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Correlation of English Syntactic Awareness, Vocabulary and Verbal Working Memory and English Reading Comprehension in Second Language Learners

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**Correlation of English Syntactic Awareness, Vocabulary and Verbal Working Memory
and English Reading Comprehension in Second Language Learners**

By

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Abstract

Comprehending what one reads is the essence of all reading instruction. Much research has been conducted to determine how English reading comprehension is achieved. The simple view of reading (Gough & Tunmer, 1986) states that reading is the product of decoding times comprehension. Whether or not second language learners learn to read in English the same way that native English speakers do has not been as highly researched. The purpose of this study is to look at the English oral language skills of syntactic awareness, vocabulary and verbal working memory to see what correlations exist between these abilities and English reading comprehension with native Spanish speakers. Testing was done with third through eighth grade participants with equal groups of native English and native Spanish speakers. It was found that the variable of vocabulary was significant to reading comprehension with native English speakers, while working memory was significant to reading comprehension with native Spanish speakers. The difference between native English and native Spanish speaking participants could have implications in the school setting as to how teachers address reading comprehension with second language learners.

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Chapter 1: INTRODUCTION

Reading comprehension is the primary goal of reading instruction not only for native English learners (L1) but also for second language learners (L2). Reading comprehension is a prerequisite to acquiring knowledge and concepts in all areas of learning and increases as learners progress into middle and high school (Lesaux, Lipka, & Siegel, 2006). Regardless of the importance of reading comprehension, data has shown that L2 learners often fall behind their English-speaking counterparts when it comes to reading skill and reading comprehension. Kieffer and Vukovic (2012) found evidence from the Early Childhood Longitudinal Study: Kindergarten Cohort showing that approximately 27% of English as a second language (ESL) students who enter Kindergarten with limited English proficiency go on to encounter reading difficulties by the end of 3rd grade as opposed to only 9% of English speaking children. This is a significant problem and requires further research into the development of reading comprehension in L2 learners.

Numerous factors contribute to reading comprehension including cognitive functions, such as word recognition, oral language skills, and phonological awareness, psychological functions, such as motivation and teacher expectations, and ecological functions, such as socioeconomic status, home environment, and dialect (Joshi & Aaron, 2000). This study focuses on the cognitive functions related to reading comprehension. Reading comprehension in L2 learners may or may not involve the same functions as reading comprehension in L1. The simple view of reading (Gough & Tunmer, 1986) states that reading is the product of decoding times comprehension. Decoding is defined as the understanding of letter-sound correspondences and comprehension is defined as linguistic comprehension. Linguistic comprehension encompasses the subcategories of oral language, such as vocabulary, syntactic awareness and working

memory (Babayigit, 2015). Studies have shown that the development of decoding ability typically manifests in the early primary grades as learners are introduced to the grapheme-phoneme relationships of the language. The ability to decode can be predicted by measures of word reading fluency. Fluent word reading is imperative to successful reading comprehension as it frees up the reader to use cognitive functions for other aspects of reading, such as comprehension (Lesaux, & Geva, 2006, Lesaux, Lipka, Siegel, 2006). Linguistic comprehension has been shown to have stronger effects on reading comprehension as students move to upper grades. Linguistic comprehension can be measured by tests of vocabulary, syntactic and morphosyntactic skills, as well as working memory (Babayigit, 2015).

Word recognition and oral language processing skills have been proven to be effective predictors of success in reading comprehension for both L1 and L2 learners. Learners who have difficulties in either of these two domains have been shown to have difficulties with reading comprehension as well (Babayigit, 2015, Lesaux & Geva, 2006). Studies have further shown that students who have difficulties in oral language skills, but are proficient in word recognition skills, will still have difficulties in reading comprehension. Babayigit (2015) found that word reading measures were similar in L1 and L2 learners but that linguistic comprehension differed according to language background. It is suggested that as learners decipher the code of language, word reading ability becomes less of a predictor of reading comprehension and processes of syntactic awareness, working memory and vocabulary begin to have a stronger effect on reading comprehension. Interestingly, oral language processes have shown differing results between native English speaking learners and second language learners. Some studies have found syntactic awareness and working memory to be stronger predictors of reading comprehension in L2 learners (Lesaux, Lipka & Siegel, 2006, Lesaux & Siegel, 2003, Lipka &

Siegel, 2011). Other studies have shown vocabulary to be a strong predictor of reading comprehension in L2 learners (Proctor, Carlo, August, Snow, 2005, Verhoeven, 1990). Moreover, L2 learners have been shown to have more significant deficiencies in oral language processing skills than L1 learners but have similar proficiency to L1 learners in word recognition skills (Babayigit, 2015). This would suggest that oral language processing skills are a higher predictor of reading comprehension than word recognition in both L1 and L2 learners, but an even higher predictor for L2 learners. The Threshold Hypothesis proposed by Cummins (1979) may explain why this is true. The Threshold Hypothesis suggests that learners must reach a certain level of fluency to pass a threshold of understanding before they may progress to a higher threshold of language proficiency. If basic literacy skills are not mastered, language learning may not progress to the higher threshold. In this case, oral language processes may have a more significant affect on L2 learners if they have not already mastered literacy skills in the first threshold.

