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Examining the Contributions of Syntactic Awareness and Syntactic Knowledge to Reading Comprehension

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THE FLORIDA STATE UNIVERSITY
COLLEGE OF COMMUNICATION AND INFORMATION

EXAMINING THE CONTRIBUTIONS OF SYNTACTIC AWARENESS AND SYNTACTIC
KNOWLEDGE TO READING COMPREHENSION

By

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A Dissertation submitted to the
School of Communication Science and Disorders
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy

Degree Awarded:
Fall Semester, 2011

Danielle M. Brimo defended this dissertation on October 24, 2011.

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ACKNOWLEDGEMENTS

I am so thankful for my major professor, Kenn Apel, whose encouragement, time, and patience has helped me through the dissertation process. To my awesome committee, thank you so much for your assistance and time. I also would like to thank my wonderful family and friends who picked up the phone when I needed to vent and pushed me to work harder.

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ABSTRACT

The purpose of this study was to examine the direct and indirect effect(s) of syntactic knowledge and syntactic awareness on adolescents' reading comprehension. One hundred and eighty, 9th and 10th grade students' syntactic awareness, syntactic knowledge, and reading comprehension skills were assessed. In addition, other known contributors to reading comprehension were assessed including word level reading, working memory, and vocabulary knowledge skills. Structural equation modeling was used to analyze the indirect and direct effects of syntactic awareness and syntactic knowledge on reading comprehension. Students' syntactic awareness contributed significant variance to reading comprehension but did not indirectly relate to reading comprehension through syntactic knowledge. Conversely, syntactic knowledge did not have an indirect or direct effect on reading comprehension. This study confirmed the significant contribution of syntactic awareness to reading comprehension among adolescent students. From the current study's findings, researchers are able to expand on the Simple View of Reading by defining the specific skills associated with the contributions that language comprehension makes to reading comprehension as syntactic awareness and vocabulary knowledge.

CHAPTER ONE

INTRODUCTION

Reading comprehension is the process of building mental representations of written language by deciphering the meaning of written text at the word, sentence, and text levels (Perfetti, Landi, & Oakhill, 2005). Many researchers use a conceptual framework called the “Simple View of Reading” to describe the elements that contribute to reading comprehension success (e.g., Gough & Tunmer, 1986; Hoover & Gough, 1990). The Simple View of Reading defines reading comprehension as the joint product of decoding, or word-level reading ability, and language comprehension. Interestingly, researchers have found that students’ word-level and language abilities impact reading comprehension differently across the age-span. For example, in a longitudinal study, Catts, Hogan, and Adolf (2005) found that the contributions of word-level reading abilities and language comprehension skills to reading comprehension varied across grades, such that word-level reading played a significant role in predicting reading comprehension in second grade and language comprehension played a significant role in predicting reading comprehension in later grades (fourth and eighth).

While the measures used to assess word-level reading are relatively consistent, the tasks used to measure language comprehension vary notably across studies. Investigators have used measures of semantic, morpho-syntactic, and/or syntactic knowledge when attempting to determine the influence of language comprehension on reading comprehension with the majority of the studies including measures of semantic knowledge (e.g., Beck, Mckeown, Kucan, 2002; Biemiller, & Boote 2006; Gough & Tunmer, 1986; Nation & Snowling, 1998; Roberts & Scott, 2006).

Far less research has been conducted on the contributions of syntactic knowledge to reading comprehension. In the limited studies conducted, the tasks used to measure syntactic knowledge have varied. Some investigators have used measures that directly assess syntactic knowledge. That is, the tasks measured students’ ability to comprehend different grammatical structures within the context of a sentence (e.g., Catts, Adolf, & Weismer, 2006; Cutting & Scarborough, 2006). Other researchers have used tasks that assess syntactic awareness. These tasks require students to manipulate and reflect on the grammatical structures of language (e.g., Cain, 2007). Whereas the former tasks measure students’ comprehension of specific syntactic

structures, syntactic awareness tasks assess individuals' conscious ability to judge or manipulate word order (i.e., metalinguistic awareness; Roth, Speece, Cooper, & De La Paz, 1996; Zipke, Ehri, & Cairns, 2009). To date, only two investigations have examined the role of syntactic knowledge and syntactic awareness on reading comprehension (Bowey & Patel, 1988; Cain, 2007). Given that tasks used to measure these two types of syntactic skills tap into different constructs (i.e., knowledge versus meta-awareness of that knowledge), additional studies are needed to clarify their potentially unique contributions to reading comprehension particularly in older students because of the limited information about older students' syntactic knowledge and syntactic awareness. The Simple View of Reading could be better informed by delineating these contributions to determine the specific skills that contribute to reading comprehension. Thus, the purpose of this study was to clarify the role these two types of syntactic skills play in reading comprehension among 9th and 10th grade students.

Contributions of Syntactic Knowledge to Reading Comprehension

Several researchers who have investigated the factors that contribute to reading comprehension have included a measure of syntactic knowledge. For example, Catts et al. (2006) compared the language comprehension and phonological processing abilities of students who were identified as either poor comprehenders or typical readers in the eighth grade (Study 1). The students were given a battery of tests to examine reading comprehension, word-level reading, intelligence, and language comprehension. Language comprehension was assessed using a combination of tasks measuring receptive vocabulary, discourse comprehension, and grammatical understanding. Specifically, Catts et al. (2006) administered the Peabody Picture Vocabulary Test-Revised (PPVT-R; Dunn & Dunn, 1981), the listening comprehension subtest from the Qualitative Reading Inventory, 2nd Edition (QRI-2; Leslie & Caldwell, 1995), an experimental inference comprehension task, and the Concepts and Directions subtest from the Clinical Evaluation of Language Fundamentals, 3rd Edition (CELF-3; Semel, Wiig, & Secord, 1995). The authors described this latter subtest as assessing students' ability to understand commands involving a variety of syntactic structures (i.e., syntactic knowledge).

To determine the differences between subgroups of readers in the 8th grade, the researchers grouped students based on the word-level reading and reading comprehension percentile scores. Students who scored below the 25th percentile in reading comprehension and above the 40th percentile on word-level reading were classified as poor comprehenders. Students

who scored below the 25th percentile on word-level reading and above the 40th percentile on reading comprehension were classified as poor decoders. Students who scored between the 40th and 84th percentiles on both reading comprehension and word-level reading were classified as typical readers. The results revealed that poor comprehenders scored lower than typical readers and poor decoders on the discourse comprehension test measured with the QRI-2 and experimental inferencing task. Contrastively, poor decoders scored similarly to typical readers on these measures. For receptive vocabulary, the results revealed that poor comprehenders scored significantly lower than poor decoders and typical readers. No significant differences were found on receptive vocabulary between poor decoders and typical readers. For grammatical understanding, poor comprehenders and poor decoders also scored significantly lower than typical readers.

Overall, Catts et al. (2006) found differences between poor comprehenders and poor and typical readers on discourse comprehension, vocabulary knowledge, and syntactic knowledge tasks. Importantly, was the significant differences found between poor comprehenders and poor decoders and typical comprehenders on the syntactic knowledge task. The authors stated that although poor decoders scored significantly lower, their scores were in the average range whereas poor comprehenders' scores were below the average range. This suggests that deficits in syntactic knowledge are found in students who have difficulty comprehending what they read. However, the syntactic knowledge measure used (i.e., Concepts and Directions subtest from the CELF-3) provided broad information about the role of grammatical knowledge in reading comprehension but did not provide information about specific types of syntactic structures that may be more challenging for students who struggle specifically with reading comprehension. Additionally, syntactic awareness was not assessed which may have provided more information about the differences between the subgroups of readers' metalinguistic ability.

Cutting and Scarborough (2006) investigated the contribution of word-level reading and language comprehension skills to reading comprehension among 97 first through tenth grade students. Reading comprehension was assessed with three different tests: Gray Oral Reading Test, 3rd Edition (GORT-3; Wiederholt & Bryant, 1992), Gates-MacGinitie Reading Test-Revised (G-M; MacGinitie, MacGinitie, Maria, & Dreyer, 2000), and Weschsler Individual Achievement Test (WIAT; Wechsler, 1992). Word-level reading was assessed with the basic reading subtest from the WIAT (Wechsler, 1992) and the word attack subtest from the

Woodcock Johnson Psychoeducational Battery-Revised (Woodcock & Johnson, 1989). Lastly, other cognitive skills known to contribute to reading comprehension were assessed (i.e., reading speed, rapid serial naming, IQ, verbal memory, and attention).

The researchers measured two aspects of language comprehension: lexical factor (i.e., vocabulary knowledge) and sentence processing factor (i.e., syntactic knowledge). Vocabulary knowledge was assessed with the Peabody Picture Vocabulary Test-Third Ed. (Dunn & Dunn, 1997), the Boston Naming Test (Kaplan & Goodglass, 1978), and the word classes subtest from the CELF-3 (Semel, Wiig, & Secord, 1995). Sentence processing was assessed with three subtests from the CELF-3 (i.e., Concepts and Directions, Formulated Sentences, and Recalling Sentences) and a 16-item experimental syntactic comprehension measure (Menyuk & Cohen, n.d.). The latter task was designed to evaluate students' understanding of complex sentences with embedded clauses. Students were read complex sentences and were asked a comprehension question following the presentation of the sentence. No reliability information was provided for the task. Lexical and sentence-processing composite scores using principle component analysis were created.

