MARKERS OF DYSLEXIA IN ADULT SPANISH-SPEAKERS WHO REPORT SEVERE DIFFICULTY LEARNING ENGLISH

By

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Abstract

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by

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The relationship between native-language reading ability and second-language (L2) learning was explored in a cohort of 60 adult Spanish-speakers learning English as a second language. The research questions centered on whether underlying native-language deficits associated with dyslexia would be present in a subset of English Language Learners who reported severe difficulty learning English. Our participants were divided into two education groups (below and above12th grade). These two groups were classified into three groups based on self- and teacher- ratings of ease or difficulty in English learning ability: for the high-education group, Poor English Language Learners (PELL, N=7); Good English Language Learners (GELL, N=6); and English Language Learners with a range of average ratings (PEER=17); for the low-education group, PELL-Low education (PELL-Low ed., N=9) and PEER-Low education (PEER-Low ed., N=21).

Three hypotheses were tested in Spanish: That, among the PELL group H1) phonology-spelling deficits would adversely influence decoding, phonological

awareness and spelling to dictation; H2) orthographic-lexical deficits would adversely influence word recognition and sentence reading; and H3) longer latencies in the speed of visual-verbal associations would be evident in rapid automatized naming tasks, suggesting problems in rapid retrieval during online reading.

Overall, testing supported each of the hypotheses posed. For H1, the PELL group took longer than the GELL group in decoding time. Trends toward longer decoding time and poor spelling were found when the PELL group was compared with the PEER group. Phonological awareness did not reveal differences among the groups. For H2, the PELL group took longer to identify correct word spellings than the GELL and the PEER groups. The PELL group took longer in reading sentences when compared with the GELL and PEER groups and was less accurate than the GELL group. For H3, the PELL group took longer in the rapid naming of letters when compared with the GELL and PEER groups. They were also less accurate than the GELL and PEER groups. The PELL group took longer in the rapid naming of colors than the GELL and PEER groups. They were less accurate in the rapid naming of objects when compared with the GELL and PEER groups.

We conclude that previously unidentified native language deficits associated with dyslexia can be found in a subset of English Language Learners who report experiencing severe difficulty in their ability to learn English as a second language.

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TABLE OF CONTENTS

TABLES

FIGURES

Chapter I: Introduction

In this doctoral dissertation we examine whether specific problems reflected in the native language of Spanish-speaking adults (19-49 years of age) learning English as a second language may explain the difficulties some of them report in learning and reading English.

This investigation was motivated by my experiences as a speech-language pathologist in working with a subset of Spanish-speaking clients, both children and adults, who report difficulty learning and reading in English. Many of these students often attend English as a second language classes (ESL) for years with little success. A consensus among students and their teachers is often to report difficulty in their overall ability to learn English, which is most often compounded by difficulties in reading English.

In designing this dissertation, several factors were considered as sources of difficulty in the learning of English as a second language. Orthographic differences between English and Spanish can pose special challenges for English language learners (ELLs), given the highly consistent phoneme-to-grapheme correspondence in Spanish and the less systematic correspondence in English. Difficulties in learning a foreign language (FL) can be influenced by native language reading strategies. How we first learn to read can influence how reading is approached in a second language and may pose difficulty when moving from a more consistent to a less consistent orthography (Ijalba and Obler, 2002). ESL learning difficulties can also be attributed to social factors, such as reasons for immigrating and the resulting social class and educational opportunities found in the United States. Taking into account these social differences has been an important

focus of the current study, lest the results obtained would primarily reflect social conditions.

A central consideration in this research is that whereas there are many reasons for difficulty in learning English, deficits in underlying reading and FL learning abilities are among the primary reasons why some individuals experience extreme difficulty in learning English. To identify such a group by testing them for characteristics of dyslexia in their native language and predicting their English learning ability is congruent with research that links native language proficiency and second or foreign language learning ability (see Sparks, Patton, Ganschow, Humbach & Javorsky, 2006). This study is expected to shed light into how native language and second language learning interface in core linguistic processes implicated in reading. Further understanding of these interactions will assist us in identifying and providing remediation for a subset of English language learners who face disproportional difficulties in their ability to learn English.

Undertaking a study of dyslexia in Spanish-speakers learning English as a second language requires knowledge from a broad range of perspectives and disciplines. The following pages include a review of the literature on the problems in the learning of a foreign language and in the neuropsychology of reading. The research questions to be explored in this dissertation and the design of this study evolve from core findings in these major research areas.

Literature Review

2.1. Reading and the learning of a foreign language

A body of research in foreign language (FL) learning originates from the problems reported by university students who must fulfill their FL college requirement and experience difficulty learning a FL (e.g., Sparks and Ganschow, 1993; Ganschow et al., 1998; Ganschow and Sparks, 2000; Sparks et al., 1998; MacIntyre, 1995). Other related research stems from bilingual education and the needs of students in the process of learning ESL (e.g., Cummins, 1979, 1997; Hakuta, 1985; Baker, 1997; August and Hakuta, 1998). A common finding in both types of literature is that FL learning is related to proficiency in native-language skills.

Whereas one perspective focuses on general "transfer" from L1 to L2 (see Cummins, 1979, 1983, linguistic interdependence hypothesis), a more modular perspective focuses on the specificity of FL learning, particularly phonological processing. Sparks and Ganschow (1993a) propose that if phonological problems are the root of difficulty in L1 learning within the oral and written modalities, these same phonological difficulties are also likely to cause oral and written language problems in L2. As a result of evolving research showing the links between L1 and L2 processing, Sparks and Ganschow (1989, 1991) postulated the Linguistic Coding Differences Hypothesis (LCDH) which states that individual differences in FL learning derive from inefficiency in the phonological, syntactic, and semantic codes. These deficits may be overt or subtle in the native language and are likely to also affect the learning of a FL.

One way of determining the deficits of FL learners who experience excessive difficulty in FL learning is to compare them with successful FL learners on core language

processing tasks. In a study aimed at differentiating good FL learners from poor FL learners, Ganschow et al. (1991), administered a set of phonological, syntactic, semantic, writing and cognitive measures (IQ) to two groups of college students. One group (N=15) were successfull FL learners and the second group (N=15) were unsuccessful FL learners who had petitioned for a waiver from the FL requirement. Results indicated that students with FL learning problems performed poorly on all phonological tasks, on English spelling, on syntactic measures (both oral and written) and in math calculation (verbal problems). The students did not differ from successful FL learners on intelligence measures (WAIS-R) and there were no significant differences between the groups on measures of reading comprehension in English. The authors concluded that students experiencing difficulty in learning a FL have specific language-based problems, particularly in phonology, spelling, and syntax, that if detected in L1 could effectively predict problems in learning a second language.

Many of the studies conducted with students who experience difficulty in FL learning consistently show a link between the levels of native language proficiency, reading and writing and attained FL language proficiency. Sparks et al. (1992) found that measures of reading and writing in the native language were predictive of FL learning. The authors compared regular and learning-disabled high-school students on L1 measures of semantics, phonology, syntax, reading comprehension and vocabulary. Results showed that what best differentiated between the two groups of students and were also predictive of FL learning and proficiency, were the measures of spelling and word recognition (i.e. reading) in the students' native language. In two later but related studies, