For each word, one expressive and one receptive question was developed to target each of the four types of word knowledge. Expressive definitional word knowledge was assessed by asking children to produce one or more meanings for each target word, contextual word knowledge was assessed by asking children to use the target word in a sentence, and expressive conceptual word knowledge was assessed by asking children to produce a synonym and antonym for each target word. Expressive morphological word knowledge

was assessed using an adapted version of Carlisle's (2000) morphological derivation task, where children produce a morphologically complex word in response to a cloze sentence.

Receptive definitional and conceptual word knowledge were assessed using a multiple choice format; words and phrases that were developed as options had similar acquisition ages as the target word. Receptive contextual word knowledge was assessed by asking children to identify sentences that used target words appropriately. Receptive morphological word knowledge was assessed with an adapted version of the derivational suffix choice test (University of Washington, 1999) where children chose the appropriate morphologically complex word to complete a cloze sentence.

Words that were included in the final protocol were chosen so that following the training item, the first three words should be known by most kindergarten and first graders (Mogilner, 1992), the middle six words should be known by most third and fourth graders, and the last three words should be known by most fifth and sixth graders. *Coding scheme*. The coding scheme was developed for expressive questions, by collecting definitions, synonyms and antonyms for the target words from the Dictionary.com website that draws from multiple sources including *The American Heritage Dictionary,* and *Webster's Revised Unabridged Dictionary* (Lexico Publishing Group, 2006). From this collection of results, a shorter list was compiled of the most common definitions, synonyms and antonyms, from which the coding scheme was developed (Appendix D). When students provided answers that conformed to definitions, synonyms or antonyms that were included in the larger list, but were not included in the coding schema, two raters discussed and came to an agreement concerning points. For expressive definitions, responses were coded to award points for format (e.g. formal Aristotelian definitions), content and syntax (e.g. appropriate tense). Synonyms and antonyms were also coded for content and syntax, but also included a related scale for responses that were not true synonyms or antonyms, but still captured some of the correct meaning (e.g. magic as a synonym for enchant).

Expressive sentences (targeting contextual word knowledge) were coded similarly so that points were awarded for content and syntax, with additional points awarded for the inclusion of related and meaning constraining phrases (e.g. "The baby is crying," as opposed to "My brother cried because I kicked him").

Morphological knowledge was coded for absolute correctness and also for providing a morphologically complex derivative of the target word, even if the word was not correct given the expressive morphological task. Because this protocol sought to better understand what children know about a word, derivatives of the target root word still reveal knowledge about that word.

Receptive questions that targeted definitions, contextual sentences, morphology, synonyms and antonyms were coded dichotomously. The correct answer for each of the contextual sentences was derived by having seven graduate students rate sentences with target words; the sentences were rated with regards to how correctly the target word was used (correctly or "very good," incorrectly or "not so good," or neither correctly or incorrectly or "sort of good"). A frequency count was utilized to decide upon the appropriate responses.

PROCEDURE

All students who turned in signed permission forms participated in the assessment. The evaluator asked both teacher and individual student for consent to participate; student and evaluator then retreated to a quiet area where the evaluator briefly described the tasks, expectations, and rewards for participating. The test battery, of which the protocol was but one assessment, took approximately two hours to complete, and was generally administered in two to three session.

Reliability of Coding Schema

Interrater reliabilites were assessed for the expressive measures of the coding schema on a randomly chosen sample of 21 or 25% of subjects. The three raters had an average interrater reliability of 0.952, with reliabilities for each of the subscales ranging from 0.864 and 0.985 (Table 1).

Basic Statistics

Means, standard deviations, reliabilities and bivariate correlations are included in Table 2. The reliabilities for the vocabulary protocol were mostly satisfactory with the exception of two subscales: receptive abstract meaning and receptive synonym. An item analysis yielding alpha if item deleted statistics suggested that eliminating any single item would not markedly improve the overall alpha for the receptive abstract meaning and receptive synonym subscales (Table 3). Whereas these results firstly suggest an overall poorly designed measure of the constructs of definitional and conceptual knowledge, respectively, another interpretation of these results suggests that the low alphas are indicative of the independence of knowledge about different words; knowing one item in the given subscale does not necessarily predict knowing another item. For example, knowing the synonym of a target word does not necessarily suggest knowledge of a synonym for another target word. The reliabilities for the experimental passages were 0.968 and 0.826, for the narrative and expository passages, respectively.

Evaluation of skewness and kurtosis indicated the presence of only minor deviations from normal distributions. Values of skewness and kurtosis are presented in Table 4. Six outliers, from five subscales were "brought to the fence" by changing their values to the median plus or minus two standard deviation units (Table 5).

Relations with receptive synonyms and the experimental expository passages were significant at the .05 level, with all but a few of the remaining correlations significant at the .01 level. Interestingly, all but one of the non-significant values were associated with the *Gray Oral* comprehension subscale. These low correlations hint at a greater problem with this popularly utilized assessment of comprehension. Keenan and Betjemann (in press) found that 86% of questions on the GORT could be answered at

above chance, even without reading the corresponding passage. Because reading may not be a requirement in correctly answering the comprehension question, the GORT may not be measuring the target construct. Keenan and Betjemann (in press) argue that another factor such as prior knowledge may account for a significant proportion of the variance in this subcale.

Whereas correlations between the subscales of the vocabulary protocol, the *Woodcock Johnson* passage comprehension subscale, *Listening Comprehension*, and the experimental narrative passages support previous findings concerning the relation between vocabulary and comprehension (Tannenbaum et al., in press), correlations between these variables and the comprehension subscale of the *Gray Oral* refute this trend. These results suggest that this subscale may be a poor measure of the construct of comprehension.

Description of models and model fits

This study proposed that the general construct of word knowledge would be more accurately represented with a model comprised of four dimensions: abstract, contextual, morphological and conceptual word knowledge. Each dimension was assessed using two measures in order to create latent variables. By using latent variables, common variance associated with the tasks was represented without the error associated with the individual tasks. Confirmatory factor analysis was utilized to explore which model best fit the construct of word knowledge. Besides the four dimension model, representing four distinct underlying abilities, additional one, two, three and four dimension models were tested that combined the types of word knowledge into single dimensions that represent combined underlying abilities that account for individual differences. Whereas the general model suggests that each construct is measuring the same underlying dimension or "fund of knowledge," the multidimensional models suggest that separate underlying dimensions account for differences in word knowledge. Also, because word knowledge has so often been segregated into expressive and receptive vocabulary abilities, and because each of the four dimensions was assessed receptively and expressively, models testing expressive and receptive factors were tested (see description of models in Appendix E).

19

A summary of model fits statistics, including the χ^2 difference test between the general model and the more specific models are in Table 6. The best fitting model ($\chi^2=$ 25.00, df = 32, N=84) had three factors: a morphology factor comprised of expressive and receptive morphological measures, a receptive factor comprised of the remaining receptive measures (definitional, contextual, conceptual), and an expressive factor comprised of the remaining expressive measures (definitional, contextual, conceptual, Figure 1). The model fit statistics of Tucker-Lewis Index (TLI) and Comparative Fit Index (CFI) were 1.03 and 1.00, respectively; because a value greater than .95 is desirable, these statistics suggest a good fitting model (Hu & Bentler, 1999). The root mean square error of approximation (RMSEA) was 0.000 (cut-off score 0.05) additionally suggesting a good fitting model. Furthermore, because this model had a highly non-significant p-value (p= .806), the null hypothesis that this model fits the data well was not rejected.

This model has a significantly better fit than the general model (χ^2 diff= 24.967, df = 3, p=0.000). It suggests that word knowledge is best represented by three highly correlated but separate underlying abilities for morphological, receptive and expressive word knowledge.

The three factor model for word knowledge was tested with a latent variable representing comprehension in order to determine how related these constructs are. Vocabulary and reading comprehension have consistently been related, but whether the different underlying dimensions of vocabulary, or word knowledge are equally or differentially related, was tested. Summary of model fits are included in Table 7. Initially a model with all of the measures of comprehension loading onto a single comprehension factor was tested. Although this model fit the data well, a second model was run that did not include that *Gray Oral* comprehension subscale due to its uncertain relation to the construct of comprehension. According to the fit indices, this model has a better fit than the model that included that the *Gray Oral*. In order to better specify the relation between the three factors of word knowledge and comprehension, additional models were run that constrained the covariances between the dimensions of word knowledge and comprehension. The model that constrained the expressive and receptive covariances yielded the best fit model between the three factors of word knowledge and

comprehension; it was not significantly different from the unconstrained model (χ^2 diff= 0.795, df = 1, p=0.373, Figure 2). Because the constrained and unconstrained models are not significantly different from each other, the constrained model with the added restriction on the model's complexity is the more parsimonious and therefore preferred model. The constrained model suggests that neither the expressive nor receptive latent variables are differentially related to the construct of comprehension[*]. The latent variable representing morphological knowledge was highly correlated with the latent variable representing comprehension.

---

[*]*Note. Although the covariates were constrained to be equal, the standardization of these parameters causes the estimates to appear different. The unstandardized estimates between the expressive and receptive latent variables and comprehension were both 16.23.*

GENERAL DISCUSSION

This study had two aims. The first aim was to identify the underlying dimensions of word knowledge. It was hypothesized that word knowledge would be best represented by correlated but distinct types of vocabulary knowledge, with dimensions representing combinations of expressive and receptive abstract (definitional), contextual, morphological and conceptual word knowledge. The second aim was to determine whether the dimensions were differentially related to comprehension.

With regards to the first question, confirmatory factor analyses suggest that an a priori determined model that posits three distinct but correlated latent variables best represents the construct of vocabulary knowledge: receptive vocabulary knowledge, expressive vocabulary knowledge and morphological vocabulary knowledge.

Prior research supports the contribution of morphological knowledge to word knowledge. In an extensive review of the literature on morphological knowledge, Anglin (1993) argues that children's morphological knowledge is related to their acquisition of information about words; as children gain insight into morphology, this ability should help them "figure out" the meanings of novel words (p. 39). The model proposed in this suggests that morphological knowledge is an underlying dimension of vocabulary knowledge, and is consistent with the assertation that morphological knowledge plays a role in vocabulary development.

Whereas this model suggests that morphological knowledge is an independent contributor to vocabulary knowledge, it contrasts another model described by Muse (2006), who did not find a significant difference between a single latent variable model representing morphology and vocabulary, and a two factor model representing two distinct abilities for morphology and vocabulary. Muse administered six measures of morphological knowledge and two measures of vocabulary knowledge (one receptive, one expressive) to a population of 4th graders from the same southeastern city. One similarity to the model proposed by Muse (2006) is that a single latent variable best represented morphology, regardless of measurement method. Muse (2006), assessed morphological knowledge with receptive and expressive measures, use-based and awareness-based measures, and with derivation and decomposition tasks. Two of her

measures, including the original version of the suffix choice test and morphological derivation task, are similar in nature and style to those used in the current study. Her finding, that there is a single underlying morphological ability, regardless of method, supports the construct validity of using these morphological measures to represent the construct of morphological word knowledge. The difference between the two models, in the representation of vocabulary and morphology as a single latent trait, may be due to the different measures utilized in assessing vocabulary knowledge. Though her expressive measure was definitional in nature, her receptive measure required choosing one of four pictures that corresponded to a spoken word, and does not correspond well to any of this study's dimensions. This difference in specification may have resulted in the differences in model fit.

The second aim of this study was to determine whether the dimensions of vocabulary knowledge were differentially related to the construct of comprehension. In the best fitting model, where the expressive and receptive dimensions were constrained to be equally related to comprehension, and the morphological dimension was allowed to be differentially related, the correlation between comprehension and the expressive, receptive and morphological dimensions were 0.73, 0.86 and 0.91, respectively. Findings by Ouellette (2006)suggest a similar pattern of relations between expressive and receptive vocabulary knowledge and comprehension. In a study that used hierarchial regression analyses, with decoding and word recognition entered as control variables, Ouellette (2006)found that neither expressive nor receptive vocabulary breadth, measured with the Expressive Vocabulary and Receptive Vocabulary subtests of the Test of Word Knowledge (Wiig & Secord, 1992), predicted unique variance in reading comprehension; instead both measures shared variance A significant difference between this study and that conducted by Ouellette (2006) is that an additional variable for expressive vocabulary depth, measured with the Word Definitions subtest of the Test of Word Knowledge, accounted for unique variance beyond the other two measures and control variables. The Word Definitions subtest is an expressive definitional task, and is therefore similar in format to this study's expressive definitional task. Although this measure corresponded well to one utilized in this study, the other differences in specifications of vocabulary knowledge may account for some of the differences in findings. Clearly, it is

important to investigate further the relations between expressive and receptive vocabulary knowledge dimensions and comprehension.

The correlations between comprehension and the three dimensions for vocabulary knowledge support previous findings of positive relations between the two constructs, but Tannenbaum, Torgesen and Wagner (in press) note that these correlations are higher than most previously reported. An exception is the aforementioned study by Tannenbaum, et al. (in press) who also found high correlations between two latent variables of word knowledge, breadth and depth/fluency, and reading comprehension. This study is especially interesting in that it proposed an alternative, multidimensional conceptualization of word knowledge. The authors proposed that vocabulary knowledge is comprised of three underlying dimensions corresponding to latent traits for vocabulary breadth, or the extent of one's vocabulary, vocabulary depth, or the "richness of knowledge" about a word, and fluency, or the rate of access to a word's meaning. Confirmatory factor analysis was utilized to determine that the best fitting model had two latent variables, one representing breadth, and a second representing depth/ fluency. This model suggests that breadth is a unique but highly correlated dimension of word knowledge. Depth and fluency formed a second dimension. This latent variable makes intuitive sense as both depth and fluency may be influenced by similar experiences because greater familiarity with a word allows for both faster access and a greater understanding of that word (Tannenbaum et al., in press).Whereas the nature of this model is different from the one proposed in this study, it is similar in suggesting that prior conceptualizations of word knowledge are lacking. Though the Breadth-Depth/Fluency model utilized different assessment measures, several share features with those utilized in this study. For example, the Word Use Fluency subtest of Dynamic Indicators of Basic Early Literacy Skills (Good & Kaminski, 2002) used to assess the construct of fluency is similar in nature to the task designed to target expressive contextual knowledge, and the Weschler Intelligence Scale for Children- Third Edition (Wechsler, 1991), used to assess the construct of breadth, is similar to the task designed to target expressive abstract knowledge. Further research should seek to merge the unique and similar constructs identified in these two models in order to better define the target construct of vocabulary or word knowledge.

It was previously suggested that the low reliabilities of several of the subscales implied independence of different types of knowledge about words. An alternative to this interpretation is that the measures were poorly designed and therefore did not adequately tap the intended constructs. The two measures with particularly low reliabilities were the receptive abstract meaning subscale, and the receptive synonym task, which were both multiple choice tasks. Further studies should seek to determine if the aforementioned tasks are good measures of their respective constructs, or if alternative measures should be utilized.

This study determined that a three factor model for expressive, receptive and morphological knowledge best fit the construct of word knowledge. Furthermore, this study suggests that the expressive and receptive dimensions of word knowledge were not differentially related to comprehension. With regards to expressive and receptive word knowledge, future research should seek to better define this distinction. Although these dimensions do not appear differentially related to comprehension, expressive and receptive word knowledge may be differentially related to other cognitive skills, e.g. fluency. Whereas previous studies suggest important and potentially reciprocal relations between morphology and vocabulary (Anglin, 1993), future studies should seek to verify the finding that morphological word knowledge is a dimension of word knowledge rather than a related skill.

Table 1. Interrater reliabilities for word knowledge protocol coding scheme

Subject	Overall	Meaning	Sentence	Synonym	Antonym	Morphology
2	0.954	0.964	0.865	0.925	0.883	0.974
5	0.968	0.969	0.869	1.000	0.943	1.000
9	0.891	0.878	0.837	0.911	0.894	1.000
27	0.970	0.891	0.888	0.979	0.924	1.000
28	0.991	0.970	0.930	0.910	0.953	1.000
30	0.916	1.000	0.882	1.000	1.000	1.000
32	0.977	0.986	0.863	1.000	0.943	0.969
34	0.952	0.961	0.799	0.934	0.874	1.000
36	0.936	0.935	0.884	0.830	0.828	1.000
46	0.934	0.923	0.902	0.958	0.973	1.000
49	0.951	0.956	0.956	0.855	0.810	1.000
51	0.945	0.936	0.970	0.849	0.845	1.000
69	0.971	1.000	0.839	0.819	0.914	1.000
71	0.991	0.996	0.904	0.921	0.958	0.974
72	0.965	0.980	0.913	0.924	0.957	0.960
75	0.986	1.000	0.796	0.891	0.930	0.978
79	0.919	0.791	0.780	0.946	0.895	0.965
85	0.941	0.944	0.943	0.751	0.891	1.000
92	0.945	0.947	0.588	0.875	0.906	1.000
99	0.950	0.956	0.845	0.921	0.904	1.000
103	0.942	0.957	0.894	0.868	0.768	0.866
N= 21	*M= 0.952*	*M= 0.950*	*M= 0.864*	*M= 0.908*	*M= 0.904*	*M= 0.985*

Table 2. Means, standard deviations, reliabilities (on diagonal), and bivariate correlations

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 Receptive morphology	(0.56)														
2 Expressive morphology	0.51	(0.50)													
3 Receptive abstract meaning	0.36	0.40	(0.23)												
4 Expressive abstract meaning	0.42	0.42	0.43	(0.72)											
5 Receptive context sentence	0.47	0.47	0.47	0.54	(0.67)										
6 Expressive context sentence	0.37	0.36	0.46	0.69	0.52	(0.70)									
7 Receptive antonym	0.50	0.37	0.48	0.51	0.44	0.38	(0.50)								
8 Expressive antonym	0.45	0.39	0.47	0.65	0.48	0.62	0.39	(0.68)							
9 Receptive synonym	0.24	0.41	0.28	0.27	0.28	0.28	0.35	0.34	(0.41)						
10 Expressive synonym	0.33	0.29	0.38	0.61	0.37	0.49	0.39	0.62	0.25	(0.56)					
11 Passage Comprehension	0.55	0.50	0.50	0.57	0.54	0.53	0.39	0.53	0.27	0.35	(0.85)				
12 Listening Comprehension	0.42	0.42	0.36	0.49	0.41	0.39	0.47	0.32	0.26	0.30	0.50	(0.71)			
13 Gray Oral comprehension	0.29	0.32	0.38	0.33	0.18	0.28	0.18	0.32	0.04	0.27	0.56	0.48	(0.97)		
14 Experimental narrative passag	0.32	0.43	0.37	0.38	0.27	0.31	0.31	0.22	0.26	0.18	0.54	0.46	0.44	(0.97)	
15 Experimental expository pass	0.24	0.49	0.26	0.35	0.22	0.34	0.30	0.33	0.37	0.24	0.36	0.24	0.18	0.44	(0.83)
Total possible	12	24	12	120	48	48	12	48	12	48	68	34	70	8	8
M	10.18	18.52	8.32	31.23	26.89	27.21	7.65	19.57	8.80	19.49	39.33	22.00	35.20	5.26	4.29
SD	1.74	2.86	1.61	11.66	5.37	6.51	1.70	5.53	1.44	6.29	5.79	3.46	8.31	1.71	1.44

Note. Correlations greater than 0.18 are significant at the 0.05 level
Correlations greater than 0.28 are significant at the 0.01 level