Most studies have compared the correlations between cognitive and linguistic functions and reading comprehension with heterogeneous groups of L2 learners (Babayigit, 2015). Others have attempted to single out the functions of particular language groups, such as Spanish, Persian, or Arabic (Abu-Rabia & Siegel, 2002, Gholamain & Geva, 1999, Kieffer & Vukovic, 2012). In a study done by Joshi, Tao, Aaron and Quirez (2012) decoding ability was correlated to reading comprehension in the native languages of Spanish, English and Chinese. Research has shown the area of L2 oral language and working memory to have significant variance to L2 reading comprehension (Babayigit, 2015, Droop & Verhoeven, 2003, Lipka & Siegel, 2011, Low & Siegel, 2005) but research is lacking in looking at these skills in specific language backgrounds of L2 learners. For these reasons, this study focused on the English oral language

processing skills of syntactic awareness, vocabulary and verbal working memory of L2 learners as a predictor of English reading comprehension in specific native language groups of English and Spanish.

The following research questions address these issues:

1. What is the correlation between English language processing skills of syntactic awareness, vocabulary and verbal working memory and reading comprehension in L2 learners?
2. Which area of oral language processing (syntactic awareness, vocabulary, verbal working memory) has a higher correlation to reading comprehension?
3. What correlation exists between L2 learners of Spanish native language background and native English speakers in the areas of English language processing skills and reading comprehension in English.

Chapter 2: LITERATURE REVIEW

Reading Development

The development of reading comprehension is a multifaceted process involving a network of cognitive and linguistic skills and abilities, including, but not limited to: vocabulary knowledge, syntactic knowledge, metacognitive skills, phonological awareness, word recognition, semantics, fluency, working memory and knowledge of orthography (Gholamain & Geva, 1999, Nergis, 2013). The simple view of reading proposed by Gough and Tunmer (1986), as the name states, attempts to simplify the process of reading comprehension into two components and states that reading(R) is the product of decoding(D) and comprehension(C). This formula can be expressed as $R = D \times C$. The components of decoding and comprehension encompass a variety of subcategories. Decoding ability is directly related to knowledge of the spelling-sound correspondence rules of English and can include skills related to combining, deleting, or substituting sounds to make or read words. Comprehension in this model refers to *linguistic* comprehension, or the ability to interpret lexical information at the sentence and discourse level. Linguistic comprehension itself encompasses a wider area of oral language skills, such as vocabulary, syntactic and morphosyntactic skills, as well as working memory (Babayigit, 2015).

It is debated if the simple view of reading can be applied to both L1 and L2 learners. According to Gough and Tunmer (1986), reading ability should be predictable through a measure of pseudoword reading, which taps decoding ability, and a measure of listening comprehension as a proxy for linguistic skill. A study done by Kieffer and Vukovic (2012) attempted to test the hypothesis of the simple view of reading as suggested by Gough and Tunmer (1986). They used two measures instead of one for each of the areas of code-related skills (word reading, phoneme

deletion) and linguistic related skills (picture vocabulary, oral comprehension). Results showed support for the simple view of reading in both L1 and L2 and found that in third grade native English speakers and Spanish L2 learners had similar scores on both code-related and linguistic-related skills with corresponding results in reading comprehension. Learners with low comprehension had similarly low results on all measures regardless of language background.

In addition to cognitive and linguistic components of reading development, there are also environmental or individual influences that may affect the development of reading comprehension. The component model of reading proposed by Joshi and Aaron (2000) attempts to include a broader array of influences that may affect reading development and states that there are three component groups that have an effect on reading ability: *cognitive* (word recognition, oral language, comprehension), *psychological* (motivation, interest, teacher expectation, gender), and *ecological* (teacher knowledge, dialect, socioeconomic status (SES), home environment). While the two additional components of psychological and ecological areas affect not only reading comprehension, but learning in general, they have been shown to have valid effects on reading comprehension. Some researchers have included the component of socioeconomic status (SES) among components of cognition and have found low SES to have an effect on reading comprehension in both English and Spanish speaking learners (Droop and Verhoeven, 2003, Kieffer & Vukovic, 2012).

This study focused on the cognitive and linguistic functions that contribute to reading comprehension in L2 learners which will be discussed further in the paper.

Cognitive and Linguistic Factors Related to Reading Comprehension in L1 and L2

Many studies have found the functions of phonological processing, syntactic awareness, vocabulary, and working memory to be important to reading ability in both L1 and L2 learners

(Lesaux, Lipka & Siegel, 2006, Lipka & Siegel, 2011, Low & Siegel, 2005). Studies have also found measures of word reading ability to be the strongest predictor of reading ability in L1 or L2. The speed at which a reader is able to decode words signifies reading fluency, with reading fluency being critical for gaining comprehension of the text (Lesaux, & Geva, 2006, Lesaux, Lipka, Siegel, 2006). While speed of word reading may be an important factor to reading comprehension, it is not necessarily the only predictor of reading success. Learners may be able to rapidly read words, but if they are not able to understand what the words mean, comprehension is not achieved (Lesaux & Geva, 2006). In addition, numerous studies have found measures of word reading ability to be similar among L1 and L2 participants but have found differences in measures of oral language and working memory between the groups (Babayigit, 2015, Droop & Verhoeven, 2003). A study done by Babayigit (2015) found measures of oral language skills and working memory to be a stronger predictor of reading comprehension than word reading fluency for both L1 and L2 learners, but for L2 learners oral language skill and working memory showed a stronger correlation to reading comprehension than for L1 learners. Kieffer and Vukovic (2012) found similar results where L1 and L2 learners with poor comprehension showed good scores on word recognition and phonological awareness but were low on measures of oral language skill. In this study language background did not discriminate between results on testing measures as did the previous study and low oral language skill was found in poor comprehenders in both L1 and L2 groups.

It is believed that as learners become more automatized in decoding skills the influence of word reading ability on reading comprehension lessens. Therefore, skills, such as syntactic awareness, vocabulary, and working memory may become more important for reading comprehension in the later grades, and other factors, such as phonological awareness and word

reading, may be better predictors of reading ability in lower grades (Droop & Verhoeven, 2003, Lipka & Siegel, 2011, Nakamoto, Lindsey, Manis, 2008). Catts, Tomblin, Compton and Bridges (2012) further explain that:

In the initial phases of reading development, children must learn to decode and recognize printed words. However, as children progress through grade school, reading texts change to include a greater percentage of informational passages or more complex narratives that place higher demands on the language and cognitive processing needed for comprehension. (Pg. 177)

Studies have found that this change typically manifests at the third or fourth grade level when the content of reading becomes more symbolic and decontextualized (Babayigit, 2015, Droop & Verhoeven, 2003).

It is interesting to note that while most studies have found similarities between L1 and L2 learners in measures of word reading ability, differences occur between the two groups in the areas of oral language. The Threshold Hypothesis by Cummins (1979) explains that there is a threshold of linguistic competence that must be met in order for learners to progress in their language development. Cummins (1979) further explains that there are possibly two thresholds. The lower threshold must be met to avoid cognitive delays in the L1 or L2, whereas the higher threshold must be met in order for L2 learners to advance to native-like language development. The lower threshold may vary depending on the learner's cognitive development as well as the level of curriculum the learner is entering. L2 learners who enter school in upper grades may encounter a more cognitively demanding lower threshold as language becomes more symbolic. In addition, Cummin's Interdependence Theory (1979) states that the level of L1 proficiency a learner possesses prior to L2 literacy instruction will affect how adequately a learner is able to

acquire the second language and move through the thresholds. Learners who enter formal instruction in L2 with insignificant exposure to vocabulary concepts, decontextualized language, and written language in their native language may be confronted with nonsense as they begin literacy instruction in a second language, leaving them with no background knowledge from which to draw upon when learning new concepts. Intensive literacy instruction in the early grades is imperative for non-literate L2 learners to achieve proficiency later on. This could help explain why previously stated research showed L2 learners to be equivalent to L1 learners in skills such as phonological awareness and word reading ability (lower threshold) but lag behind native English speaking peers in oral language skills, such as syntactic awareness (higher threshold). It could be possible that L2 learners entered school with intensive literacy instruction and were able to achieve the first threshold, but then as language became more decontextualized and abstract, L2 learners required more time to reach the higher threshold of competence.

Due to the fact that research has already shown similarities in phonological awareness and word reading ability in L1 and L2 learners in early grades (Babayigit, 2015, Chiappe & Siegel, 1999, Droop & Verhoeven, 2003), this study looks at the oral language and working memory skills of reading in L2 learners as predictors of reading comprehension.

Oral Language Measures

Syntactic Awareness. Syntactic awareness is defined as the ability to understand the patterns and structure of grammar in a specific language. Syntactic awareness contributes to reading fluency in that if readers are knowledgeable about the linguistic elements that form grammatical sentences they will be able to quickly and efficiently predict words that come next in a sentence. If readers are able to use sentence and context clues to effectively predict what comes next, this skill contributes to speed and accuracy of reading, which are important for

reading comprehension (Lesaux, Lipka & Siegel, 2006, Lipka & Siegel, 2011, Low & Siegel, 2005).

Testing Syntactic Awareness Knowledge. In order to test a learner's knowledge of syntactic awareness researchers typically use an oral-cloze test (Babayigit, 2015, Lesaux, Lipka & Siegel, 2006, Lipka & Siegel, 2011, Low & Siegel, 2005, Swanson, 2015, Verhoeven, 1990). In the oral-cloze test, learners are presented aurally with phrases, sentences or short stories and are asked to supply a missing word within the passage. Learners must use syntactic awareness in order to supply the missing word. This requires knowledge of the context and grammar of the sentence in order to find the correct word. An example of this test item from the Oral Cloze Test includes "*Betty ____ a hole with her shovel.*" "*It was a sunny day with a pretty _____ sky.*" (Low & Siegel, 2005). In this example, participants must provide the correct missing word using the correct part of speech. Other syntactic awareness tests include grammatical judgment tests where participants are presented either aurally or written with two sentences and are asked to choose the grammatically correct sentence and also sentence correction tests which require participants to correct ungrammatical sentences. (Babayigit, 2015, Lesaux, Lipka & Siegel, 2006).

Syntactic Awareness and Reading Comprehension. Studies have shown syntactic awareness to be a strong predictor of reading comprehension. In a study done by Lesaux, Lipka and Siegel (2006) it was found that L2 learners in 4th grade performed the same as English speaking peers on tests of word reading and phonological awareness but did not perform as well on measures of syntactic awareness and working memory. Interestingly, this deficit in syntactic awareness and working memory did not affect the reading comprehension of L2 learners. It was predicted that as these students entered the middle school grades the deficit noticed in oral

language would begin to hinder their reading comprehension. Results of two follow-up longitudinal studies show differing results. When these same students entered sixth grade, it was found that L2 learners did not perform as well as English-speaking peers on tests of syntactic awareness and working memory and subsequently did not perform as well on tests of reading comprehension (Low & Siegel, 2005). On the other hand, a study done by Lipka and Siegel (2011) found that once these students entered seventh grade there was no difference in reading comprehension but L2 learners still lagged behind their English-speaking peers on measures of syntactic awareness and working memory. It was suggested by the researchers that the difference between reading comprehension in sixth and seventh grade could have been attributed to the fact that several students had just entered the district the year before the sixth grade testing occurred, therefore those students needed an extra year to catch up to their peers in seventh grade. Regardless, in all grades L2 learners demonstrated lower scores on syntactic awareness and working memory in comparison to their L1 peers. A study done by Chiappe and Siegel (1999) found similar results where Punjabi speaking learners showed a deficit in syntactic awareness compared to English-speaking peers. In this study the deficit did affect their word reading ability.

Vocabulary. Vocabulary knowledge is important to the development of reading comprehension because when readers have good vocabulary knowledge their cognitive efforts can be directed towards comprehension of the text rather than deciphering unknown words. Vocabulary can be measured by breadth (how many words are known) and depth (how well the words are known) (Guo & Roehrig, 2011, Nergis, 2013). L2 learners begin reading in a second language with significantly less vocabulary word knowledge than L1 learners. It is suggested that a sufficient breadth of vocabulary knowledge for L2 learners should be 3,000 word families

or 5,000 word forms for minimum text comprehension to occur (Guo & Roehrig, 2011). What this means is that for good reading comprehension to occur, an L2 reader must not have more than 2-3% of unknown words in a given text. With the deficit L2 learners already possess in vocabulary knowledge, it would be expected that reading comprehension would suffer (Droop & Verhoeven, 2003). In addition, if the short-term memory capacity of L2 learners is strained by the struggle to recognize unfamiliar words, they will be unable to use their understanding of the context to determine the meaning of new words (Proctor, Carlo, August, Snow, 2005, Verhoeven, 1990). In this sense, all three variables of working memory, syntactic awareness and vocabulary work together to achieve reading comprehension.

Testing Vocabulary Knowledge. Vocabulary knowledge can be tested in a variety of ways. In receptive vocabulary tests researchers present learners with a vocabulary word who are then asked to point to a picture of the word or to choose the correct definition of the word. An example of a test item where participants must locate the correct definition is found in a study done by Nergis 2013 using the *Depth of Vocabulary Knowledge measure: The word is ACCURATE (a) exact (b) helpful (c) responsible (d) reliable*. Participants must then select the correct synonym of the word, *accurate*. In productive vocabulary tests, learners may be presented with pictures of objects and must produce the name of the objects. (Kieffer & Vukovic, 2012, Proctor, Carlo, August & Snow, 2005, Nakamoto, Lindsey & Manis, 2008). In the *Woodcock Johnson III* battery used by Kieffer & Vokovic (2012), the *Picture Vocabulary* test began with more common objects (ex: *apple, star*) and increased in difficulty as the test progressed (ex: *gavel*).

Vocabulary and Reading Comprehension. Many studies have found vocabulary to be a strong predictor of reading comprehension. A study done by Proctor, Carlo, August and Snow

(2005) used the variables of alphabetic knowledge, word reading fluency, vocabulary and listening comprehension and found vocabulary to be the strongest predictor of reading comprehension for L2 learners. Droop and Verhoeven (2003) used measures of vocabulary, word reading fluency, morphosyntactic skill, and listening comprehension and found vocabulary to be the strongest predictor of reading comprehension in language minority learners. Kieffer and Vukovic (2012) compared 3rd grade English and Spanish speakers on measures of word recognition, phonological awareness, vocabulary and listening comprehension as predictors of reading comprehension. A correlation between low scores on vocabulary and listening comprehension with low reading comprehension was found for both native English speakers as well as Spanish L2 learners. On the other hand results from a study done by Nergis (2013) found that in an advanced homogeneous group of L2 learners, metacognitive awareness was the best predictor of reading comprehension followed by syntactic awareness with vocabulary not demonstrating a strong prediction to reading comprehension. The author suggests that the results from this study differed from other studies because the learners were advanced in their English ability and may have surpassed the higher threshold as suggested by Cummins (1979), therefore vocabulary may not have had as strong of an effect on reading comprehension as metacognitive and syntactic awareness.

Verbal Working Memory. Verbal working memory, also referred to as working memory, is defined as the ability to retain information in working memory while simultaneously processing incoming information and subsequently retrieving information from long-term memory, such as pronunciation or grapheme-phoneme rules. Working memory is a complex component of reading comprehension as learners must decode incoming information, retrieve previously learned language rules and remember the context of what was read (Gholamain &

Geva, 1999, Lesaux, Lipka & Siegel, 2006, Lipka & Siegel, 2011, Low & Siegel, 2005, Swanson et. al., 2011, Swanson, 2015).

Testing Verbal Working Memory. There are many ways to measure working memory. Some researchers have chosen to use measures that ask participants to repeat phrases or sentences of increasing difficulty. For example, Lesaux, Lipka and Siegel (2006) used the *Stanford Binet Memory for Sentences* subtest where sentences to repeat began simple (*Drink milk*) to more complex (*Ruth fell in a puddle and got her clothes all muddy*). Another working memory measure is to present participants with sentences with the final word missing. Participants are then asked to produce the missing word in each sentence and then repeat the missing words of all the sentences in the section, demonstrating their ability to hold information in working memory (Abu-Rabia & Siegel, 2002, Babayigit, 2015, Lesaux, Lipka & Siegel, 2006, Lesaux & Siegel, 2003, Lipka & Siegel, 2011, Low & Siegel, 2005). Following is an example from the *Working Memory for Words* task of such a test: “*Running is fast, walking is _____, At the library people read _____, An apple is red, a banana is _____*” (Low & Siegel, 2005). In a similar version of this test, participants are first presented aurally with all the sentences in each section and are asked to judge if they are grammatical or ungrammatical, this is done in an effort to ensure that learners pay attention to the context of the sentence and are not simply memorizing the words. Participants are then presented with the sentences a second time, this time with the final word missing and must supply the missing word through memory. Example sentences include: “*The only thing left in the kitchen cupboard was a broken cup, and, I dreamed that I was in with field a sheep*” (Alptekin & Ercetin, 2010). Another method of testing working memory is to present participants with groups of words which they must remember all of the words in each group in order to provide the opposite to the words. For example the participants

may be presented with the two words: *good, down* and are then expected to produce the words: *bad, up*. (Gholomain & Geva, 1999).

Verbal Working Memory and Reading Comprehension. Studies have found working memory to be a predictor of reading comprehension. Gholomain and Geva (1999) found working memory was a significant predictor of word reading ability for first through fifth grade English L1 and Persian L2 learners. Alptekin and Ercetin (2010) also found that in Turkish university EFL learners, working memory capacity was similar in their L1 and L2 and that L2 working memory was a predictor of L2 reading comprehension. In a study done by Low and Siegel (2005), as referred to in the previous section, sixth grade Spanish L2 learners did not perform as well as English-speaking peers on tests of syntactic awareness and working memory which correlated with low performance on tests of reading comprehension.

Chapter 3: METHOD

The following details explain how this research will attempt to answer the following research questions:

1. What is the correlation between English language processing skills of syntactic awareness, vocabulary and verbal working memory and reading comprehension in L2 learners?
2. Which area of oral language processing (syntactic awareness, vocabulary, verbal working memory) has a higher correlation to reading comprehension?
3. What correlation exists between L2 learners of Spanish native language background and native English speakers in the areas of English language processing skills and reading comprehension in English.

Participants

As research has shown, oral language processes, as well as working memory skills, become strong predictors of reading comprehension around the third grade level as reading text becomes more content-oriented and decontextualized (Babayigit, 2015, Droop & Verhoeven, 2003). Participants for this study were chosen at the third through eighth grade level in order to effectively evaluate reading comprehension and the effects of oral language and working memory skills. Consent was obtained from the school district for participation in the study. Class lists were provided by the school district and participants were selected from these lists in the grades of third through eighth based on native language spoken, English or Spanish. Consent forms were sent to selected participant households asking for parent/guardian permission for student participation. Participants from Spanish speaking households were also sent consent forms in Spanish as well as a pre-recorded phone message in Spanish to explain the study.

Participants with signed and returned consent forms were selected to participate in the study. Testing schedules were arranged with classroom teachers and individual participant testing took place during school hours in a quiet location separate from other students for ten minutes per student. Student participants were asked to sign a student consent form before testing began. Completed test forms were collected and tabulated at the conclusion of testing.

Participants in this study consisted of 44 students in grades 3-8, 3rd ($n = 12$), 4th ($n = 5$), 5th ($n = 7$), 6th ($n = 7$), 7th ($n = 5$), 8th ($n = 8$). Of the 44 participants, 22 were native English (L1) speaking students in grades 3-8 (13 boys and 9 girls) and 22 were native Spanish language (L2) speaking students in grades 3-8 (8 boys and 12 girls)/ All participants were students from the same school district in a rural, upper Midwestern state. The language of instruction in the school was English. Of the 22 L2 participants, 2 reported speaking 75% English in the home while 20 reported speaking 50-100% Spanish in the home. All L2 participants reported speaking 75-100% English at school. Of the 22 L2 participants, 12 (54%) were born outside of the United States and 10 (45%) were born in the United States. Length of residence in the United States of the L2 participants ranged from 1-9 years.

Materials

The Woodcock-Johnson IV (WJIV) Tests of Oral Language by Nancy Mather & Barbara J. Wendling testing materials were used to measure the areas of Syntactic Awareness, Vocabulary and Working Memory. The following tests covered these language skills:

Test 1: Picture Vocabulary. This test measures lexical (word) knowledge. The task requires the learner to identify pictured objects. This is primarily an expressive language task at the single-word level. There are 54 vocabulary questions in the test. Items become increasingly difficult as the test progresses. The pictures at the beginning of the test consist of basic

vocabulary words, such as *horse, baby, apple*. Towards the end of the test the vocabulary pictures are notably more difficult: *pendulum, mandolin, scallop*. The median reliability is .78

Test 2: Oral Comprehension. This test measures the ability to comprehend a short audio-recorded passage and then supply the missing word using syntactic cues. This test is an oral cloze procedure which begins with simple analogies and associations and progresses to more complex passages. Examples would include: *Cars almost always have four _____ (wheels)* and *A bird flies, a fish _____ (swims)*. There are 33 total questions in this test. This test measures syntactic awareness and has a median reliability of .82.

Test 5: Sentence Repetition. This test measures the ability to remember and repeat single words, phrases, and sentences presented from audio recordings. There are 37 questions total which increase in difficulty as the test progresses. Phrases to be repeated at the beginning of the test include, “*good cookie*” and “*my mom is home.*” Phrases towards the end of the test include, “*On a snowy day, I can look out my kitchen window and see deer feeding in the woods*” and “*Bright colors, such as yellow, red, and orange, are used to paint signs that can be seen from far away.*” This test primarily measures working memory and has a median reliability of .83.

Reading Comprehension Test. To measure reading comprehension, results of the Minnesota Comprehensive Assessment (MCA) in the area of reading were used. Test results were from a testing period in April 2016. Results were analyzed on a scale of pass or fail in the area of reading comprehension.

Procedures

Each participant was given the tests of oral language skills individually. Testing took place in a quiet area separate from the classroom and away from distractions. Testing materials

were prepared for each student ahead of time. Testing procedures followed the WJIV testing manual and were given in this order:

Test 1: Picture Vocabulary. Participants were presented with a sample question. Participants were then asked to look at pictures on the testing booklet and name the objects as the administrator pointed to them. 1 point was given for correct answers, 0 was given for incorrect answers. There were 54 questions in total and each question increased with difficulty as the test progressed. Testing stopped after 6 incorrect answers had been given, or until the last item had been administered.

Test 2: Oral Comprehension. This test required an audio CD and CD player. Participants listened to two sample questions. Participants then listened to the rest of the following test questions and were asked to speak one-word answers to finish the sentences. If participants gave longer answers they were asked to give a one-word answer and were not penalized. Answers needed to be of the correct part of speech required for the question. The audio CD allowed time between each question but administrators were allowed to pause the CD if needed. Questions could not be repeated. 1 point was given for correct answers, 0 was given for incorrect answers. Testing stopped after 6 incorrect answers had been given, or until the last item had been administered.

Test 5: Sentence Repetition. This test required an audio CD and a CD player. Participants were asked to repeat each sentence exactly as it was presented. 1 point was given for correct answers, 0 was given for incorrect answers. Sample item A was presented and then items 1 through 8. Then sample item B was presented and the remaining of the test questions. The audio CD allowed time between each question but administrators were allowed to pause the

CD if needed. Questions could not be repeated. Testing stopped after 6 incorrect answers had been given, or until the last item had been administered.

Reading Comprehension. Results of the standardized MCA reading test were used to determine reading comprehension ability.

Chapter 4: RESULTS

To analyze results from the study two statistical analyses were run, correlations and regressions. Correlations were run with all 44 participants, as well as split groups of 22 L1 and 22 L2 participants. Results in Table 1 show that when all participants were included in the correlation, the variable of working memory showed slight significance ($p < .05$) at $p < .052$ on the dependent variable of pass MCA (reading comprehension). The variables of vocabulary and syntactic awareness did not show significance. When the correlations were split between groups, L1 did not show any of the variables to be significant on pass MCA (Table 2). For the L2 group, the variable of working memory was significant to pass MCA at $p < .048$ with all other variables not showing significance (Table 3).

Table 1**Correlations - All Participants**

		Vocab	Syntactic Awareness	Working Memory	MCA
Vocab	Pearson Correlation	1	.808	.612	.094
	Sig. (2-tailed)		.000	.000	.542
	N	44	44	44	44
Syntactic Awareness	Pearson Correlation	.808	1	.576	.098
	Sig. (2-tailed)	.000		.000	.525
	N	44	44	44	44
Working Memory	Pearson Correlation	.612	.576	1	.295
	Sig. (2-tailed)	.000	.000		.052
	N	44	44	44	44
MCA	Pearson Correlation	.094	.098	.295	1
	Sig. (2-tailed)	.542	.525	.052	
	N	44	44	44	44

*. Correlation is significant at the 0.05 level (2-tailed).

Table 2**Correlations – L1**

		Vocab	Syntactic Awareness	Working Memory	MCA
Vocab	Pearson Correlation	1	.533*	.488*	-.387
	Sig. (2-tailed)		.011	.021	.075
	N	22	22	22	22
Syntactic Awareness	Pearson Correlation	.533*	1	.414	-.270
	Sig. (2-tailed)	.011		.055	.224
	N	22	22	22	22
Working Memory	Pearson Correlation	.488*	.414	1	-.192
	Sig. (2-tailed)	.021	.055		.391
	N	22	22	22	22
MCA	Pearson Correlation	-.387	-.270	-.192	1
	Sig. (2-tailed)	.075	.224	.391	
	N	22	22	22	22

*. Correlation is significant at the 0.05 level (2-tailed).

Descriptive Statistics

	Mean	Std. Deviation	N
Vocab	33.14	2.949	22
Syntactic Awareness	21.27	2.640	22
Working Memory	26.27	2.453	22
MCA	.8182	.39477	22

Table 3**Correlations – L2**

		Vocab	Syntactic Awareness	Working Memory	MCA
Vocab	Pearson Correlation	1	.745**	.349	-.147
	Sig. (2-tailed)		.000	.112	.513
	N	22	22	22	22
Syntactic Awareness	Pearson Correlation	.745**	1	.301	-.078
	Sig. (2-tailed)	.000		.174	.730
	N	22	22	22	22
Working Memory	Pearson Correlation	.349	.301	1	.426*
	Sig. (2-tailed)	.112	.174		.048
	N	22	22	22	22
MCA	Pearson Correlation	-.147	-.078	.426*	1
	Sig. (2-tailed)	.513	.730	.048	
	N	22	22	22	22

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Descriptive Statistics

	Mean	Std. Deviation	N
Vocab	27.68	3.301	22
Syntactic Awareness	16.27	2.979	22
Working Memory	23.36	2.381	22
MCA	.4091	.50324	22

When looking at the regression models, Table 4 shows when all participants are combined the variable of working memory is slightly significant to reading comprehension at $p < .052$ while the variables of vocabulary and syntactic awareness did not show significance. Regressions run with L1 show vocabulary to be a significant contributor to reading comprehension (pass MCA) at $p < .033$ with other variables being insignificant (Table 5). When the regression was run with all three variables included on the L1 group, vocabulary did not continue to show significance. Regressions run with L2 show working memory at the significant level $p < .021$ with all other variables not showing significance (Table 6). Regressions run with all three variables included with L2 participants show working memory to still be significant to reading comprehension at $p < .023$ with all other variables insignificant.

Table 4

REGRESSIONS All Participants														
	Model Summary				ANOVA					Coefficients				
	R	R square	Adjusted R square	Std. Error of the Estimate	Sum of Squares	df	Mean square	F	Sig.	B	Std. Error	Beta	t	Sig.
Vocab	0.094	0.009	-0.015	0.50099	0.095	1	0.095	0.377	0.542	0.011	0.018	0.094	0.614	0.542
					10.542	42	0.251							
Syntactic Awareness	0.098	0.01	-0.014	0.5008	0.103	1	0.103	0.41	0.525	0.013	0.02	0.098	0.641	0.525
					10.533	42	0.251							
Working Memory	0.295	0.087	0.066	0.48078	0.928	1	0.928	4.016	0.052	0.052	0.026	0.295	2.004	0.052
					9.708	42	0.231							
All variables	0.315	0.099	0.032	0.48934	1.058	3	0.353	1.473	0.236	-	0.014	0.032	-0.12	0.488
					9.578	40	0.239			-	0.003	0.034	0.026	-0.1
										0.068	0.034	0.384	1.99	.053

* vocab

** syntactic awareness

*** working memory

Table 5

REGRESSIONS L1															
	Model Summary	R	Adjusted R square	Std. Error of the Estimate	ANOVA					Coefficients					
					Sum of Squares	df	Mean square	F	Sig.	B	Std. Error	Beta	t	Sig.	
Vocab	0.456	0.208	0.169	0.44896	1.06	1	1.06	5.256	0.033	-	0.076	0.033	0.456	2.293	0.033
					4.031	20	0.202								
Syntactic Awareness	0.177	0.031	-0.017	0.4966	0.159	1	0.159	0.643	0.432	-	0.033	0.041	0.177	0.802	0.432
					4.932	20	0.247								
Working Memory	0.308	0.095	0.05	0.47996	0.484	1	0.484	2.1	0.163	-	0.062	0.043	0.308	1.449	0.163
					4.607	20	0.23								
All Variables	0.478	0.228	0.099	0.46726	1.161	3	0.387	1.772	0.188	-	0.076	0.044	0.456	1.742	.099
					3.93	18	0.218	0.023			0.023	0.047	0.123	0.491	0.63
											-	0.028	0.049	0.137	0.565

* vocab

** syntactic awareness

*** working memory

Table 6

REGRESSIONS L2														
	Model Summary				ANOVA					Coefficients				
	R	R square	Adjusted R square	Std. Error of the Estimate	Sum of Squares	df	Mean square	F	Sig.	B	Std. Error	Beta	t	Sig.
Vocab	0.033	0.001	-0.049	0.51539	0.006	1	0.006	0.021	0.889	0.005	0.034	0.033	0.146	0.866
					5.313	20	0.266							
Syntactic Awareness	0.078	0.006	-0.044	0.51409	0.032	1	0.032	0.122	0.73	0.013	0.038	0.078	0.35	0.73
					5.286	20	0.264							
Working Memory	0.488	0.238	0.2	0.45019	1.265	1	1.265	6.24	0.021	0.103	0.041	0.488	2.498	0.021
					4.053	20	0.2003							
All Variables	0.511	0.262	0.138	0.46709	1.391	3	0.464	2.125	0.133	0.032	0.047	0.208	0.672	0.51
					3.927	18	0.218			0.012	0.051	0.071	0.234	0.818
										0.114	0.046	0.539	2.488	0.023

* vocab

** syntactic awareness

*** working memory

Chapter 5: DISCUSSION

As stated earlier, the factors related to reading comprehension are numerous.

Researchers have given us theories and models from which to attempt our understanding of the multifaceted skill of reading comprehension. Among these theories, Gough and Tunmer (1986) gave us the simple view of reading which breaks down reading comprehension into two components decoding (combining, deleting, or substituting sounds to make or read words) and linguistic comprehension (interpreting lexical information at the sentence and discourse level, such as vocabulary and syntactic awareness skills). Joshi and Aaron (2000) used the component model of reading with three influences on reading comprehension: *cognitive* (word recognition, oral language, comprehension), *psychological* (motivation, interest, teacher expectation, gender), and *ecological* (teacher knowledge, dialect, socioeconomic status (SES), home environment).

While these theories help us to understand the process through which English reading skill and comprehension are achieved, it is not certain if learning to read in English as a second language follows the same format. The Threshold Hypothesis by Cummins (1979) helps us to understand that learning English as a second language may include first mastering specific levels, or thresholds, of understanding before being able to master upper level processes in reading development. The Linguistic Interdependence Theory, also by Cummins (1979) show us that native language proficiency can be transferred to second language acquisition. The purpose of this study was not to determine the exact nature a second language learner develops reading comprehension, but rather to isolate a small part of the cognitive development of English reading comprehension in second language learners and to see what correlations existed between English reading skills and English reading comprehension in second language learners in order to better understand the development of English reading comprehension.

The first research question that this study addressed was: *What is the correlation between English language processing skills of syntactic awareness, vocabulary and verbal working memory and reading comprehension in L2 learners?* The results show that for both the correlation and regression analyses the variable of working memory was significant to reading comprehension with second language learners (L2). This was shown to be true when all three variables of working memory, vocabulary and syntactic awareness were included together in the regression analysis as well as when working memory was separated out from the other variables. The variables of vocabulary and syntactic awareness did not show significance in either of these analyses. Because of the straight-forward results, question 2, *which area of oral language processing (syntactic awareness, vocabulary, verbal working memory) has a higher correlation to reading comprehension*, was also answered being that the results showed only one variable (working memory) to have significance to reading comprehension with second language learners (L2). When we look at what working memory entails we can see that it is quite complex, involving the ability to decode incoming information, retrieve previously learned language rules and remember the context of what was read (Gholamain & Geva, 1999, Lesaux, Lipka & Siegel, 2006, Lipka & Siegel, 2011, Low & Siegel, 2005, Swanson et. al., 2011, Swanson, 2015). In essence, learners must have a good understanding of English syntactic awareness and vocabulary in order for their working memory to function properly for reading comprehension to occur. These results could be interpreted as support of Cummin's Threshold Theory (1979). It is likely that L2 learners in this study had not reached the first threshold of language acquisition and were still struggling with remembering vocabulary meanings and/or the grammar of the language while reading, which would completely fill their working memory capacity, leaving little room for comprehending what was being read. Studies done by Alptekin and Ercetin (2010), Low and

Siegel (2005), Lipka and Siegal (2011) and Babayigit (2014) found working memory to be a predictor of English reading comprehension by L2 participants. Second language learners in these studies who performed poorly on tests of working memory also performed poorly in reading comprehension. These mentioned studies did not all contain the same variables as did the current study and some did not factor out working memory as a separate variable but rather grouped it into all oral language measures. It is interesting to see in the current study when working memory is grouped with syntactic awareness and vocabulary that it stands out as an important factor in reading comprehension.

For the final question, *what correlation exists between L2 learners of Spanish native language background and native English speakers in the areas of English language processing skills and reading comprehension in English*, the results show that English participants (L1) had a higher correlation to reading comprehension with the variable of vocabulary rather than working memory as did Spanish native speakers (L2). Again, these results would suggest support the Threshold Hypothesis (Cummins, 1979). It is possible that the native English speaking participants had achieved proficiency in the literacy skills required of the first threshold and their working memory was able to function properly for reading comprehension to occur without having to struggle with first understanding the syntax of what was being read. A study done by Kieffer and Vukovic (2012) also found a correlation between low scores on vocabulary and listening comprehension with low reading comprehension for native English speakers, but results were the same for Spanish L2 learners.

Limitations

This study contained a few limitations, one being the low number of participants. It may be difficult to draw strong conclusions from the data given the $n=22$ of each respective group (L1

and L2). Because of difficulties securing willing school districts to participate in the study, participants were limited to the one school district. This reason also leads to the second limitation of the study, that being the range of grades (3rd-8th) present in the data. Some may view this as a limitations when looking at the results because of the wide range of ages and abilities. It might be more useful to focus on one particular grade in order to see larger impacts of the variables on reading comprehension.

Implications

The pedagogical implications of this study would indicate that the development of English vocabulary and syntactic awareness in second language learners is necessary for learners to achieve reading comprehension. When learners must focus too much of their attention on these skills while reading, working memory is not able to function properly to effectively retain comprehension. Most English instruction for second language learners already places much importance on the teaching of vocabulary and grammar so to imply that teachers should include these skills in their curriculum is redundant. Rather, an effort to include vocabulary and grammar instruction within context that L2 learners are able to utilize effectively may be more helpful. As stated earlier, many L2 learners may be beginning their English instruction with very little exposure to literacy in their native language. Recognizing this fact, and creating curriculum that scaffolds and supports vocabulary and grammar instruction will be necessary to build background from which learners may be able to make understanding of these new concepts.

Chapter 6: CONCLUSION

The goal of any reading instruction is for learners to achieve reading comprehension. The numerous factors that relate to English reading comprehension have been analyzed and studied for many years. Multiple theories exist in how reading comprehension is achieved, but research is less extensive in determining if the same factors that affect native English learners ability to achieve reading comprehension are the same or different for second language learners learning to read in English (Babayigit, 2015). This study isolated three variables to reading comprehension, vocabulary, syntactic awareness and working memory, in an effort to determine if a correlation existed for native English speakers and native Spanish speakers. The results from this study were somewhat straight-forward and showed that for native English speakers, vocabulary was the only variable significant to reading comprehension. For native Spanish speakers, working memory was the only variable significant to reading comprehension. These results could have practical implications for teachers of second language learners.

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