Cutting and Scarborough's (2006) primary goal was to examine the different contributions of word-level reading and language comprehension to three different measures of reading comprehension. The researchers used hierarchical regression analyses to examine the effects of word-level reading and language comprehension skills to reading comprehension. In their analysis, principle composite scores (i.e., word-level reading factor, lexical factor, and sentence processing factor) were entered. They found 6-12% of the variance in reading comprehension was uniquely accounted for by the word-level reading composite across all three reading comprehension measures. Additionally, 9-15% of the variance in reading comprehension was uniquely accounted for by the lexical factor and sentence processing factor jointly. When examining the two language factors separately, vocabulary knowledge uniquely contributed 4-5% of the variance in reading comprehension and syntactic knowledge uniquely contributed 1-3% of the variance in reading comprehension. Overall, word-level and language comprehension skills combined contributed 49-72% of the variance in reading comprehension. No other contributions were made by the other cognitive level skills except for reading speed which contributed 1-6% of the variance across the three measures of reading comprehension.

Cutting and Scarborough's (2006) findings support the Simple View of Reading model that suggests word-level reading and language comprehension, including syntactic knowledge, contribute a large amount of variance on reading comprehension (i.e., 49-72%). However, it is important to highlight how syntactic knowledge was assessed. Cutting and Scarborough (2006) stated that using multiple measures of sentence processing skills (i.e., syntactic knowledge), from broad (i.e., comprehending concepts and directions, formulating sentences, and recalling sentences) to specific measures (i.e., syntactic comprehension measure), is important when modeling reading comprehension. However, these individual tasks vary in what they measure. In particular, comprehending concepts and directions is a receptive syntactic knowledge task while formulating sentences and recalling sentences are expressive syntactic knowledge tasks. Thus, it is not clear which aspects of syntactic knowledge may be contributing to reading comprehension.

The investigations reviewed used measures that assessed students' knowledge of syntactic structures. What was not included was a measure of syntactic awareness. This type of assessment would provide more information about students' ability to reflect upon the structure of language. A few other investigators; however, have used measures that tap into students' awareness of syntactic structures.

Contributions of Syntactic Awareness to Reading Comprehension

Demont and Gombert (1996) conducted a longitudinal study exploring the effects of phonological, phonemic, and syntactic awareness on word-level reading and reading comprehension with 23, kindergarten through third grade French speaking students. They hypothesized that phonological and phonemic awareness would influence word-level reading and syntactic awareness would influence reading comprehension in students learning to read.

The students were tested across four time points starting in kindergarten and ending in third grade. The students were administered four types of metalinguistic tasks which included a "concepts about linguistic units" task, five phonological awareness tasks, five phonemic awareness tasks, and four syntactic awareness tasks at each time point. The first of the four syntactic awareness tasks was a lexical segmentation of sentences measure on which the students were directed to count and pronounce the words in 24 phrases or sentences. The second syntactic awareness task was a grammatical judgment task on which students were directed to judge the grammaticality of 20 correct sentences and 20 agrammatical sentences. Ten of the sentences in each category represented morpho-syntactic constructions (i.e., Elodie is putting on her coat).

Morpho-syntactic constructions assess students' ability to judge or manipulate morphological markers such as subject-verb agreement, past tense, and plural tense. This is different from syntactic awareness because it does not assess students' ability to judge or manipulate word order within syntactic constructions such as clauses or phrases. Thus, the task was not a pure measure of syntactic awareness. The last two tasks consisted of a grammatical correction task, in which students were directed to correct the grammatical error in the sentences presented in the grammatical judgment task, and a grammatical correction of semantically and grammatically incorrect sentences. On this latter task, the students were directed to correct the semantic grammatical error of 16 incorrect sentences (i.e., sentences in which the verb in French can be either feminine or masculine).

In addition to the multiple metalinguistic tasks, the students' word-level reading and reading comprehension abilities were assessed using French standardized reading assessments. The reading comprehension measure was unique because students were given sentences written on cards and instructed to match the meaning of the sentence to one of four pictures. Nonverbal intelligence and vocabulary also were assessed using the Raven's Progressive Matrices and the Weschler Intelligence Scale for Children (Weschler, 1974).

The researchers used fixed-order multiple regression analyses with the word-level reading and reading comprehension tests measured at third grade as the dependent variable and nonverbal intelligence and vocabulary entered in the first two steps of the regression analyses. The third step entered into the regression was one of the metalinguistic tasks measured at kindergarten, first, and second grade. These analyses were designed to determine whether students' phonemic and syntactic awareness measured in kindergarten, first, and second grade predicted later reading comprehension measured in 3rd grade.

Overall, Demont and Gombert (1996) found that after controlling for nonverbal intelligence, which was a powerful predictor of reading comprehension, grammatical correction measured in kindergarten, grammatical judgment and correction measured in 1st grade, and grammatical correction measured at 2nd grade made significant contributions to reading comprehension. The researchers concluded that starting at the beginning of kindergarten, awareness of how sentences are organized (i.e., grammaticality) played an important role in reading comprehension. They also stated that the ability to reflect upon and manipulate the

grammatical structure of sentences allowed students to monitor the meaning of the sentences being read.

Muter, Hulme, Snowling, and Stevenson (2004) conducted a longitudinal study investigating the contribution of phonological skills, letter knowledge, syntactic awareness, and vocabulary knowledge to word-level reading and reading comprehension of 90 students whose mean age at the beginning of the study was four years and nine months. Students were tested three times over a two-year period. At Time 1, phonemic awareness subtests from the Phonological Abilities Test (Muter, Hulme, & Snowling, 1997) were administered. These included rhyme detection, rhyme completion, and phoneme deletion tasks. Also administered were a rhyme oddity task on which students were instructed to identify rhyming words, a letter knowledge task on which students were instructed to supply the name of 26 lower case letters, the British Vocabulary Scale II (BPVS II; Dunn, Dunn, Whetton, & Burely, 1997) used to measure receptive vocabulary, and the Hatcher Early Word Recognition Test (Hatcher, Hulme, Ellis, 1994) used to measure single word-level reading. At Time 2, all tasks presented at Time 1 were readministered. In addition, a word order correction task, used to measure students' syntactic awareness, and a morphological generation task, used to measure students' morpho-syntactic awareness, were administered. Lastly, the British Abilities Scales II Word Reading Test (BAS II; Elliot, 1996) was administered to measure single-word-level reading. At Time 3, the students were readministered the Hatcher Early Reading Test and BAS II. Additionally, the Neale Analysis of Reading Ability II (NARA II; Neale, 1997) was administered to assess accuracy of word-level reading and reading comprehension.

Muter et al. (2004) found that the two grammatical awareness measures were moderately correlated with the Hatcher Early Word Recognition Test at Time 1, the BAS II at Time 2, and the NARA at Time 3. Specifically, significant correlations of .56 and .61 were found between the word-level reading and reading comprehension subtests from the NARA and the word order correction syntactic awareness task, respectively. To further analyze the data, the researchers performed a path analysis examining the skills that best supported reading comprehension. Phoneme sensitivity, word-level reading, letter knowledge, vocabulary knowledge, and grammatical awareness (i.e., syntactic and morpho-syntactic awareness) were modeled in a path analysis to predict reading comprehension. The researchers found that the paths of vocabulary knowledge, grammatical awareness, and word-level reading (Time 1) were significant and

predicted 86% of the variance in reading comprehension. Muter et al. concluded that vocabulary, grammatical awareness, and word-level reading are important skills that contribute to later reading comprehension.

In 1999, Gaux and Gombert investigated the effect of syntactic awareness on reading comprehension among 83 sixth grade students. The researchers grouped the syntactic awareness tasks into explicit and implicit syntactic awareness. Explicit awareness tasks measured students' ability to manipulate syntactic structures or explain grammatical errors whereas implicit awareness tasks assessed students' ability to judge the grammaticality of syntactic structures. Seven tasks were used to measure explicit and implicit syntactic awareness. Explicit syntactic awareness was measured by an explanation task on which students were asked to explain the grammatical error that was presented within an orally presented sentence, a replication task on which students were prompted to produce a novel written and oral sentence with the same error presented in the explanation task, and an identification task on which students were asked to identify a word or phrase within a sentence that matched the same grammatical mistake as a modeled sentence. For the replication and identification tasks, students were read the sentences in addition to having a written version of the sentences (i.e., presented in dual modalities). Implicit awareness was measured by a repetition task on which students repeated an orally presented sentence that contained a grammatical error, a judgment task on which students judged the grammaticality of orally presented correct and incorrect sentences, a correction task on which students corrected the error in the sentences judged to be incorrect from the judgment task, and a localization task on which student identified the location of the grammatical error within an orally presented sentence.