Table 2. continued

Receptive Abstract Meaning	Mean if deleted	Variance if item deleted	Item-total correlation	Alpha if item deleted
Cry	7.35	2.57	0.03	0.23
Joy	7.56	2.37	0.04	0.23
Easy	7.76	2.11	0.17	0.16
Weak	7.36	2.50	0.13	0.21
Neglect	7.63	2.09	0.22	0.13
Delight	7.46	2.47	0.01	0.24
Courage	7.38	2.36	0.26	0.17
Flourish	7.80	2.14	0.15	0.17
Construct	7.58	2.39	0.02	0.24
Enchant	7.88	2.30	0.04	0.24
Dispute	7.77	2.30	0.04	0.24
Rigid	8.00	2.53	-0.10	0.30

Receptive Synonym	Mean if deleted	Variance if item deleted	Item-total correlation	Alpha if item deleted
Cry	8.56	2.54	0.09	0.41
Joy	8.50	2.66	0.00	0.42
Easy	8.55	2.59	0.04	0.42
Weak	8.73	2.13	0.29	0.34
Neglect	8.80	2.07	0.29	0.33
Delight	8.65	2.42	0.10	0.41
Courage	8.55	2.40	0.33	0.36
Flourish	9.04	2.20	0.14	0.40
Construct	8.58	2.46	0.14	0.40
Enchant	8.77	2.08	0.29	0.33
Dispute	8.77	2.44	0.01	0.45
Rigid	9.00	2.29	0.08	0.43

Table 3. Statistics for skewness and kurtosis

Subscale	skewness	kurtosis
Receptive morphology	-1.26	1.52
Expressive morphology	-0.83	0.50
Receptive abstract meaning	0.18	-0.32
Expressive abstract meaning	1.15	2.93
Receptive context sentence	0.05	-0.17
Expressive context sentence	-0.15	-0.08
Receptive antonym	-0.53	-1.86
Expressive antonym	0.65	0.12
Receptive synonym	-0.47	0.16
Expressive synonym	0.46	0.90

Table 4. Summary of outlier data

Subscale (number of outliers)	Median	Intrqrtle Range	Score	Fixed score
Receptive Morphology (0)	10.5	3	----	----
Expressive Morphology (1)	19	4	9	11
Receptive Abstract Meaning (0)	8	2	----	----
Expressive Abstract Meaning (1)	30	16	84	62
Receptive Context Sentence (0)	27	8	----	----
Expressive Context Sentence (0)	28	9	----	----
Receptive Antonym (1)	8	2	2	4
Expressive Antonym (1)	19.5	7	38	34*
Receptive Synonym (0)	9	2	----	----
Expressive Synonym (2)	19	8	37	35
			36	35

* *Note:* Rounded from 33.5 to 34

Table 6. Model fit statistics for word knowledge models

| Model	Description	χ^2	df	p-value	χ^2/df	TLI	CFI	RMSEA	χ^2 diff	p-value
	GENERAL MODEL									
1	Ab Cx Mo Cp*	49.968	35	0.048	1.428	0.939	0.953	0.072	----	----
	2-FACTOR MODELS									
2a	Cx & Ab Mo Cp	49.932	34	0.038	1.469	0.933	0.949	0.075	0.036	0.850
2b	Ab & Cx Mo Cp	46.865	34	0.070	1.378	0.946	0.959	0.068	3.103	0.078
2c	Cx Ab & Mo Cp	48.949	34	0.047	1.440	0.937	0.953	0.073	1.019	0.313
2d	Cx Mo & Ab Cp	49.309	34	0.043	1.450	0.936	0.951	0.074	0.659	0.417
	3-FACTOR MODELS									
3a	Cx & Ab & Mo Cp	44.754	32	0.067	1.399	0.943	0.960	0.069	5.214	0.157
3b	Cx & Mo & Ab Cp	42.670	32	0.098	1.333	0.952	0.966	0.063	7.298	0.063
3c	Cx & Cp & Ab Mo	46.509	32	0.047	1.453	0.935	0.954	0.074	3.459	0.326
3d	Ab & Cp & Cx Mo	45.494	32	0.058	1.422	0.940	0.957	0.071	7.844	0.049
3e	Mo & Cp & Ab Cx	42.124	32	0.109	1.316	0.955	0.968	0.062	7.844	0.049
	4-FACTOR MODEL									
4	Ab & Cx & Cp & Mo	36.894	29	0.149	1.272	0.961	0.975	0.057	13.074	0.042
	EXPRESSIVE-RECEPTIVE MODELS									
5a	Ex & Rc	39.933	34	0.223	1.174	0.975	0.981	0.046	10.035	0.002
5b	Ab & Ex Mo Cp Cx & Rc Mo Cp Cx	40.839	32	0.136	1.276	0.961	0.972	0.058	9.129	0.028
5c	Cx & Ex Mo Cp Ab & Rc Mo Cp Ab	42.807	32	0.096	1.338	0.952	0.966	0.064	7.161	0.067
5d **	Mo & Ex Ab Cp Cx & Rc Ab Cp Cx	25.001	32	0.806	0.781	1.031	1.000	0.000	24.967	0.000
5e	Ex Cp & Rc Cp & Ex Ab Mo Cx & Rc Ab Mo Cx	35.770	29	0.180	1.233	0.967	0.979	0.053	14.198	0.028
5f	Ex Mo Cx & Rc Mo Cx & Ex Ab Cp & Rc Ab Cp	34.138	29	0.234	1.177	0.975	0.984	0.046	15.830	0.015

Note   * Ab= abstract; Cx= contextual; Mo= morphological; Cp= conceptual
　　　　　　** denotes best fitting model

31

**Table 7. Model fit statistics for word knowledge and comprehension models**

Model	Description	χ^2	df	p-value	χ^2/df	TLI	CFI	RMSEA
6a	Mo & Ex & Rc & Comp	95.641	84	0.181	1.139	0.971	0.977	0.041
6b	Mo & Ex & Rc & Comp (No Gray)	71.154	71	0.473	1.002	1.000	1.000	0.005
6c	Mo & Ex & Rc & Comp Constrain	101.858	73	0.014	1.395	0.921	0.937	0.069
6d*	Mo & Ex & Rc & Comp Constrain Ex Rc	71.949	72	0.480	0.999	1.000	1.000	0.000
6e	Mo & Ex & Rc & Comp Constrain Ex Mo	93.392	72	0.046	1.297	0.941	0.953	0.060
6f	Mo & Ex & Rc & Comp Constrain Rc Mo	91.101	72	0.064	1.265	0.947	0.958	0.057

Note   *denotes best fitting model
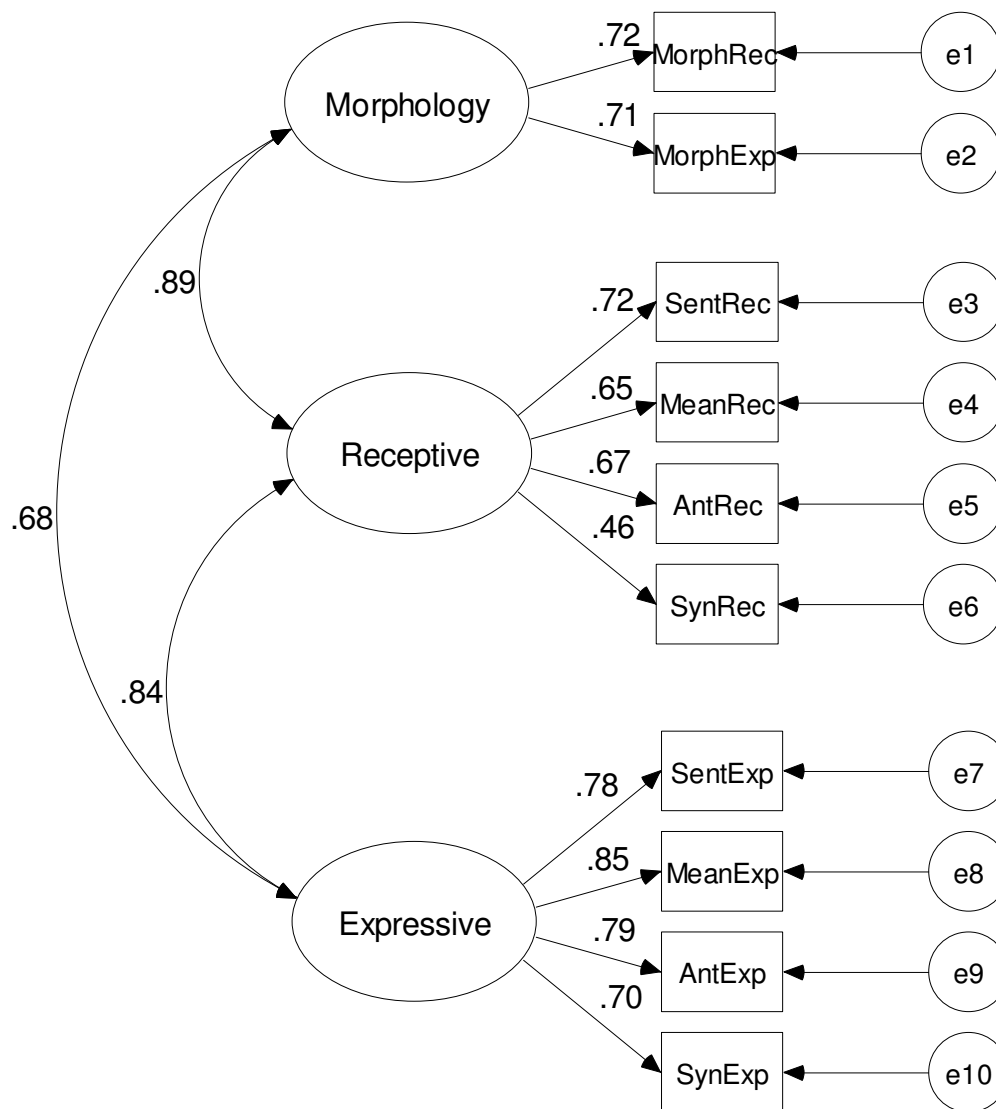
Note. All paths significant at p-level .001

Figure 1. Best fitting word knowledge model (χ^2 = 25.00, *df*=32, p=.81)
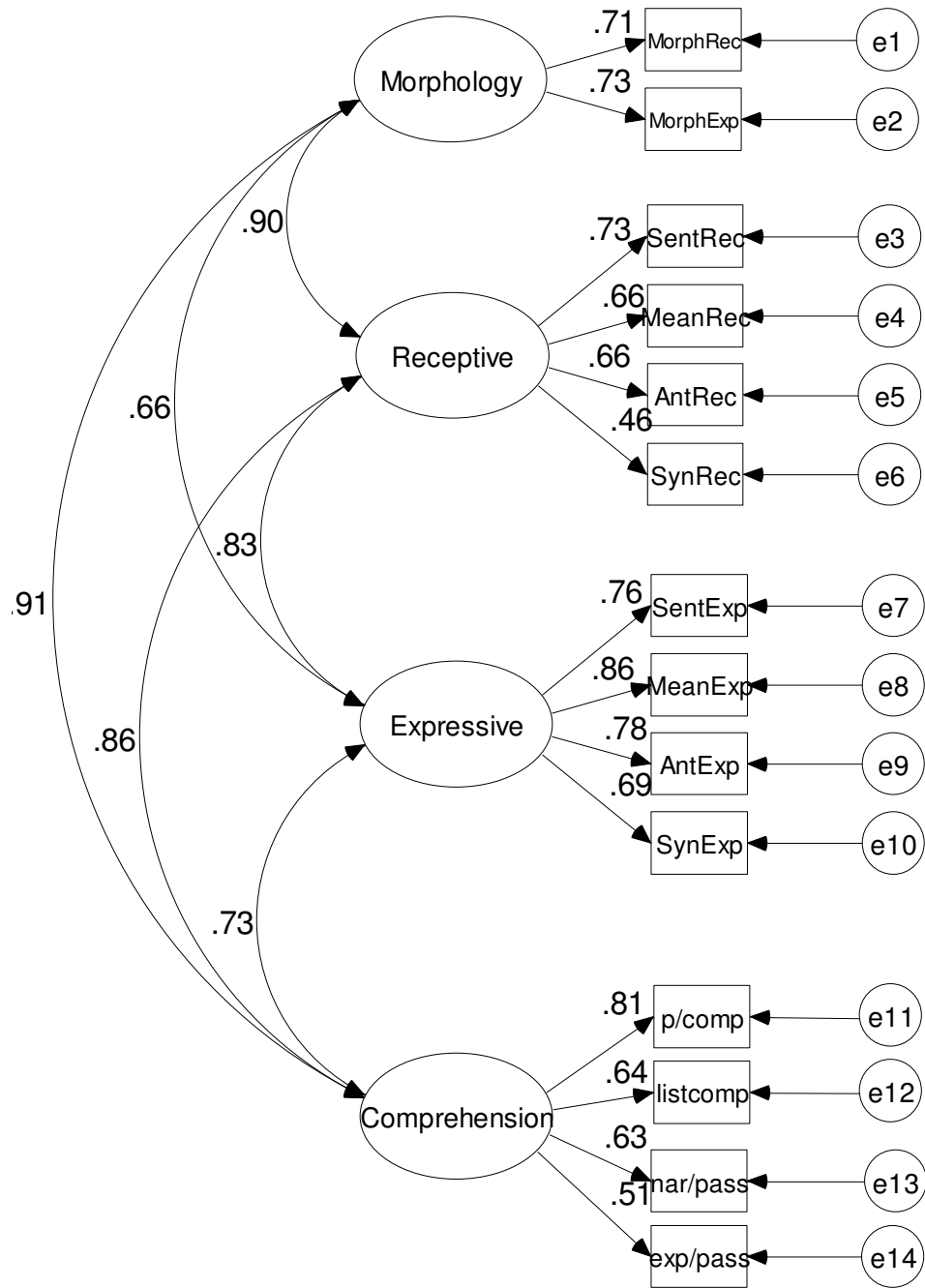
Note. All paths significant at p-level .001

Figure 2. Best fitting word knowledge and comprehension model (χ^2=71.95, *df*=71, p=.47)

APPENDIX A

Institutional Review Board and permission slip

Florida State UNIVERSITY

Office of the Vice President For Research

Human Subjects Committee
Tallahassee, Florida 32306-2742
(850) 644-8633· FAX (850) 644-4392

REAPPROVAL MEMORANDUM

Date: 2/24/2006

To:
Richard Wagner
MC:1270

Dept.: **PSYCHOLOGY DEPARTMENT**

From: **Thomas L. Jacobson, Chair**

Re: **Reapproval of Use of Human subjects in Research:**
Origins of Individual and Developmental Differences in Reading Comprehension

Your request to continue the research project listed above involving human subjects has been approved by the Human Subjects Committee. If your project has not been completed by 2/7/2007 please request renewed approval.

You are reminded that a change in protocol in this project must be approved by resubmission of the project to the Committee for approval. Also, the principal investigator must report to the Chair promptly, and in writing, any unanticipated problems involving risks to subjects or others.

By copy of this memorandum, the Chairman of your department and/or your major professor are reminded of their responsibility for being informed concerning research projects involving human subjects in their department. They are advised to review the protocols of such investigations as often as necessary to insure that the project is being conducted in compliance with our institution and with DHHS regulations.

Cc: Carol Rashotte; C. Kelley
HSC No. 2006.0066-R

The Florida State University
Tallahassee, Florida 32306-1270
Department of Psychology

Dear Parent,

Last year (and the year before) you kindly gave permission for your child to be part of a large group of students who were given comprehension related tasks. These tasks were part of a research study to help us better understand the kinds of reading skills that promote reading comprehension. Because we would like to check the progress in reading development that each child has made over the past year, we are asking parents of all children who participated for the last two years to consent to have their child participate *one last time.*

Your child's participation will involve reading or listening to a set of reading passages and tasks that most children find enjoyable. The tasks will be given individually in an open area at your child's school to students whose parents or guardians indicate consent. The total time involved is about 90 minutes.

We would also like permission to obtain your child's scores on the FCAT or SAT10 reading test for Spring, 2006 so we can determine how well our tasks predict performance on this measure of reading comprehension. Scores from all tests will be kept in strictest confidence by the personnel named below. Completed test booklets will be placed in a secure filing cabinet in our office at FSU and the cover sheet with your child's name will be removed and shredded as soon as the FCAT/SAT10 scores are obtained.

The participation of your child in this study is voluntary. Your consent may be withdrawn at any time. There will be no penalty and it will not affect your child's grade. The results of the study may be published, but your child's name will not be used. Confidentiality of records will be maintained to the full extent allowed by Florida law. Possible benefits of your child's participation include increased understanding of the kind of reading skills that are needed for successful reading comprehension.

The project has the approval of the Florida State University Review Board as well as your school principal. If you have any questions concerning this study or your child's participation, please call me at 644-1033 or call my research coordinator Dr. Carol Rashotte at 644-4563.

Sincerely,
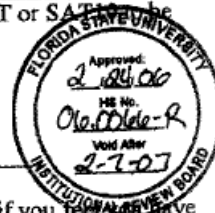
Richard K. Wagner
Alfred Binet Professor of Psychology

_____
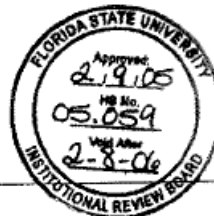
I GIVE permission for my child (print child's name here) _____
to participate in the above reading study and for my child's reading scores on the FCAT or SAT10 to be provided to the researchers of this study.

Parent's Name: _____

Parent's Signature _____   Date: _____

If you have any questions about your child's rights as a participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Committee, Institutional Review Board, through the Vice President for the Office of Research at (850) 644-8633.

36

Experimental passages and comprehension questions

N1 – G4   Andrew's Father

Everyone said Andrew's father was the most cultured man in town. He was a gentleman. Andrew's father had studied hard as a boy, and he went to college as a young man. He knew about music and paintings. He had read many books. Andrew's father had something else he was known for. It was his beautiful flower garden. He worked in his garden everyday. He grew roses, dandelions, and violets. People could enjoy the fragrance of his flowers as their scents mingled in the air. People brought their dying and feeble plants to Andrew's father. He told the people what to do. Soon their plants were strong again. As a small boy, Andrew scampered in and out of the garden as his father weeded and planted. He would play in the bushes and get very dirty. Now that he was older, Andrew worked alongside his father, learning everything he could. He learned how to plant flowers, water them, fertilize them, and keep them healthy. When Andrew grew up, people remarked about how much he resembled his father. This made Andrew feel proud.

Time to read passage: _____

1. What was Andrew's father known for?
   (correct answers: cultured (gentle)man: his beautiful garden)

2. What did people bring to Andrew's father?
   (correct answers: brought their dying/feeble plants to him)

3. In what way was Andrew like his father?
   (correct answers: he liked working with plants, he knew how to take care of plants)

4. Why do you think Andrew was proud to be like his father?
   (correct answers: because people admired his father, his father knew so many things)

5. In your own words, summarize the story in a sentence or two.
   Note: Write down the child's sentence or check the highlighted facts. To be correct the child should have 4 or 5 of the highlighted facts.

   Andrew's father was a **cultured**, **educated man** who **worked in his garden every day** and **helped people with their sick plants**. **Andrew helped his father in the garden** and **liked it when people said he was like his father**.

Myths

A myth is a story. Myths tell us about the beliefs of a group of people. Some are about gods and heroes. Myths were created as explanations for things that happen in nature. The Norse and Greek people had many myths. The Norse people believed that thunder was caused by the chariot of the god Thor as he rode across the sky. The Greek people believed that lightening and thunder happened when the god Zeus threw his mighty thunderbolts, which crashed among the clouds. The Greeks also believed that the movement of the sun was really the god Apollo's chariot racing across the sky. Some myths are about a hero's adventures. Hercules was a famous Greek hero. There are many myths about him. In one story, he rescues his love from the underworld. Today, what we know about nature comes from science. We know that thunder is the noise we hear during a lightening storm. We know that the sun does not "race across the sky" but that the Earth moves around the sun. We know that myths are not real. However, people continue to read myths because they are interesting stories. You can find many books about myths in the library.

Time to read passage: _____

1. What is a myth?
   (correct answer: a story)

2. Why did people create myths?
   (correct answer: to explain things that happen in nature)

3. What do the Greek and Norse myths have in common?
   (correct answer: they believed that events such as thunder and lightening were caused by their gods doing things)

4. Why are myths interesting if they are not true?
   (correct answer: because they are good adventure stories; they tell us what people used to believe about nature)

5. In your own words, summarize the passage you read in a sentence or two.
   Note: To be correct the child should have 4 or 5 or the highlighted facts.

   The passage talks about **myths that are really stories about the beliefs of people** like the **Norse and Greek's** such as **thunder and lightning caused by Zeus throwing thunderbolts** or the **sun moving was really Apollo's chariot racing across the sky.** We know that the **myths aren't true** but they are **interesting to read.**

"How I spent my summer vacation" was the topic for Rita's first essay when school resumed. Her two best friends did exciting things during the summer. Shana went to Mexico. She had seen the Aztec pyramids, and she brought Rita a colorful woven change purse for a present. Juan went to Montana. He had gone fishing with his brother, and hiked up hills. Since Rita didn't go anywhere, she thought that her vacation would sound dull. She thought about what she had done during the summer. During Rita's summer vacation, her Aunt Marta came to visit. Marta had just had surgery on her wrists. It took several weeks before Marta could even do simple jobs. Rita helped her aunt whenever she could. She opened doors and cut her food. She even held the phone for Aunt Marta when her cousin Alex called. When Aunt Marta left, she gave Rita a silver dollar for all her help. Rita put the silver dollar in the purse that Shana had brought from Mexico. Now Rita knew what she would write in her essay. She was going to title her essay "The Silver Dollar."

Time to read passage: _____

1. What did Shana see in Mexico?
    (correct answer: the Aztec pyramids)

2. Who came to stay with Rita's family?
    (correct answer: her Aunt Marta)

3. Why do you think Aunt Marta came to stay with them?
    (correct answer: she had had surgery and couldn't do a lot of simple things; she couldn't open doors or cut her food)

4. What did Rita write about in her essay "The Silver Dollar"?
    (correct answer: about her Aunt coming to stay with them after surgery and how her Aunt gave her a silver dollar for all the help Rita gave her)

5. In your own words, summarize the story in a sentence or two.
    Note: To be correct the child should have 4 or 5 of the highlighted facts.

    Rita had to write a story at school about her **summer vacation** and although **she didn't go anywhere exciting** she decided to **write about how her Aunt Marta** who had just **had surgery** had come to visit them and how **her Aunt gave her a silver dollar for helping her**.

Have you ever seen a rainbow in the sky? Have you ever seen a rainbow in a puddle? You might have wondered why we see rainbows. The main reason we see a rainbow is that the light from the sun strikes water drops. The water drops could be rain, a puddle, spraying water or even fog. The sun's light passes through the water drops. The drops act like a glass prism. The water drops break up the sunlight into all the different colors that are actually there. Do you know what colors you will always find in a rainbow? If you don't, just remember Roy G. Biv! **R**ed **O**range **Y**ellow **G**reen **B**lue **I**ndigo **V**iolet. The sun's light is made up of all these colors. You will always see the same colors in every rainbow. Rainbows can be seen only when the person is standing between the water and the sun's light. Even if rainbows don't end in a glorious pot of gold that is protected by a leprechaun, they are a beautiful sight to see. They always remind us of the splendor of nature.

Time to read passage: _____

1. What other places, besides the sky, can we see rainbows?
   (correct answer: puddle; water fall)

2. What colors will you always find in a rainbow?
   (correct answer: red, orange, yellow, green, blue, indigo and violet)

3. What does a prism do?
   (correct answer: it breaks up light)

4. Could rainbows happen at night even if we can't see them? Why?
   (correct answer: No, rainbows can only happen when there is sunlight)

5. In your own words, summarize the story in a sentence or two.
   Note: To be correct the child should have 4 or 5 of the highlighted facts.

   This story is about **rainbows**, how **rainbows are formed by the sun's light passing through water**, how **every rainbow has the same colors** which are (**Roy G. Biv**), and how you can **only see a rainbow if you stand between the water and the sun's light**, and how **beautiful** they are.

Word Knowledge Protocol

Example. HOT

1. What does the word *hot* mean?
    a. If correct: "Great. That was a good definition for the word *hot*.
    b. Query: Tell me more about the word *hot*.
    c. If wrong: A good definition for *hot* would be, "Hot means very warm."
2. Tell me another meaning for the word *hot.*
    a. If correct: Great! Hot has several definitions. Hot also means spicy. Not all words have more than one meaning.
    b. Query: Tell me more about the word hot.
    c. If wrong or don't know: That's okay. Hot also means spicy. Not all words have more than one meaning.
3. Try and use *hot* in a sentence to show me you know what it means.
    a. If correct: Great! That sentence shows me you know what hot means.
    b. Query: Add more to that sentence to show me you know what hot means.
    c. If wrong or don't know: A good sentence would be "The cookies were hot when they came out of the oven."
4. Look at this sentence (read one at a time). How well is *hot* used in this sentence: not so good, sort of good, or very good?
    a. The hot sun burned me.
        i. "Very good" would be the answer because this sentence uses the word hot very well.
    b. The ice cube was very hot.
        i. "Not so good" would be the answer because this sentence does not use the word hot well. It should say, "The ice cube was very cold."
    c. The soda became very hot from being left out on the counter.
        i. "Sort of good" would be the answer because this sentence doesn't use the word hot very well. It should say, "The soda became warm from being left out on the counter," but hot and warm almost mean the same thing.
5. Tell me a word that means the same as *hot.*
    a. If correct: Good! That word means the same as hot.
    b. If more than two words: Try and tell me an answer with one or two words.
    c. If don't know or wrong: A word that means the same as hot is spicy.
6. Tell me a word that means the opposite of *hot.*
    a. If correct: Good! That word means the same as hot.
    b. If more than two words: Try and tell me an answer with one or two words.
    c. If don't know or wrong: A word that means the opposite of hot is cold.
7. Use this word as part of a new word to complete the sentence
    a. *Hot.* In spring it's hot, but in summer it's even _____ (hotter).
        i. If hotter: Great! In spring it's hot, but in summer it's even hotter. The word hot is part of the word hotter.
        ii. If wrong or don't know: The word would be hotter. In spring it's hot but in summer it's even hotter. The word hot is part of the word hotter.
    b. *Hot.* With the heater on, the room is becoming _____ (hotter).

i. If hotter: Great! With the heater on, the room is becoming hotter. The word hot is part of the word hotter.
    ii. If wrong or don't know: The word would be hotter. With the heater on, the room is becoming hotter. The word hot is part of the word hotter.
8. *Choose the word that fits the blank best*. Last Saturday was the _____ day of the year.
    a. hotter   b. hottest   c. hotly   d. hots
    i. If b: Good! The best choice would be hottest. Last Saturday was the hottest day of the year.
    ii. If wrong: The best choice would be hottest. Last Saturday was the hottest day of the year.
9. Choose the best definition for *hot*.
    a. A little warm
    b. Having a high temperature
    c. Glowing like a fire
    d. A temperature that is very low
        i. If b: Good! The best choice would be b. Having a high temperature.
        ii. If wrong: The best choice would be b. Having a high temperature.
10. Choose the word that means the same as *hot*.
    a. wintry   b. fresh   c. burning   d. quick
    i. If c: Good! A word that means the same as hot is burning.
    ii. If wrong: The best choice would be c. burning.
11. Choose the word that means the opposite of *hot*.
    a. cold   b. bitter   c. strong   d. cozy
    i. If a: Good! A word that means the opposite of hot is cold.
    ii. If wrong: The best choice would be a. cold.

1.   CRY
    1. What does the word *cry* mean? (If don't know, skip to Q3)
    2. Tell me another meaning for the word *cry*.
    3. Try and use *cry* in a sentence to show me you know what it means.
    4. (If no prior answer given) Try and tell me what *cry* means now?
    5. Look at sentence __ (a-d respectively): How well is *cry* used in this sentence: not so good, sort of good, or very good?
        a. The photographer said, "Cry for the picture!"
        b. Getting as A on his math test made him cry.
        c. The clown made everyone cry a lot.
        d. Sometimes babies cry when they are hungry.
    6. Tell me a word that means the same as *cry*.
    7. Tell me a word that means the opposite of *cry*.
    8. Use this word as part of a new word to complete the sentence. *Cry*. His eyes were red because he'd been _____ (crying).

    9. *Choose the word that fits the blank best*. She _____ when she learned that the trip was canceled (c).
        a. cries   b. crying   c. crier   d. cried
    10. Choose the best definition for *cry* (a).

       a. To shed tears
       b. To say in a quiet voice
       c. To explain
       d. To show emotion with a chuckle

11. Choose the word that means the same as *cry* (d).
       a. whisper   b. giggle   c. yap   d. weep

12. Choose the word that means the opposite of *cry* (b).
       a. sob   b. laugh   c. fun   d. shout

2.   JOY

1. What does the word *joy* mean? (If don't know, skip to Q3)
2. Tell me another meaning for the word *joy*.
3. Try and use *joy* in a sentence to show me you know what it means?
4. (If no prior definition given)) Try and tell me what joy means now?
5. Look at sentence __ (a-d respectively): How well is *joy* used in this sentence: not so good, sort of good, or very good?
       a. He felt joy when he bought the milk.
       b. The team showed joy when they tied the game.
       c. The little dog wagged his tail with joy when he saw the boy.
       d. The mother showed joy when she lost her car keys.
6. Tell me a word that means the same as *joy*.
7. Tell me a word that means the opposite of *joy*.
8. Use this word as part of a new word to complete the sentence. *Joy*. Everyone agreed that the celebration was_____ (joyous/ joyful).
9. *Choose the word that fits the blank best.* The family was _____ when their house burned down (b).
       a. joyful   b. joyless   c. joyous   d. joyfully
10. Choose the best definition for *joy* (a).
       a. A state of happiness
       b. Favored by luck
       c. A display of sadness
       d. To have a good time
11. Choose the word that means the same as *joy* (a).
       a. happiness   b. loved   c. sadness   d. humor
12. Choose the word that means the opposite of *joy* (b).
       a. nervous   b. sorrow   c. anger   d. gladness

3.   EASY

1. What does the word *easy* mean? (If don't know skip to Q3).
2. Tell me another meaning for the word *easy*.
3. Try and use *easy* in a sentence to show me you know what it means?
4. (If no prior definition given)) Try and tell me what *easy* means now?
5. Look at sentence __ (a-d respectively): How well is *easy* used in this sentence: not so good, sort of good, or very good?
       a. Tying your shoelaces is easy once you learn how.
       b. The baseball player made it look easy to hit the ball.

      c. It is easy for a baby to pick up a car,.

      d. They studied for days, but still the test was so easy that no one got an A.

6. Tell me a word that means the same as *easy.*
7. Tell me a word that means the opposite of *easy.*
8. Use this word as part of a new word to complete the sentence. *Easy.* Tell me what I can do to make things _____ (easier).
9. *Choose the word that fits the blank best.* The medicine _____ the pain in her forehead (a).

      a. eased   b. unease   c. easing   d. easiness

10. Choose the best definition for *easy* (b).

      a. Enjoying warmth

      b. Causing little difficulty

      c. Relieving stress

      d. Hard to deal with

11. Choose the word that means the same as *easy* (b).

      a. difficult   b. simple   c. basic   d. complete

12. Choose the word that means the opposite of *easy* (a).

      a. hard   b. stiff   c. sturdy   d. painless

4.   WEAK

1. What does the word *weak* mean? (If don't know skip to Q3)
2. Tell me another meaning for *weak*.
3. Try and use *weak* in a sentence to show me you know what it means?
4. (If no prior definition given) Try and tell me what *weak* means now?
5. Look at sentence __ (a-d respectively): How well is *weak* used in this sentence: not so good, sort of good, or very good?

      a. After the surgery he was too weak to walk by himself.

      b. After a good night's rest she felt weak.

      c. Milk makes your bones weak.

      d. She was so weak she could bend the metal pole in half.

6. Tell me a word that means the same as *weak.*
7. Tell me a word that means the opposite of *weak.*
8. Use this word as part of a new word to complete the sentence. *Weak.* At school, spelling is her greatest _____ (weakness).
9. *Choose the word that fits the blank best.* The bridge was _____ by a ferocious storm (b).

      a. weakly   b. weakened   c. weakness   d. weaker

10. Choose the best definition for *weak* (d).

      a. To make useless

      b. Solid of firm

      c. Feeling of sadness

      d. Without strength

11. Choose the word that means the same as *weak* (b).

      a. slow   b. powerless   c. forceful   d. useless

12. Choose the word that means the opposite of *weak* (a).

      a. strong   b. clear   c. successful   d. sickly

5.   NEGLECT
1. What does the word *neglect* mean? (If don't know skip to Q3)
2. Tell me another meaning for *neglect.*
3.   Try and use *neglect* in a sentence to show me you know what it means?
4. (If no prior definition given) Try and tell me what *neglect* means now?
5. Look at sentence ___ (a-d respectively): How well is *neglect* used in this sentence: not so good, sort of good, or very good?
    a. When you neglect your flowers they will bloom beautifully
    b. If you neglect to feed your fish it will die.
    c. Please neglect to play in the rain.
    d. The rusted bike showed signs of neglect.
6. Tell me a word that means the same as *neglect.*
7. Tell me a word that means the opposite of *neglect.*
8. Use this word as part of a new word to complete the sentence. *Neglect.* The cat was very sick; it had been _____ (neglected).
9. *Choose the word that fits the blank best.* Her bad grades showed that she'd been _____ her studies (c).
    a. neglects   b. neglected   c. neglecting d. neglectful
10. Choose the best definition for *neglect*.
    a. Giving insufficient attention
    b. To look after
    c. Treat as noble
    d. To carry out
11. Choose the word that means the same as *neglect* (a).
    a. ignore   b. prevent   c. protect   d. disagree
12. Choose the word that means the opposite of *neglect* (a).
    a. cherish   b. overlook   c. foster   d. forget

6.   DELIGHT
1. What does the word *delight* mean? (If don't know skip to Q3)
2. Tell me another meaning for the word *delight.*
3.   Try and use *delight* in a sentence to show me you know what it means?
4. (If no prior definition given) Try and tell me what *delight* means now?
5. Look at sentence ___ (a-d respectively): How well is *delight* used in this sentence: not so good, sort of good, or very good?
    a. The baker took delight in creating delicious pies.
    b. There was much delight at the funeral.
    c. They take delight in cleaning up the dirty kitchen.
    d. You delight in studying every night.
6. Tell me a word that means the same as *delight.*
7. Tell me a word that means the opposite of *delight.*
8. Use this word as part of a new word to complete the sentence. *Delight.* They agreed that her laughter was _____ (delightful).
9. *Choose the word the fits the blank best.* I would be _____ to take you home (d).
    a. delightedly   b. delightful   c. delightsome   d. delighted
10. Choose the best definition for delight (c).

45

        a. To feel desire
        b. Causing suffering
        c. Give enjoyment
        d. To cast off
11. Choose the word that means the same as *delight* (a).
        a. enjoyment   b. adore   c. laughter   d. distaste
12. Choose the word that means the opposite of delight (b).
        a. happiness   b. displeasure c. anger   d. joy

7.   COURAGE
1. What does the word *courage* mean? (If don't know skip to Q3)
2. Tell me another meaning for the word *courage*.
3. Try and use *courage* in a sentence to show me you know what it means?
4. (If no prior definition given)) Try and tell me what *courage* means now?
5. Look at sentence __ (a-d respectively): How well is *courage* used in this sentence: not so good, sort of good, or very good?
        a. She felt courage for being caught telling a lie.
        b. The firefighter showed courage when fighting fires.
        c. The soldier's courage was evident when he ran away from the war.
        d. You need courage to be able to stand up for what you believe in.
6. Tell me a word that means the same as *courage.*
7. Tell me a word that means the opposite of *courage.*
8. Use this word as part of a new word to complete the sentence. *Courage.* That medal is awarded to someone who is _____ (courageous).
9. *Choose the word that fits the blank best.* Even though she is small, she acted _____ (c).
        a. discourage   b. courageousness c. courageously   d. discouraged
10. Choose the best definition for *courage* (a or d).
        a. Strength to face danger
        b. A frame of mind
        c. Lacking power
        d. Strong spirited
11. Choose the word that means the same as *courage* (b).
        a. alarm   b. bravery   c. fear   d. thoughtful
12. Choose the word that means the opposite of *courage* (b).
        a. sickly   b. cowardice c. wits   d. nerve

8.   FLOURISH
1. What does the word *flourish* mean? (If don't know skip to Q3).
2. Tell me another meaning for the word flourish.
3. Try and use *flourish* in a sentence to show me you know what it means?
4. (If no prior definition given) Try and tell me what *flourish* means now?
5. Look at sentence __ (a-d respectively): How well is *flourish* used in this sentence: not so good, sort of good, or very good?
        a. Friendships flourish when the friends live far apart.
        b. The humid weather created an environment for mold and mildew to flourish.
        c. The business will flourish when it closes for renovation.

d. The plants flourish when there is no sunshine or rain.
6. Tell me a word that means the same as *flourish.*
7. Tell me a word that means the opposite of *flourish.*
8. Use this word as part of a new word to complete the sentence. *Flourish.* With her new adoptive family, the girl was _____ (flourishing).
9. *Choose the word that fits the blank best.* The small town _____ when they built the train station (b).
    a. flourishing   b. flourished   c. flourishingly   d. flourishes
10. Choose the best definition for *flourish* (d).
    a. Decreasing in material
    b. To make poorer
    c. Of the finest and richest kind
    d. To grow abundantly
11. Choose the word that means the same as *flourish* (a).
    a. Thrive   b. decay   c. expel   d. divide
12. Choose the word that means the opposite of *flourish* (b).
    a. reject   b. deteriorate c. improve   d. recover

9.   CONSTRUCT
    1. What does the word *construct* mean? (If don't know skip to Q3)
    2. Tell me another meaning for the word *construct.*
    3. Try and use *construct* in a sentence to show me you know what it means?
    4. (If no prior definition given) Try and tell me what *construct* means now?
    5. Look at sentence __ (a-d respectively): How well is *construct* used in this sentence: not so good, sort of good, or very good?
        a. City planners construct old building to make room for new, modern buildings.
        b. After this wood working class you will be able to construct a porch swing.
        c. Can you construct a birthday cake?
        d. Fires construct forests every year.
    6. Tell me a word that means the same as *construct.*
    7. Tell me a word that means the opposite of *construct.*
    8. Use this word as part of a new word to complete the sentence. *Construct.* The building is currently under _____ (construction).
    9. *Choose the word that fits the blank best.* The argument was heated but very _____ (c).
        a. constructs   b. constructional   c. constructive   d. constructor
    10. Choose the best definition for construct (a).
        a. To make by combining parts
        b. A question for inquiry
        c. To use as a foundation
        d. To do away with

    11. Choose the word that means the same as *construct* (b).
        a. gather   b. build   c. scatter   d. distribute
    12. Choose the word that means the opposite of *construct* (d).
        a. explanation   b. structure   c. defeat   d. demolish

47

10. ENCHANT
   1. What does the word *enchant* mean? (If don't know skip to Q3)
   2. Tell me another meaning for the word *enchant.*
   3. Try and use *enchant* in a sentence to show me you know what it means.
   4. (If no prior definition given) Try and tell me what *enchant* means now.
   5. Look at sentence __ (a-d respectively): How well is *cry* used in this sentence: not so good, sort of good, or very good?
        a. The chemical enchant the bugs so that they stay away.
        b. A skunk's unpleasant smell will enchant you.
        c. The beach's famous sunsets enchant visitors from all over the world.
        d. The melodic music will enchant you.
   6. Tell me a word that means the same as *enchant.*
   7. Tell me a word that means the opposite of *enchant.*
   8. Use this word as part of a new word to complete the sentence. *Enchant.* Have you ever met anyone so _____ (enchanting/ enchanted)?
   9. *Choose the word that fits the blank best.* She was ___ by the opera singer's voice (b).
        a. enchants   b. enchanted   c. enchanter   d. enchantingly
   10. Choose the best definition for *enchant* (c).
        a. Act of making beautiful
        b. To attract and move deeply.
        c. Push away or apart
        d. To take by force.
   11. Choose the word that means the same as *enchant* (a).
        a. charm   b. grip   c. like   d. resist
   12. Choose the word that means the opposite of *enchant* (a).
        a. repel   b. prevent   c. attract   d. inrease

11. DISPUTE
   1. What does the word *dispute* mean? (If don't know skip to Q3)
   2. Tell me another meaning for the word *dispute.*
   3. Try and use *dispute* in a sentence to show me you know what it means.
   4. (If no prior definition given)Try and tell me what *dispute* means now.
   5. Look at sentence __ (a-d respectively): How well is *dispute* used in this sentence: not so good, sort of good, or very good?
        a. Sometimes a dispute can be settled by talking about the issue at hand.
        b. I want to dispute my score of 100%
        c. There was a dispute between the friends to never discuss grades.
        d. If you feel that you were charger incorrectly, you can dispute the fine.
   6. Tell me a word that means the same as *dispute.*
   7. Tell me a word that means the opposite of *dispute.*
   8. Use this word as part of a new word to complete the sentence. *Dispute.* I don't agree with you; I feel your argument is _____ (disputable).
   9. *Choose the word that fits the blank best.* The Principal_____ the claim that there was cheating in the school (c).
        a. disputer   b. disputable   c. disputed   d. disputing
   10. Choose the best definition for *dispute*.

    a. Pushing forcefully
    b. To investigate thoroughly
    c. To settle on or consent
    d. Engage in argument

11. Choose the word that means the same as *dispute* (c).
    a. contract   b. differ   c. argument   d. harmony
12. Choose the word that means the opposite of *dispute* (d).
    a. bargain   b. conflict   c. meeting   d. agreement

12.   RIGID
1. What does the word *rigid* mean? (If don't know skip to Q3)
2. Tell me another meaning for the word *rigid.*
3. Try and use *rigid* in a sentence to show me you know what it means
4. (If no prior definition given) Try and tell me what *rigid* means now.
5. Look at sentence __ (a-d respectively): How well is *rigid* used in this sentence: not so good, sort of good, or very good?
    a. The rules of the game were rigid and did no have to be followed.
    b. His clothing had to be rigid to allow for easy movement.
    c. The school enforces rigid rules concerning bullying.
    d. The gymnast had rigid muscles that allowed her to do amazing stunts.
6. Tell me a word that means the same as *rigid.*
7. Tell me a word that means the opposite of *rigid.*
8. Use this word as part of a new word to complete the sentence. *Rigid.* In old age his bones showed signs of _____ (rigidity/ rigidness).
9. *Choose the word that fits the blank best.* The judge stuck to his daily schedule ____ (b).
    a. rigidness   b. rigidly   c. rigidity   d. rigidify
10. Choose the best definition for *rigid* (d).
    a. Capable of changing
    b. Marked by extremes
    c. Appearing sharp
    d. Showing inflexibility
11. Choose the word that means the same as *rigid* (c).
    a. supple   b. lifeless   c. unbending   d strong
12. Choose the word that means the opposite of *rigid* (a).
    a. flexible   b. bouncy   c. unyielding   d. solid

Coding Scheme

DEFINITION GUIDELINES:

1. Prepositions, award one point (+1)
2. Synonyms (even those not listed here), award four points (+4)
3. Incorrect syntax, subtract one point from overall score (-1)
4. Content related words/ statements, award 2 points (+2)
5. Maximum four points for synonym/ content based answered (without preposition)
Note. To award content points in right column, content points must be awarded from left column.

CRY
to (1)

weep/ scream/ call (4)

tears (2)	sad/ joy/ upset (2)
shed (2)	tears (2)
call (2)	out/ loudly/ animal (2)

JOY
is/ a (1)

happiness (4)

happy (2)	feeling (2)
feeling (2)	

name (4)

EASY
is (1)

simple (4)

not/ un (2)	fast/ hurried/ hard/ complicated (2)
can be done (2)	fast/ quickly (2)

WEAK
is(1)

feeble (4)

not/ no/ un (2)	strong/ energy/ good at (2)
lacking/ without (2)	skill/ physical strength (2)

NEGLECT
to (1)

ignore (4)

not/ no (2)	attention/ care (2)

DELIGHT
to/a (1)

happiness/ pleasure/ joy (4)

give/ make/ take (2)　　　　　　　happiness/ happy/ enjoyment/ joy (2)
enjoy(2)　　　　　　　　　　　　something (2)

COURAGE
is (1)

bravery (4)

someone (2)　　　　　　　　　　brave (2)
without (2)　　　　　　　　　　fear (2)
face (2)　　　　　　　　　　　　fear (2)
confidence (2)

FLOURISH
to (1)

prosper / bloom (4)

grow (2)　　　　　　　　　　　well (2)

CONSTRUCT
to (1)

build (4)
create (4)

make (2)　　　　　　　　　　　something/ building (2)

ENCHANT
to (1)

attract/ bewitch (4)

cast / do (2)　　　　　　　　　spell/ magic (2) (*Note.* As in do magic on something)

DISPUTE
to/ a (1)

debate/ argue (4)

question (2)　　　　　　　　　　something (2)

RIGID
is (1)

stiff (4)

not (2)　　　　　　　　　　　　flexible (2)

CONTEXTUAL SENTENCE GUIDELINES

semantically correct (1)   syntactically correct (1)   no phrase (0)
                                                                     common/ related (1)
                                                                     constraining/ synonym (2)

SYNONYM/ ANTONYM GUIDELINES
(more than 2 words only 1 possible for related)

semantically correct (1)   syntactically correct (1)   related (1)

MOPHOLOGY GUIDELINES

Correct (2)
Syntactically correct (1)

APPENDIX E

Description of models tested

1. General model (one component): there is a single underlying source of individual differences in vocabulary knowledge. Each construct representing a component of vocabulary knowledge therefore is measuring the same underlying ability or "fund of knowledge."

2. Two component models:

   a. Contextual- Metalinguistic (Abstract/ Morphological/ Conceptual) Model. There are two underlying components: a contextual component that accounts for individual differences in context, and an abstract component that accounts for individual differences in abstract, morphological and conceptual knowledge (metalinguistic knowledge).

   b. Abstract- Contextual/Morphological/Conceptual Model. There are two underlying components that account for individual differences: an abstract ability that accounts for individual differences in defining a word, and a second ability that accounts for individual differences in the ability to use, manipulate and draw relations between words.

   c. Contextual/Abstract-Morphological/Conceptual Model. There are two underlying components: a contextual/abstract component that accounts for individual differences in the ability to define and use a word, and a morphological/conceptual component that accounts for individual differences in the ability to draw relationships between and manipulate words.

   d. Contextual/Morphological-Abstract/Conceptual Model. There are two underlying components: a contextual/morphological ability that accounts for individual differences in the ability to understand a word syntactically and contextually, and an abstract/conceptual component that accounts for individual differences in the ability to understand the word and its semantic relations.

3. Three component models:
    a. Contextual-Abstract-Morphological/Conceptual Model. There are three underlying components: a contextual component that accounts for individual differences in context, an abstract component that accounts for individual differences in abstract word knowledge, and a third component that accounts for individual differences in manipulating and drawing relations between words.
    b. Contextual-Morphological- Abstract/Conceptual Model. There are three underlying components: a contextual component that accounts for individual differences in context, a morphological component that accounts for individual differences in manipulating words, and a third component that accounts for individual differences in the ability to define and draw relations between words.
    c. Contextual-Conceptual-Abstract/Morphological Model. There are three underlying components: a contextual component that accounts for individual differences in context, a conceptual component that accounts for individual differences in relational word knowledge, and a third component that accounts for individual differences in the ability to define and manipulate words.
    d. Abstract-Conceptual-Contextual/Morphological Model. There are three underlying components: an abstract component that accounts for individual differences in abstract knowledge, a conceptual component that accounts for individual differences in drawing relations between words, and a third component that accounts for individual differences in manipulating and using words in context.
    e. Morphological-Conceptual-Abstract/Contextual Model. There are three underlying components: a morphological component that accounts for individual differences in manipulating words, a conceptual component that accounts for individual differences drawing relations between words, and a third component that accounts for individual differences in defining and using words.
4. Four component model: Each of the four kinds of vocabulary knowledge represent distinct though potentially correlated underlying abilities.
5. Receptive- Expressive Models:

a. Receptive- Expressive Model. There are two underlying dimensions: a receptive dimension that accounts for individual differences in choosing and responding to words, and an expressive dimension that accounts for individual differences in responding innovatively about words.

b. Abstract- Receptive- Expressive Model. There are three underlying dimensions: an abstract dimension that accounts for individual differences in defining words both receptively and expressively, a receptive dimension that accounts for individual differences in identifying appropriate morphology, sentence context, and semantic relations, and an expressive dimension that accounts for individual differences in the production of morphologically complex words, contextually appropriate sentences for target words, and semantically related words.

c. Contextual- Receptive- Expressive Model. There are three underlying dimensions: a contextual dimension that accounts for individual differences in using and identifying words in appropriate contexts, a receptive dimension that accounts for individual differences in identifying appropriate morphology, semantic relations and definitions, and an expressive dimension that accounts for individual differences in the production of morphologically complex words, semantically related words and definitions.

d. Morphological- Receptive- Expressive Model. There are three underlying dimensions: a morphological dimension that accounts for individual differences in the production and identification of appropriate morphology, a receptive dimension that accounts for individual differences in identifying appropriate definitions, sentence context, and semantic relations, and an expressive dimension that accounts for individual differences in the production of definitions, contextually appropriate sentences for target words, and semantically related words.

e. Receptive and Expressive Conceptual- Receptive and Expressive Abstract/ Contextual/ Morphological Model: There are four underlying dimensions: a receptive conceptual dimension that accounts for individual differences in identifying semantic relations, an expressive conceptual dimension that accounts for individual differences in producing semantically related words, a receptive

abstract/ contextual/morphological dimension that accounts for individual difference in identifying definitions, sentence context and complex morphology, and an expressive abstract/contextual/morphological dimension that accounts for individual differences in producing definitions, contextually appropriate sentences and complex morphology.

f. Receptive and Expressive Morphological/Contextual- Receptive and Expressive Abstract/Conceptual Model: There are four underlying dimensions: a receptive morphological/ conceptual dimension that accounts for individual differences in identifying complex morphology and contextually appropriate sentences, a morphological/ conceptual expressive dimension that accounts for individual differences in producing complex morphology and contextually appropriate sentences, a receptive abstract/ conceptual dimension that accounts for individual differences in identifying definitions and semantic relations, and an expressive abstract/ conceptual dimension that accounts for individual differences in producing definitions and semantically related words.

REFERENCES

Anderson, R.C., & Freebody, P. (1981). Vocabulary knowledge. In J. T. Guthrie (Ed.), *Comprehension and teaching: Research reviews* (pp. 77-117). Newark, DE: International Reading Association.

Anderson, R.C., & Nagy, W.E. (1991). Word meanings. Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Anderson, R.C., & Ortony, A. (1975). On putting apples into bottles- a problem of polysemy. *Cognitive Psychology, 7*, 167-180.

Anglin, J.M. (1993). Vocabulary development: A morphological analysis. *Monographs of the Society for Research in Child Development, 58(10)*, v-165.

Beck, I.L., & McKeown, M.G. (1991). Conditions of vocabulary acquisition. In R. Barr, M. L. Kamil, P. Mosenthal & P. Pearson (Eds.), *Handbook of reading research, Vol. 2* (pp. 789-814). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Beck, I.L., McKeown, M.G., & Kucan, L. (2002). *Bringing words to life: Robust vocabulary instruction. Solving problems in the teaching of literacy*. New York, NY: Guilford Publications, Inc.

Beck, I.L., McKeown, M.G., & Omanson, R.C. (1987). The effects and uses of diverse vocabulary instructional techniques. In M. McKeown & M E. Curtis (Eds.), *The nature of vocabulary acquisition* (pp.147-163). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Berko, J. (1958). The child's learning of English morphology. *Word, 14*, 150-177.

Biemiller, A., & Slonim, N. (2001). Estimating root word vocabulary growth in normative and advantaged populations: Evidence for a common sequence of vocabulary acquisition. *Journal of Educational Psychology, 93*(3), 498-520.

Carey, S. (1978). The child as word learner. In M. Halle, J. Bresnan, & G. Miller (Eds.), *Linguistic theory and psychological reality* (pp. 264-293). Cambridge, MA: MIT Press.

Carlisle, J.F. (2000). Awareness of the structure and meaning of morphologically complex words: Impact on reading. *Reading and Writing: An Interdisciplinary Journal, 12*, 169-190.

Carlisle, J.F. (in press). Fostering morphological processing, vocabulary development, and reading comprehension.

Cronbach, L.J. (1942). An analysis of techniques for diagnostic vocabulary testing. *Journal of Educational Research, 36*(3), 206-217.

Curtis, M.E. (1987). Vocabulary testing and vocabulary instruction. Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Dale, E. (1965). Vocabulary measurement: Techniques and major findings. *Elementary English, 42*, 895-90l.

Dale, E., & O'Rourke, J. (1976). The living word vocabulary: The words we know. Elgin, IL: Field Enterprises Educational.

National Institute of Child Health and Human Development (2000). Report of the National Reading Panel/ Teaching children to read: an evidence-based assessment of the scientific research literature on reading and its implications for reading and its implications for reading instruction: Reports of the subgroups (NIH Publication No. 00-4754). Washington, DC: U.S. Government Printing Office.

Durso, F.T., & Shore, W.J. (1991). Partial knowledge of word meanings. *Journal of Experimental Psychology: General, 120*(2), 190-202.

Fukkink, R.G., & de Glopper, K. (1998). Effects of instruction in deriving word meaning from context: A meta-analysis. *Review of Educational Research, 68*(4), 450-469.

Good, R.H., & Kaminski, R.A. (2002). *Dynamic Indicators of Basic Early Literacy Skills (DIBELS)*. Eugene, OR: Institute for the Development of Achievement.

Group, L.P. (2006). Dictionary.com: Lexico Publishing Group.

Hart, B., & Risley, T.R. (1992). American parenting of language-learning children: Persisting differences in family-child interactions observed in natural home environments. *Developmental Psychology, 28*(6), 1096-1105.

Hu, L., & Bentler, P.M. (1999). Cut-off criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equational Modeling, 6*, 1-55.

Jenkins, J.R., Matlock, B., & Slocum, T.A. (1989). Two approaches to vocabulary instruction: The teaching of individual word meanings and practice in deriving word meaning from context. *Reading Research Quarterly, 24*(2), 215-235.

Keenan, J., & Betjemann. (2006). Comprehending the Gray Oral Reading Test without reading it. *Scientific Studies of Reading, 10 (4),* 363-380.

Kurland, B.F., & Snow, C. (1997). Longitudinal measurement of growth in definitional skill. *Journal of Child Language, 24*, 603-625.

Leung, C.B. (1992). Effects of word-related variables on vocabulary growth through repeated read-aloud events. *National Reading Conference Yearbook, 41*, 491-498.

Miller, G.A. (1999). On knowing a word. *Annual Review of Psychology, 50*, 1-19.

Mogilner, A. (1992). *Children's writer's word book*. Cincinnati: Writer's Digest Books.

Muse, A. (2006). The nature of morphological knowledge: Florida State University.

Nagy, W. (in press). Metalinguistic awareness.

Nagy, W., Berninger, V., Abbott, R., Vaughan, K., & Vermeulen, K. (2003). Relationship of morphology and other language skills to literacy skills in at-risk second-grade readers and at-risk fourth-grade writers. *Joural of Educational Psychology, 95(4),* 730-742.

Nagy, W.E., & Anderson, R.C. (1984). How many words are there in printed school english? *Reading Research Quarterly, 19*(33), 304-330.

Nagy, W.E., & Scott, J.A. (2000). Vocabulary processes. In M. L. Kamil, P. B. Mosenthal, P.D. Pearson, & R. Barr (Eds.), *Handbook of Reading Research, Vol. 3* (pp. 269-284). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

O'Rourke, J.P. (1974). *Toward a science of vocabulary development*. The Hague: Mouton.

Ouellette, G.P. (2006). What's meaning got to do with it: The role of vocabulary in word reading and reading comprehension. *Journal of Educational Psychology, 98*(3), 554-566.

Skwarchuk, S.-L., & Anglin, J.M. (1997). Expression of superordinates in children's word definitions. *Journal of Educational Psychology, 89*(2), 298-308.

Snow, C. (1990). The development of definitional skill. *Journal of Child Language, 17*, 697-710.

Stahl, S.A. (1983). Differential word knowledge and reading comprehension. *Journal of Reading Behavior, 15*(4), 33-50.

Stahl, S.A., & Fairbanks, M.M. (1986). The effects of vocabulary instruction: A model-based meta-analysis. *Review of Educational Research, 56*, 72-110.

Sternberg, R.J. (1987). Most vocabulary is learned from context. In M. G. McKeown & M. E. Curtis (Eds.), *The nature of vocabulary acquisition* (pp. 89-105). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Tannenbaum, K.R., Torgesen, J.K., & Wagner, R.K. (in press). Relationships between word knowledge and reading comprehension in third-grade children.

Templin, M.C. (1957). *Certain language skills in children: Their development and interrelationships*. Minneapoli, MN: University of Minnesota Press.

Tomasello, M. (2003). Constructing a language: A usage-based theory of language acquisition. Cambridge, MA: Harvard University Press.

Trembly, D. (1966). Laws of learning general and specialized vocabularies. *Proceedings of the Annual Convention of the American Psychological Association,* 229-230.

University of Washington (1999). Morphological Awareness Battery: University of Washington.

Watson, R. (1985). Towards a theory of definition. *Journal of Child Language, 12*(1), 181-197.

Wechsler, D. (1991). *Wechsler Intelligence Scale for Children-Third Edition.* New York: The Psychological Corporation.

Werner, H., & Kaplan, E. (1950). Development of word meaning through verbal context: An experimental study. *Journal of Psychology, 29*, 251-257.

Wiig, E.H., & Secord, W. (1992). *Test of Word Knowledge*. San Antonio, TX: The Psychological Corporation.

Wilson, M.D. (1987). The MRC Psycholinguistic Database: Machine Readable Dictionary, version 2.00.

Wysocki, K., & Jenkins, J.R. (1987). Deriving word meanings through morphological generalization. *Reading Research Quarterly, 22*(1), 66-81.

BIOGRAPHICAL SKETCH

Caroline Phythian-Sence was born in Los Angeles, California, and was raised in both Los Angeles, and London, England. She attended Vassar College, Poughkeepsie, New York, where she received a B.A. in Psychology and was certified as a New York early elementary school teacher. While at Vassar she received a Howard Hughes Medical Institute Grant, to pursue research involving dramatic play and language production in preschool children with language impairments.

Before attending graduate school she was a teacher at Ace Integration Head Start in Brooklyn, New York. At Florida State University, Caroline is studying vocabulary and reading comprehension under the advisement of Dr. Richard K. Wagner. While pursuing this research, she received a Pre-Doctoral Interdisciplinary Research Training fellowship through the Florida Center for Reading Research.