Fixed order regressions were used to analyze the effects of syntactic awareness on reading comprehension. The first three variables inputted in the regression analyses were reasoning, memory, and linguistic competency (i.e., vocabulary and verbal fluidity) followed by each syntactic awareness task separately. Gaux and Gombert (1999) found that syntactic awareness significantly contributed to reading comprehension over reasoning, memory, and linguistic competency. Specifically, the repetition, correction, explanation, and replication tasks significantly contributed unique variance on reading comprehension (i.e., 4-5%). Additionally, the replication task contributed the most variance to reading comprehension (i.e., 8%). This task was presented to the students in dual modalities: spoken and written form. These results support

the role that syntactic awareness contributes to reading comprehension. Gaux and Gombert stated that syntactic awareness supports students' ability to identify sentence structure and how sentences are related to ultimately achieve comprehension. However, their results should be analyzed with caution because ceiling effects occurred for the judgment, correction, localization, and explanation tasks. The researchers noted that this was evident due to the simplicity of the grammatical errors presented in the sentences.

Simultaneous Contributions of Syntactic Knowledge and Syntactic Awareness on Reading Comprehension

Thus far, it appears that only two studies have investigated both syntactic knowledge and awareness in a model of reading comprehension. In the first study, Bowey and Patel (1988) investigated 60 first grade children's metalinguistic and language knowledge abilities in relation to their word-level reading and reading comprehension abilities. The students' metalinguistic ability was assessed by a phonemic categorization task and two syntactic awareness tasks: error imitation and error correction tasks. For the error imitation task, students were required to imitate orally presented sentences that contained a grammatical error. For the error correction tasks, students were required to correct sentences that contained a grammatical error. Language knowledge ability was assessed by the Peabody Picture Vocabulary Test-Revised (Dunn & Dunn, 1981) and the Sentence Imitation subtest from the Test of Oral Language Development-Primary (TOLD-P; Newcomer & Hammill, 1982). Bowey and Patel (1988) defined the sentence imitation subtest as a measure of students' syntactic knowledge ability.

Correlation coefficients were computed for vocabulary, sentence imitation, phonemic categorization, syntactic awareness (i.e., combined), word identification, and reading comprehension. Specifically, reading comprehension significantly correlated with sentence imitation ($r = .54^*$) and syntactic awareness composite ($r = .40^*$). Further, two sets of hierarchical multiple regression analyses were used to determine whether metalinguistic awareness would contribute to word-level reading and reading comprehension after controlling for language knowledge abilities. Bowey and Patel (1988) found that after controlling for language knowledge abilities, metalinguistic awareness did not significantly contribute additional variance to reading comprehension ability. Contrastively, when metalinguistic awareness abilities (i.e., phonemic and syntactic awareness) were controlled, language knowledge ability contributed 12.48% of the variance to reading comprehension ability. The

researchers concluded that metalinguistic awareness and language knowledge are not statistically independent of each other even though both language knowledge and metalinguistic awareness contributed a substantial amount of variance to reading comprehension individually (i.e., 29.3% and 17.4%, respectively).

In the second relevant study, Cain (2007) examined 196, seven to ten year old children's word-level reading, reading comprehension, memory, vocabulary, syntactic knowledge, and syntactic awareness skills. Specifically, syntactic knowledge was measured with the Test of Reception of Grammar 2nd edition (TROG; Bishop, 1983). This task required students to listen to an orally presented sentence ranging in grammatical complexity and then point to the picture that best depicted the sentence from an array of four pictures. This task measured syntactic knowledge rather than syntactic awareness because students did not manipulate or reflect on the grammatical structure of language; rather, they used their knowledge of syntax to comprehend a sentence. Conversely, syntactic awareness was measured by two tasks: a grammatical correction task which required students to correct an orally presented sentence that contained errors on subject-verb agreement and a word-order correction task which required students to rearrange words to create a grammatically-correct sentence. Reading comprehension was assessed with a standardized reading assessment which students read passages that varied in length and answered literal and inferential questions related to each passage.

To determine the contribution of syntactic awareness on reading comprehension, fixed-order hierarchical regressions were computed. Vocabulary, memory, and syntactic knowledge were entered in step 1 of the analysis and followed by either the grammatical correction task or the word order correction task. The results revealed that neither syntactic awareness task contributed additional variance after controlling for vocabulary, grammatical knowledge, and memory. Similar to the findings of Bowey and Patel (1988), when syntactic knowledge and syntactic awareness were both entered into a regression analysis, syntactic awareness did not add additional variance on reading comprehension. Both Cain (2007) and Bowey and Patel (1988) found that language knowledge contributed significant variance to reading comprehension ability after controlling for metalinguistic abilities. However, these researchers used a joint language ability score instead of investigating syntactic knowledge solely.

Regardless of the inconclusive findings, Bowey and Patel (1988) suggested that syntactic awareness and other metalinguistic skills (i.e., phonemic awareness) are correlated with a general

language factor (i.e., language knowledge). Thus, students with advanced language knowledge (i.e., syntactic knowledge) perform better on metalinguistic tasks (i.e., syntactic awareness). Results from Cain (2007) and Bowey and Patel (1988) suggest that metalinguistic awareness may not be statistically independent of language knowledge. However, as presented by the previous research, both syntactic knowledge and awareness provide important skills related to reading comprehension.

Thus far, previous research on the effect of syntactic knowledge or syntactic awareness on reading comprehension has not clearly delineated the individual contributions of these two skills, possibly due to differences in tasks used to measure them. Based on the definitions of syntactic knowledge and awareness, syntactic awareness and syntactic knowledge assessments likely provide different information about students' syntactic skills. Thus, it may be that the best model when examining contributions to reading comprehension is to include both measures of syntactic knowledge and syntactic awareness. A syntactic knowledge measure could serve as a language comprehension measure while a syntactic awareness measure would serve as a metalinguistic measure (Cain, 2007; Gaux & Gombert, 1999). Investigating the roles of syntactic knowledge and syntactic awareness would lead to a model that would determine whether syntactic awareness and syntactic knowledge are unique contributors to reading comprehension or whether their relation to reading comprehension is mediated by each other and thus expand and inform the Simple View of Reading model.

Additionally, most researchers investigating the contributions of syntactic awareness or syntactic knowledge on reading comprehension have focused on elementary-age students (e.g., Cain, 2007; Demont & Gombert, 1996, Muter, Hulme, Snowling, & Stevenson; 2004). It is important to investigate the effects of syntactic awareness and knowledge on reading comprehension in adolescence because these older students encounter more complex syntax in expository text presented in core academic courses. That is, the types of written text presented at the secondary level contain more complex syntactic structures which may impede reading comprehension (Scott, 2009).

Purpose and Research Questions

The purpose of this study was to examine the direct and indirect effect(s) of syntactic knowledge and syntactic awareness on adolescents' reading comprehension. To address this purpose, structural equation modeling was conducted and indirect coefficients were used to

determine whether syntactic knowledge mediated the relation between syntactic awareness and reading comprehension and/or vice versa. Also, included in that model of reading comprehension were word-level reading, vocabulary knowledge, and working memory, other abilities known to contribute to reading comprehension (Beck, McKeown, & Kucan, 2002; Catts, Hogan, & Adolf, 2005; Hoover & Gough, 1990). Six models were created with a sentence comprehension endogenous variable, a reading comprehension endogenous variable, and a latent comprehension endogenous variable. Specifically, the following questions were addressed, with each question focused on the sentence comprehension, passage comprehension, and latent comprehension models:

1. What is the direct effect of adolescent students' syntactic knowledge and syntactic awareness on reading comprehension above other known contributing factors?
2. What is the indirect effect of adolescent students' syntactic awareness on reading comprehension through syntactic knowledge above other known contributing factors?
3. What is the indirect effect of adolescent students' syntactic knowledge on reading comprehension through syntactic awareness above other known contributing factors?
4. What is the total effect of adolescent students' syntactic awareness and syntactic knowledge on reading comprehension above other known contributing factors?

Based upon the results of previous studies, (Bowey & Patel, 1988; Cain, 2007; Gaux & Gombert), it was hypothesized that there would be a high to moderate relation between syntactic awareness and syntactic knowledge and reading comprehension. In addition, it was hypothesized that syntactic awareness would have significant direct effects on reading comprehension after controlling for syntactic knowledge and other contributing factors even though Bowey and Patel (1988) and Cain (2007) found syntactic knowledge significantly contributed to reading comprehension and syntactic awareness did not. This assumption was based on the type of syntactic awareness items that were utilized in the current study that adhered to the operational definition of syntactic awareness. Additionally, it was hypothesized that syntactic awareness would indirectly contribute to reading comprehension through syntactic knowledge, a path which has not been tested in previous studies.

CHAPTER TWO

METHOD

Participants

Participants were 193, 9th and 10th grade students who attended a high school located in a southeastern state. Of the 193, thirteen students were excluded from the data set and analysis because they were receiving exceptional student education (ESE) services. Parental consent and student assent were obtained for each participating student as approved by the local institutional review board. The sample included 51.1% females and the sample mean age was 15.7 (1.3) years old. Ethnicity information was gathered from students' school records and was as follows: 52.2% Caucasian, 33.3% African American, 5.6% Hispanic, 2.2% Asian, and 6.7% other. The school-wide (i.e., elementary through secondary) percentage of students on free and reduced lunch was 20.6%. All students spoke English either as their primary or secondary language. According to teacher report, none of the students were classified as having a learning disability or speech/language disorder.

Measures

A battery of assessments was administered to measure reading comprehension and known contributors to reading comprehension. Additionally, syntactic awareness and syntactic knowledge was assessed.

Criterion Variables. Reading comprehension was measured at the passage and sentence levels. At the passage level, the Gates-MacGinitie Reading Test, 4th ed. (GMRT-4; MacGinitie, MacGinitie, Maria, K., & Dreyer, 2000) was administered. This is a group-administered reading comprehension assessment. Students read passages and answered multiple choice questions related to each passage. Some questions required the students to recall information stated in the text, while other questions require that students make inferences from the text. The comprehension test included 11 narrative and expository passages and 48 questions and participants were allowed 35 minutes to complete the test. Students read the questions from a test booklet and marked their response on an answer sheet. Raw scores were used in the analysis. Test-retest reliability for the GMRT reading comprehension subtest was reported by the test authors' manual at .87 for 9th grade and .81 for 10th grade.

At the sentence level, the Test of Silent Reading Efficiency and Comprehension (TOSREC; Wagner, Torgesen, Rashotte, & Pearson, 2010) was administered. This was a group-administered assessment on which students read sentences silently and marked Yes or No on an answer sheet to indicate whether the sentence was true or false. Sentences ranged in difficulty from easy (e.g., *An airplane can fly high*) to hard (e.g., *Purchasing a stretch limousine is the ultimate way to economize*). Alternate form reliability for 9th and 10th grade students was reported by the authors' manual at .85 and .84, respectively. Sentence comprehension was included in this study because it was hypothesized that syntactic awareness and syntactic knowledge would contribute greater to sentence level comprehension task than a passage level task because the syntactic awareness and syntactic knowledge tasks were based on grammatical manipulation or understanding of single sentences.

Predictor Variables. Syntactic awareness was measured using two tasks; syntactic *judgment and correction* and syntactic *word-order*. These tasks are the most widely used assessments of syntactic awareness that involve the manipulation of oral sentences through word order correction tasks and error detection tasks (e.g., Cain, 2007; Cain & Oakhill, 2007; Demont & Gombert, 1996; Gaux & Gombert, 1999). However, most researchers use an oral only presentation structure that relies heavily on students' working memory (Cain, 2007; Gaux & Gombert, 1999). To decrease working memory demands, and similar to Gaux and Gombert's tasks, the syntactic awareness tasks used in this study were structured so that students read sentences and words in addition to having the task stimuli read by the investigator.

The syntactic knowledge and syntactic awareness tasks were created to comprise complex syntactic constructions based on phrases and subordinate clauses. Complex constructions were used because older students expand their sentence complexity by including phrases and clauses into their oral and written language (Nippold, 1998; Scott, 1988; 2004). Furthermore, items on the judgment task were classified into four types: misplaced phrase or clause, dangling phrase or clause, fragment phrase or clause, and correct items. Items on the word-order task were not classified into error types because students were required to rearrange the words, not judge grammaticality. See Appendix A for examples. The syntactic judgment and correction and word-order correction tasks were analyzed in a previous study to determine reliability (Brimo, Apel, & Petscher, in review). Item Response Theory analysis was used to

determine the difficulty and discrimination ability of the selected items on each task and resulted in tasks that were reliable. (See Brimo et al., for specifics).

Syntactic Judgment and Correction Task. The judgment and correction task was group-administered. Students were required to judge whether a sentence was grammatically correct by circling 'Right' or 'Wrong' on their answer sheet. After judging all 22 items on the task, students were directed to correct the grammatical error for items that they circled wrong. Students were given 15 seconds to judge each sentence and 20 minutes to correct sentences. All sentences were presented in writing on an easel and orally presented via a CD recording. The judgment and correction portions were scored separately. Judgment portion was scored as correct (1) or incorrect (0). The raw score represented the total number of correct items out of 22 items. The correction portion was scored as correct (1) and incorrect (0). Items were scored correct if the student created a grammatical sentence without deleting any of the words in the sentence. This ensured that the students did not simplify the complex sentence to correct it. The raw score represented the number items corrected out of 18 items.

Syntactic Word-Order Task. The word order task also was group-administered. Students were presented 12 sentences containing word order violations and were required to rewrite the words to create a grammatically-correct sentence in writing on their answer sheet. All sentences were presented in writing on an easel and orally presented via a CD recording. Items were scored as correct (1) and incorrect (0). The raw score represented the total number of correct items.

Syntactic Knowledge. Syntactic knowledge was measured by the listening comprehension subtest from the Group Reading Assessment Diagnostic Evaluation (GRADE; Williams, 2001). This also was group-administered and measured students' listening comprehension. Students listened to sixteen orally-presented sentences and chose one of four pictures that best corresponded to the sentence presented.

Control Variables. Vocabulary knowledge, word-level reading skills, and working memory have been shown to contribute to reading comprehension (Beck, Mckeown, & Kucan, 2002; Catts, Hogan, & Adolf, 2005; Cutting & Scarborough, 2006; Hoover & Gough, 1990; Muter, Hulme, Snowling, & Stevenson, 2004). Thus, these abilities were assessed to isolate the specific effect of syntactic awareness and syntactic knowledge on reading comprehension. Vocabulary knowledge was assessed with the vocabulary subtest of the GMRT. Reliability for this task was reported by the authors' manual at .92 for 9th grade and .88 for 10th grade. Word-

level reading was assessed using the word identification and word attack subtests of the Test of Word Reading Efficiency (TOWRE; Torgesen, Wagner, & Rashotte, 1999). The word identification subtests assessed students' ability to read real words while the word attack subtest assessed students' ability to decode nonwords. Test-retest reliability for the TOWRE was reported by the authors' manual at .88 for adolescent students. Lastly, working memory was assessed with the memory for digits and nonword repetition subtests of the Comprehension Test of Phonological Processing (CTOPP; Wagner, Torgesen, & Rashotte, 1999). The memory for digits subtest assessed students' ability to recall and repeat a series of numbers. The nonword repetition subtest assessed students' ability to recall and repeat nonsense words. Test-retest reliability was reported by the authors' manual at .83.

Procedure

Trained undergraduate and graduate level students assisted the primary investigator during the data collection process. Participating students' were administered all but the word-level reading and working memory tasks over three, 50-minute group testing sessions during their English course. The word-level reading and working memory measures were administered individually during the students' elective periods.

Data Analysis

Students' data were entered into the statistical program PASW 18 to examine the data descriptively. Further, MPLUS version 6 (Muthen & Muthen, 2010) using maximum likelihood estimation was used to investigate the mediating effects of syntactic awareness and syntactic knowledge on sentence comprehension, passage comprehension, and latent comprehension, which was made up of the sentence comprehension and passage comprehension observed variables, in a structural equation model. Also, 25 percent of the students' data were rescored to obtain an inter-rater reliability score. This reliability measure was calculated by dividing the number of agreements by the number of disagreements and multiplying by 100. Inter-rater reliability for all assessments ranged from 93% to 99%.

CHAPTER THREE

RESULTS

Descriptive Statistics

Descriptive statistics for all variables are presented in Table 1. Preliminary analyses revealed that the data were normally distributed based on the skewness and kurtosis values for each variable and the criterion variables were a linear function of the predictor variables based on a plot diagram of the unstandardized residuals against each predictor variable. Bivariate scatterplots with residuals plotted against predictor variables also ruled out homoscedasticity.

Performance on the syntactic awareness tasks (i.e., syntactic judgment and correction and word order tasks) was moderately correlated with sentence comprehension, passage comprehension, and syntactic knowledge. See Table 2 for intercorrelations of all variables. Additionally, t-tests were computed to analyze grade level and gender differences on all variables. Grade level differences were found for vocabulary, $t(177) = 3.118$, $p = .002$, $d = .23$ on which 9th grade scored higher than 10th grade, and sentence comprehension, $t(177) = -3.611$, $p < .001$, $d = .27$ on which 10th grade scored higher than 9th grade. Gender differences were found for the syntactic judgment and correction task, $t(177) = 3.034$, $p = .003$, $d = .22$ and $t(177) = 3.074$, $p = .002$, $d = .23$ on which females scored higher than males. Grade level differences were not the primary focus of this study; however, to ensure that grade level differences did not affect the results, separate regression analyses were computed for 9th and 10th grade with sentence comprehension as the dependent variable and vocabulary, word-level reading, working memory, and syntactic awareness as predictor variables. For both grades, the overall model fit was significant ($9^{\text{th}} = F(5, 180) = 20.11$, $p < .001$; $10^{\text{th}} = F(5, 180) = 5.52$, $p < .001$). Though differences were found, they were judged not to affect the purpose of the study.

Table 1

Descriptive Statistics

Variables	Mean	SD	Skewness	Kurtosis
Memory Digits	14.98	2.81	-0.027	0.432
Nonword Repetition	11.32	3.12	-0.547	0.162
Word Id	89.69	9.38	-0.830	2.660
Word Attack	49.68	9.55	-0.321	1.810
Vocabulary	30.58	7.25	-0.217	-0.586
Syntactic Knowledge	12.42	1.99	-0.746	0.762
SA_Judgment	13.91	2.46	-0.493	0.363
SA_Correction	0.69	0.24	-0.910	0.415
SA_WordOrder	5.91	2.21	0.049	-0.109
Sentence Comprehension	36.75	7.68	0.846	2.290
Reading Comprehension	32.21	9.60	-0.475	-0.715

Note. All numbers represent raw scores; SD = Standard Deviation

Table 2

Summary of Intercorrelations

Measure	1	2	3	4	5	6	7	8	9	10	11
1. Memory Digits	1	.36**	.29**	.35**	0.14	.17**	.22**	.18**	.32**	.26*	.24**
2. Nonword Rep.		1	0.05	0.14	0.13	0.11	0.07	-0.001	.17*	0.07	0.12
3. Word Id			1	.47**	.24**	.15*	0.11	0.12	.36**	.43**	.24**
4. Word Attack				1	.25**	0.09	0.11	0.12	.36**	.43**	.21**
5. Vocabulary					1	.27**	0.1	.17*	.35**	.37**	.62**
6. SK						1	.21**	.38**	.41**	.19*	.40**
7. SA_Judgment							1	.41**	.30**	.23**	.34**
8. SA_Correction								1	.42**	.25**	.39**
9. SA_WordOrder									1	.49**	.44**
10. SComp										1	.43**
11. RComp											1

Note. ** = $p < .001$; * $p < .01$; Nonword Rep. = Nonword Repetition; SK = Syntactic Knowledge; SComp = Sentence Comprehension; RComp = Reading Comprehension

Structural Equation Modeling

Structural equation modeling was used to create models to explore the contributions of syntactic awareness and syntactic knowledge to reading comprehension. Because direct and indirect effects of syntactic awareness and syntactic knowledge have not been tested through structural equation modeling previously, two models were created for each endogenous variable separately (i.e., sentence and passage comprehension) and then two models were created with a latent endogenous variable (i.e., reading comprehension). Thus, six models were created to compare model fit indices for the indirect effect of syntactic awareness through syntactic knowledge and the indirect effect of syntactic knowledge through syntactic awareness on sentence comprehension, passage comprehension, and latent reading comprehension variable. Also, for each model, latent variables were created and inputted for working memory, word-level reading, and syntactic awareness. Single observed variables inputted into the model were vocabulary and syntactic knowledge.

Overall Model Fit. To explore model fit of each model individually, several measures of fit were considered. These included: goodness-of-fit index (chi-squared; ratio of chi-square to degrees of freedom), the comparative fit index (CFI; $>.90$), Tucker-Lewis Index (TLI; $>.90$), root mean square error of approximation (RMSEA; $<.08$), and standardized root mean residual (SRMR; $<.09$). However, because the sample size was less than 250, the CFI and SRMR were used predominately to analyze and explain model fit (Hu & Bentler, 1995). See Table 3 for fit indices. Of the five indices, two of them, the SRMR and RMSEA indices indicated that the data were an acceptable fit for models that tested the effects of syntactic awareness through syntactic knowledge on sentence comprehension (Model 1), passage comprehension (Model 2), and latent reading comprehension (Models 3). To compare Models 1-3 that tested the effects of syntactic awareness through syntactic knowledge on reading comprehension to Models 1a-3a that tested the effects of syntactic knowledge through syntactic awareness on reading comprehension, Akaike information criterion (AIC; Akaike, 1987) was used because models were not nested within each other. AIC index indicated that Models 1, 2, and 3, when compared to Models 1a, 2a, and 3a, displayed the better fit to the data. Thus, Models 1-3 were used to explore specific path coefficients and Models 1a-3a were not pursued further.

Table 3

Model Fit Indices for SEM Models

Model	χ^2	df	χ^2/df	CFI	TLI	RMSEA	SRMR	AIC
Model 1	66.03	26	2.539615	0.892	0.814	0.093	0.060	10059.631
Model 1A	80.24	26	3.086154	0.850	0.746	0.108	0.090	10067.845
Model 2	72.14	26	2.774615	0.890	0.810	0.100	0.061	9925.298
Model 2A	83.56	26	3.213846	0.856	0.757	0.111	0.089	10105.781
Model 3	126.85	34	3.730882	0.837	0.742	0.124	0.068	11110.52
Model 3A	103.24	34	3.036471	0.882	0.809	0.107	0.125	11128.137

Note. χ^2 = chi-square; df = degrees of freedom; CFI = comparative fit index; TLI= Tucker Lewis Index; RMSEA = root mean square error of approximation; SRMR = Standardized Root Mean Residual; AIC = Akaike information criterion

Direct Effect of Syntactic Awareness and Syntactic Knowledge on Reading

Comprehension. To determine the direct effects of syntactic awareness and syntactic knowledge within Models 1-3, standardized paths solutions for syntactic awareness and syntactic knowledge were tested. All final standardized solutions for all models are shown in Figures 1-3. Syntactic awareness contributed significant variance on reading comprehension in all three models. For Models 1, 2 and 3, the standardized estimates were .275, .271, .339, respectively. These estimates are interpreted like beta weights; so in Model 1, for every one standard deviation increase in syntactic awareness, a .275 increase in reading comprehension is expected, holding vocabulary, word level reading, and working memory constant. Overall, syntactic awareness contributed 7-11% of the variance to reading comprehension across all three models above other known contributors. Syntactic knowledge did not significantly contribute any variance to sentence level and passage level comprehension or the latent reading comprehension variable.

Indirect and Total Effects of Syntactic Awareness and Syntactic Knowledge on Reading

Comprehension. In addition to testing the direct effects of syntactic awareness and syntactic knowledge on reading comprehension, indirect and total effects were tested in Models 1-3. As evident from Figures 1 -3, the indirect paths from syntactic awareness through syntactic knowledge on reading comprehension in all three models were not significant. Interestingly, the direct paths from syntactic awareness on syntactic knowledge were all significant (i.e., .536 for Model 1; .546 in Model 2; .531 for Model 3) suggesting that students' syntactic awareness contributed to their syntactic knowledge. However, the direct paths from syntactic knowledge to sentence comprehension, passage comprehension, and latent reading comprehension were not significant, thus eliminating syntactic knowledge as a mediator between syntactic awareness and reading comprehension. Total effects could not be calculated because syntactic knowledge did not significantly contribute any variance directly in any of the models presented.

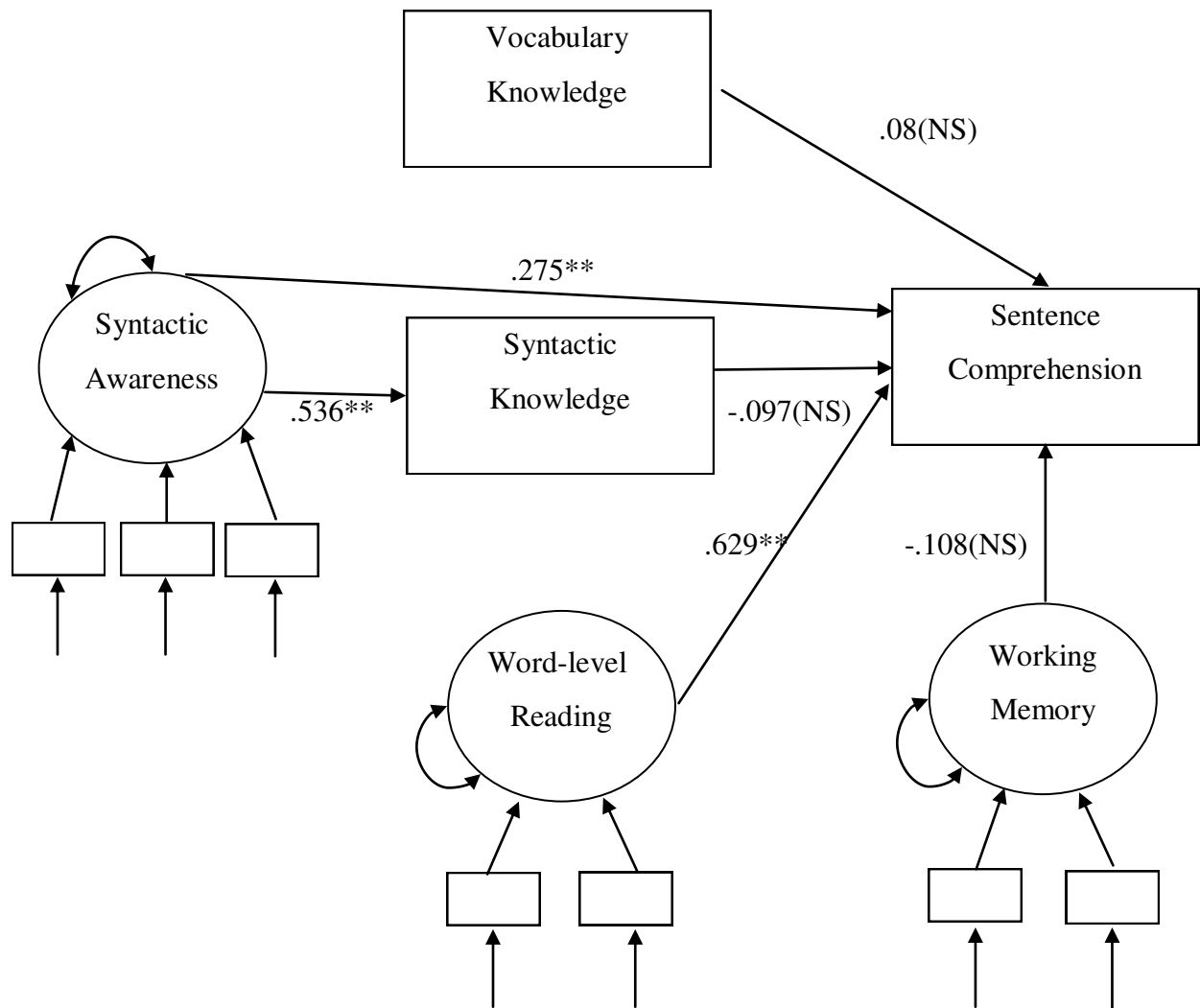


Figure 1 Model 1

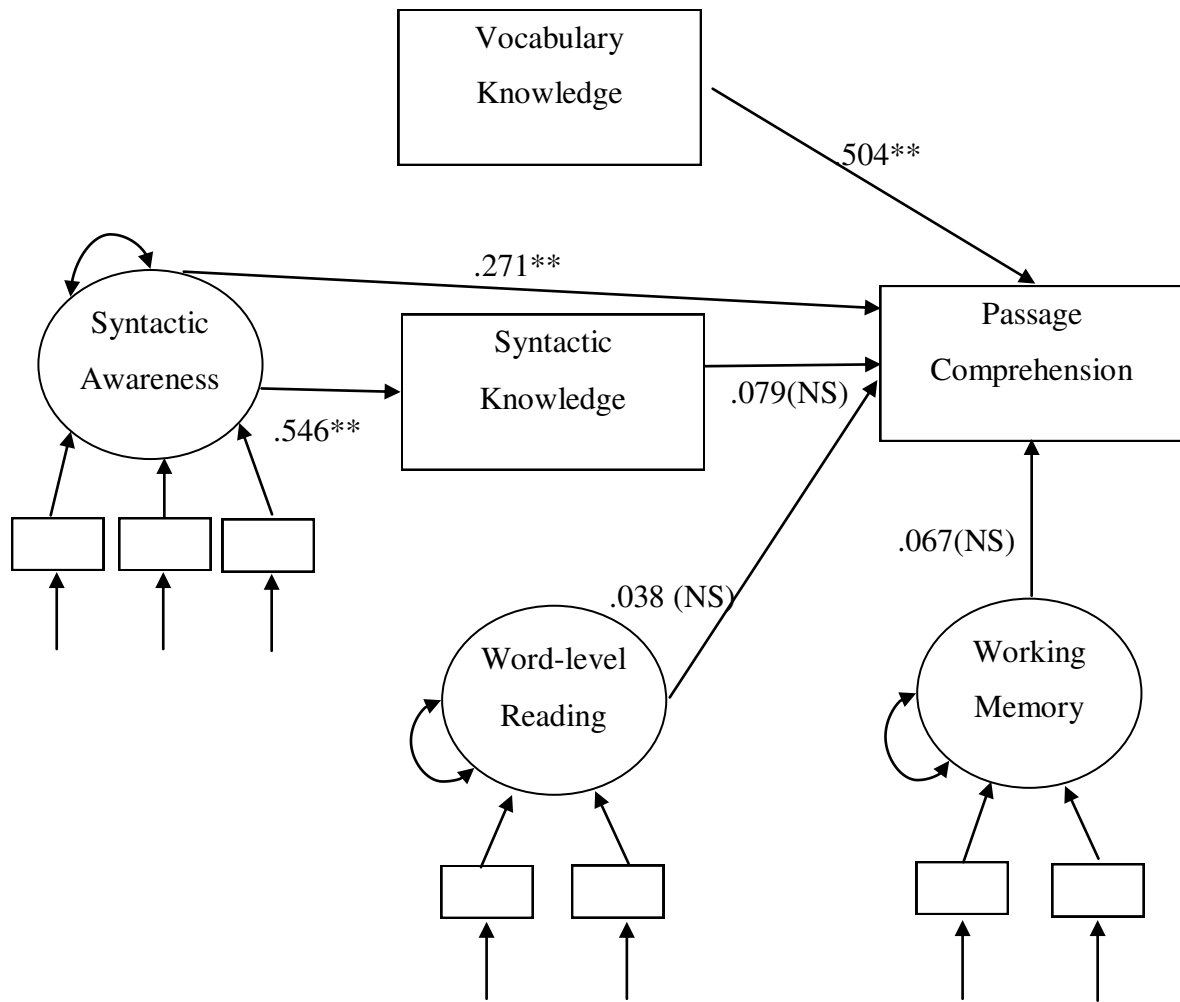


Figure 2 Model 2

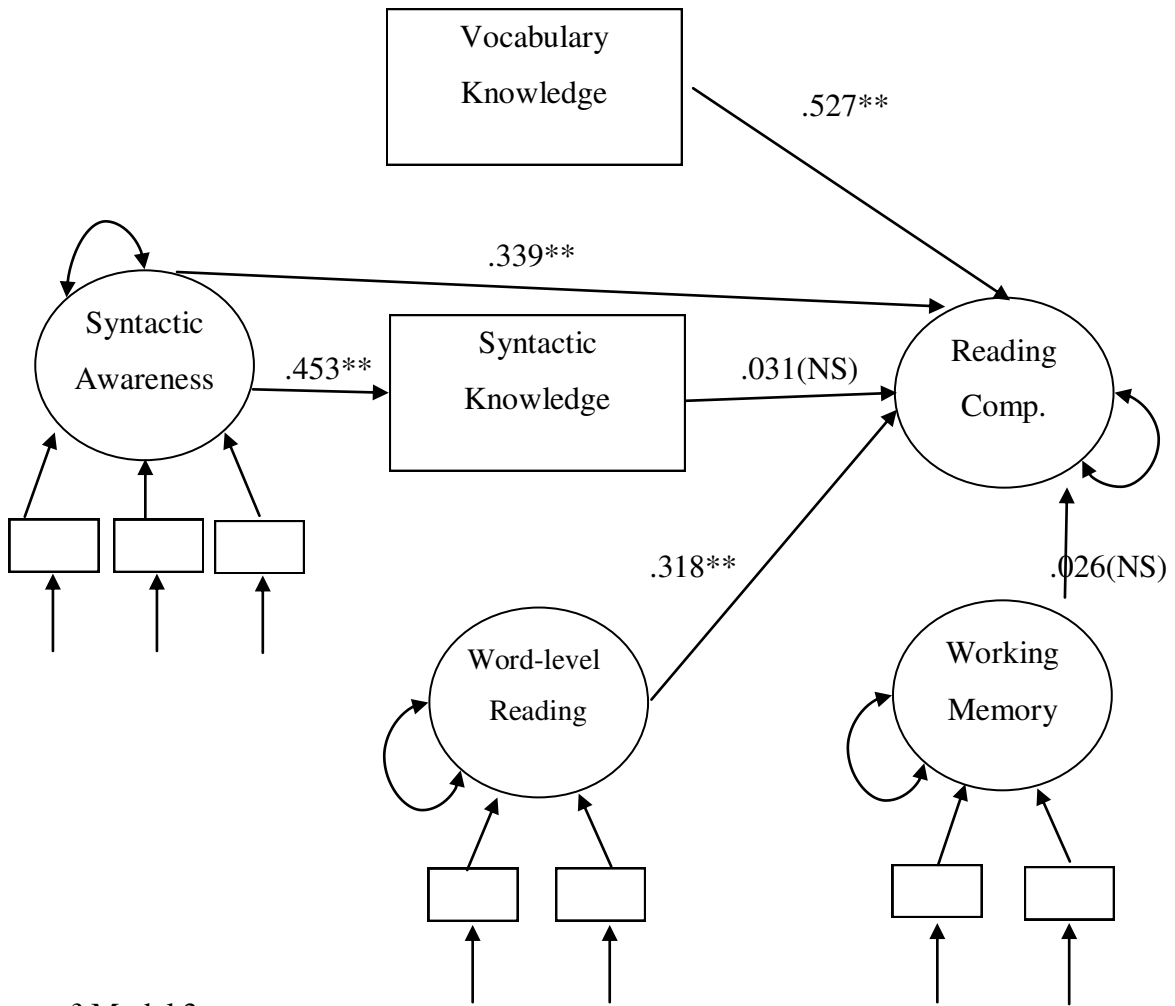


Figure 3 Model 3

CHAPTER FOUR

DISCUSSION

The purpose of this study was to examine the direct and indirect effects of syntactic knowledge and syntactic awareness on adolescents' reading comprehension. Syntactic awareness and syntactic knowledge were included simultaneously to determine the mediating effects of syntactic knowledge and syntactic awareness on reading comprehension.

Direct Effects of Syntactic Awareness and Syntactic Knowledge on Reading Comprehension

It was hypothesized that syntactic awareness would be a significant predictor to reading comprehension after controlling for syntactic knowledge and other known contributors. The findings from the current study confirmed this hypothesis and the results from previous studies (Demont & Gombert, 1996; Gaux & Gombert, 1999; Muter et al., 2004). Syntactic awareness significantly contributed to reading comprehension even after controlling for syntactic knowledge and other predictors. Path coefficients from syntactic awareness to sentence and passage comprehension were similar (i.e., .275 and .271 respectively) and the path coefficient from syntactic awareness to the latent reading comprehension factor was higher (i.e., .339) likely because of the latent nature of the variable. These beta weights indicate that syntactic awareness was uniquely predicting reading comprehension above other factors.

The finding that syntactic awareness directly contributes to reading comprehension is contrary to Bowey and Patel (1988) and Cain (2007), who found that after controlling for syntactic knowledge, syntactic awareness did not contribute significant variance to reading comprehension. The differences found between the current study and Bowey and Patel's and Cain's studies may be due to one or more differences among these investigations. First, the previous studies created a composite score of syntactic awareness and used regression analyses to determine the effects of syntactic awareness on reading comprehension. The current study utilized structural equation modeling (SEM) and created a syntactic awareness latent variable. The use of SEM was beneficial because this statistical procedure accounted for multiple relations between variables simultaneously (Kline, 2005). Further, within SEM, latent variables were created and accounted for error variance so that only shared variance within the construct was utilized in the analysis.

Second, syntactic awareness was measured differently in the previous studies compared to the current study. Bowey and Patel measured syntactic awareness with an error imitation and error correction tasks while Cain measured syntactic awareness with word-order correction and judgment tasks. The current study measured syntactic awareness with a similar format as Cain; however, the type of items used was different. The current study required the participants to manipulate word order in complex syntactic constructions. Cain used items that measured students' ability to consciously think about subject-verb and tense agreement and manipulate word order in simple syntactic constructions. It may be, then, that the effect of syntactic awareness on reading comprehension depends on the type of items utilized to measure syntactic awareness. Items targeting more complex syntactic constructions may more deeply examine students' syntactic awareness abilities leading to more robust contributions of syntactic awareness to reading comprehension.

Third, the differences in the results may be due to the age of the students assessed. Cain and Bowey and Patel assessed syntactic awareness on reading comprehension in younger students. It may be the contributions of syntactic awareness on reading comprehension are not evident until a certain age. Further investigations could examine the effects of item type in a longitudinal study by examining a wider age span of students across simple and complex item types.

Syntactic knowledge did not have a direct effect on reading comprehension. This finding may have been due to the interrelatedness of syntactic awareness and syntactic knowledge. Bowey and Patel (1988) and Cain (2007) suggested that syntactic awareness was not statistically distinct from syntactic knowledge and that both shared a significant amount of variance. In the present study, syntactic awareness was highly predictive of syntactic knowledge, supporting Bowey and Patel's and Cain's suggestion. However, contrary to their findings, the present study found that syntactic awareness subsumed the contribution that syntactic knowledge might have had on reading comprehension. Another explanation for why syntactic knowledge did not have an effect while syntactic awareness did is that syntactic awareness is a metalinguistic awareness task suggesting that adolescents students' explicit awareness of their syntactic knowledge contributed to reading comprehension over syntactic knowledge solely. Investigators have shown that other metalinguistic awareness skills significantly contribute to reading and reading comprehension, such as phonemic and morphological awareness (Castles & Coltheart, 2004;

Demont & Gombert, 1996; Nunes & Bryant, 2006). Thus, it seems that students' ability to use their knowledge of a construct in an explicit way is more beneficial than having knowledge of that construct.

Other possibilities as to why syntactic knowledge did not directly contribute to reading comprehension in the present study compared to previous studies may be related to the inclusion or exclusion of syntactic awareness in the analysis, the types of tasks used to measure syntactic knowledge, and the statistical control of syntactic knowledge in the analysis. Cutting and Scarborough (2006) and Catts et al. (2006) found significant results for syntactic knowledge; however, these researchers did not measure syntactic awareness. Thus, it may be that syntactic knowledge would not have remained a significant contributor to reading comprehension with the inclusion of syntactic awareness in their analysis. Additionally, Catts and his colleagues (2006), Cutting and Scarborough (2006), and Bowey and Patel (1988) used different tasks to measure syntactic knowledge compared to the present study. The present study used a listening comprehension task to test students' ability to listen to a complex sentence and match a picture that best depicted the sentence. Catt et al. utilized tasks that required students to listen and follow oral directions. Cutting and Scarborough measured syntactic knowledge with tasks that measured students' ability to formulate sentences, recall sentences, comprehend sentences, and listen and follow oral directions. Bowey and Patel (1988) utilized a sentence imitation task which required students to listen and recall sentences varying in number of words. These researchers may have used tasks that measured other linguistic knowledge beyond syntactic knowledge, such as vocabulary knowledge. Similarly, the syntactic knowledge used in the current study also may have included items that assessed vocabulary knowledge in addition to comprehension of syntax. Thus, students' vocabulary knowledge may have influenced their performance on the syntactic knowledge tasks outlined previously. Future studies could investigate a measure of syntactic knowledge that isolates syntactic knowledge without being influenced by vocabulary knowledge.

Lastly, Cain (2007) found significant results for syntactic knowledge above the contributions of syntactic awareness. She also used a measure that required students to listen to complex sentences and point to a picture that best depicted the sentence from an array of four pictures, similar to the task utilized in the present study. However, in her regression analyses, syntactic knowledge was entered simultaneously with vocabulary knowledge and working memory. Thus, Cain did not separate out the contribution of syntactic knowledge from the contribution of

vocabulary knowledge to reading comprehension. So, it is not evident whether syntactic knowledge would have uniquely contributed to reading comprehension above syntactic awareness and these other factors. Future investigations could measure syntactic knowledge with either a task similar to Cain's or another task measuring students' oral use of syntax to further explore the relation of syntactic knowledge to reading comprehension above syntactic awareness. These tasks may be less likely to be influenced by students' vocabulary knowledge.

In the current study, the contributions of syntactic awareness and syntactic knowledge were examined along with vocabulary knowledge, word level reading, and working memory. In the three models tested, these other factors contributed to reading comprehension. In Model 1, syntactic awareness and word-level reading significantly contributed to sentence comprehension. Vocabulary, syntactic knowledge, and working memory were not significant predictors. In Model 2, syntactic awareness and vocabulary were significant predictors while syntactic knowledge, word-level reading, and working memory were not significant. In Model 3, syntactic awareness, vocabulary, and word-level reading were significant predictors while syntactic knowledge and working memory were not significant.

This finding that vocabulary knowledge and word-level reading contributed significant variance to reading comprehension differently in all three models was different from the results reported by Cutting and Scarborough (2004) and Muter et al. (2004). Cutting and Scarborough and Muter et al. found that vocabulary and word level reading significantly contributed to reading comprehension. However, these previous studies only examined the contributions of vocabulary and word level reading on passage level comprehension. The current study examined the contributions of vocabulary knowledge and word-level reading on both passage and sentence level comprehension. The results of this study suggested that vocabulary knowledge played a greater role in passage comprehension while word-level reading played a larger role in sentence comprehension. Additionally, vocabulary in this study was assessed in whole groups and students were asked to read the words and select another word that had a similar meaning. This type of vocabulary assessment may have assessed students' ability to read the words in addition to assessing vocabulary knowledge. Thus, only one construct was predictive in each model. Contrastively, when latent comprehension was modeled (i.e., Model 3), both vocabulary and word level reading were significant predictors which indicated that both are important predictors

of comprehension, more closely aligning with the findings from Cutting and Scarborough and Muter et al.

Working memory did not play a significant role in any of the models presented even though Gaux and Gombert (1999) and Cain (2007) found that working memory significantly contributed to reading comprehension. Again, this finding might have been due to the nature of the assessments utilized or age of the students included in the current study. Both syntactic awareness tasks limited the demand on working memory because these assessments were presented orally and in writing to all the students. Nonetheless, this study is one of very few in the literature that included all of these variables into one structural equation model investigating passage level and sentence level comprehension.

Indirect Effects of Syntactic Awareness and Syntactic Knowledge on Reading Comprehension

The present study was the first to investigate the indirect effects of syntactic awareness and syntactic knowledge on reading comprehension. One important finding was that there was not an indirect effect of syntactic awareness on sentence, passage, or latent comprehension through syntactic knowledge. This result was in contrast to Cain's (2007) suggestion that syntactic awareness may be indirectly related to reading comprehension. Her suggestion was based on regression analyses that found no contributions of syntactic awareness beyond the control of syntactic knowledge, vocabulary knowledge, and working memory. Cain's suggestions were not confirmed in this study when structural equation modeling was used. It remains inconclusive as to whether syntactic awareness truly relates to reading comprehension indirectly. More investigations are needed that examine the indirect effects of syntactic awareness and syntactic knowledge. It may be that syntactic knowledge is indirectly related to reading comprehension through syntactic awareness and syntactic awareness is only directly related to reading comprehension in adolescent students.

Overall, this study found that syntactic awareness was a significant predictor of reading comprehension and confirmed other researchers' conclusions (i.e., Demont & Gombert, 1996; Gaux & Gombert, 1999; Muter et al., 2004). Additionally, this study extends the syntactic awareness research to adolescent population and tested the indirect effects of syntactic awareness and syntactic knowledge.

Limitations

This study had several limitations. First, a larger sample size would likely have led to improved fit indices and potentially other significant path coefficients. In the future, researchers may include a larger sample size to determine those possible effects. Second, the syntactic knowledge task used in this study may have been affected by the students' vocabulary knowledge. Researchers may wish to analyze different tasks to measure syntactic knowledge that are influenced by vocabulary knowledge such as Cain's (2007) measure or a measure of students' use of oral syntax. Lastly, this study's findings are limited to 9th and 10th grade students. To obtain a more comprehensive understanding of the effect of syntactic awareness and syntactic knowledge on reading comprehension among adolescent students, researchers could assess students in other grades, such as 7th and 8th grade.

Summary

To summarize, this study confirmed the significant contribution of syntactic awareness to sentence comprehension, passage comprehension and latent comprehension variables. Researchers have utilized the Simple View of Reading (Gough & Tunmer, 1986; Hoover & Gough, 1990) to examine the skills that contribute to reading comprehension, namely word level reading and language comprehension. Based on the findings from this study, it may be beneficial to define the specific skills associated with language comprehension as syntactic awareness and vocabulary knowledge. Thus, the Simple View of Reading may be better described as a combination of word level reading, vocabulary knowledge, and syntactic awareness skills. The findings from the current study also suggest specific types of skills professionals may wish to assess to determine the needs of students who are struggling with reading comprehension. For example, identifying the need to provide syntactic awareness instruction may lead to better text integration skills (Bowey & Patel, 1988). With more specified language skills that are known to contribute to reading comprehension, such as syntactic awareness, instructional and clinical intervention may be better informed.

APPENDIX A

“SYNTACTIC CONTRUCTION EXAMPLES”

Example	Construction	Sentence Type
1. Sitting in the back row of the theater the actors could hardly be heard.	Participle Phrase	Dangling
2. A man had been responsible for the death of tens of thousands seemingly mild looking.	Adjectival Clause	Misplaced
3. Painted and signed by the author.	Participle Phrase	Fragment
4. Mike the best mechanic in the garage was able to fix the tire.	Appositive Phrase	Correct

APPENDIX B

“CONSENT FORM”

My name is Danielle Brimo and I am a doctoral student from the Department of Communication Science and Disorders at the Florida State University. Your child is invited to be in a research study looking at the relationship between grammar and reading/listening comprehension. We are asking that your child take part because your child is in the age group we want to study. We ask that you read this form and ask any questions you may have before agreeing to allow your child to take part in this study. The purpose of this study is to examine the effects of grammar (i.e., syntactic awareness) on reading comprehension and listening comprehension. If you agree to allow your child to take part, your child's reading comprehension, listening comprehension, and grammar will be tested. Your child will be asked to read a grade level passage and answer multiple choice questions related to the passage, listen to a sentence and identify the correct picture of that sentence, and identify whether a sentence is grammatically correct. In addition, your child's vocabulary and word reading also will be tested. These assessments will take about an hour and half to complete and have previously been administered to students your child's age. Most of these assessments will be administered in your child's English course in a whole group. Other assessments will be administered individually during their elective courses.

Your child has been invited to participate because he or she is in the 9th or 10th grade this year. All procedures I am using are tasks that have been used previously with children your child's age/grade. Therefore, the procedures do not involve activities that would cause discomfort to your child or put your child at risk in any way. However, if your child does become upset during testing for any reason, she/he can stop at any time without penalty or risk. Also, at the beginning of the testing sessions, I will tell your child that he or she may stop testing at any time if he or she does not want to continue. To maintain confidentiality of your child's records, I will assign an experimental code to your child's response form. The results of this research study maybe published but your child's name or identity will not be revealed. Only group findings will be reported. Confidentiality will be maintained to the extent allowed by law. However, as the request of the school district, I will provide the school with the results of your child's standardized test scores to be placed in his or her cumulative folder. In addition, this consent form allows permission of the primary investigator to examine child's school records to gather descriptive information. Your child's testing results will be kept securely for three (3) years after this study ends in a locked cabinet or office. Your child will not directly benefit from involvement in this project, beyond the typical benefits of class room instruction. However, the results of this study will provide valuable information to researchers and educators that will lead to a better understanding for how best to help students' reading comprehension.

Additionally, at your request, we will provide you with the results of our formal testing upon completion of the study. Participation in this study is voluntary. You or your child will not be paid for participation in the project. If you choose not to have your child participate or choose to withdraw from the study at any time, there will be no penalty and it will not affect your grade.

If you have any questions or concerns about your child's rights as a research subject, you may contact the FSU Institutional Review Board (IRB) at 850-644-8633 or you may access their website at <http://www.fsu.research.edu>. You will be given a copy of this consent form for your records. Please enter your child's name and sign below if you give consent for your child to participate in this study.

Your child's name: _____

Your signature _____ Date _____

FSU Human Subjects Committee Approved on 12/09/10. Void after 12/07/11. HSC# 2010.5443

APPENDIX C

“ASSENT FORM”

My name is Danielle Brimo. I am a student researcher from Florida State University. I am asking if you would like to take part in a research study called “The Effects of Syntactic Awareness on Reading and Listening Comprehension” The purpose of this study is to examine the effects of grammar (i.e., syntactic awareness) on reading comprehension and listening comprehension. If you agree to be in this study, your grammar, reading comprehension, and listening comprehension will be tested. The reading comprehension test will consist of reading several passages and answering multiple choice questions. The listening comprehension test will consist of listening to a sentence and choosing the picture that best depicts the sentence. Lastly, the grammar (Syntax) test will consist of judging whether a sentence is grammatically correct. All tests may take you about 1 hour and half to complete. This will be given over three testing sessions. To maintain confidentiality of your records, I will assign an experimental code to your response form. The results of this research study maybe published, but your or identity will not be revealed. Only group findings will be reported. Confidentiality will be maintained to the extent allowed by law. However, at the request of your school district, I will provide your school with the results of your standardized test scores to be placed in your cumulative folder. Your testing results will be kept securely for three (3) years after this study ends in a locked cabinet or office. Please talk this over with your parents before you decide whether or not to participate. We have asked your parents to give their permission for you to take part in this study. But even if you parents said “yes” to this study, you can still decide to not take part in the study, and that will be fine. If you do not want to be in this study, then you do not have to participate. This study is voluntary, which means that you decide whether or not to take part in the study. Being in this study is up to you, and no one will be upset in any way if you do not want to participate or even if you change your mind later and want to stop. You can ask any questions that you have about this study. If you have any questions or concerns about your rights as a research subject, you may contact the FSU institutional review board at 850-644-8633 or you may access their website at <http://www.fsu.research.edu>. You will be given a copy of this consent for your records.

Signing your name at the bottom means that you agree to be in this study. You and your parents will be given a copy of this form after you have signed it.

Signing your name at the bottom means that you agree to be in this study. You and your parents will be given a copy of this form after you have signed it.

Name of child (please print): _____

Signature of Child: _____

Date: _____

FSU Human Subjects Committee Approved on 12/09/10. Void after 12/07/11. HSC# 2010.5443

APPENDIX D

“IRB APPROVAL”

Office of the Vice President For Research

Human Subjects Committee

Tallahassee, Florida 32306-2742

(850) 644-8673, FAX (850) 644-4392

RE-APPROVAL MEMORANDUM

Date: 12/10/2010

To: Danielle Brimo

Dept: Communication Science and Disorders

From: Thomas L. Jacobson, Chair

Re: Re-approval of Use of Human subjects in Research

The effects of syntactic awareness on reading and listening comprehension among adolescent students.

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 12/7/2011, you must request renewed approval by the Committee.

If you submitted a proposed consent form with your renewal request, the approved stamped consent form is attached to this re-approval notice. Only the stamped version of the consent form may be used in recruiting of research subjects. You are reminded that any change in protocol for this project must be reviewed and approved by the Committee prior to implementation of the proposed change in the protocol. A protocol change/amendment form is required to be submitted for approval by the Committee. In addition, federal regulations require that the Principal Investigator promptly report in writing, any unanticipated problems or adverse events involving risks to research subjects or others.

By copy of this memorandum, the Chair 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 as often as necessary to insure that the project is being conducted in compliance with our institution and with DHHS regulations.

Cc: Kenn Apel, Advisor

HSC No. 2010.5443

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BIOGRAPHICAL SKETCH

Danielle Brimo was born in Miami, Fl. She came to The Florida State University as a freshman in 2002. She graduated with a Bachelor's of Science in 2006 and with a Master's Degree in 2008 from FSU. She completed national and state requirements to work as a licensed speech language pathologist. Danielle continued her education and received a PhD from the School of Communication Science and Disorders from FSU. She has worked to build a career examining language and literacy abilities of school-age children with and without speech and language disorders. She is looking forward to a career as a speech language pathologist and professor at a university.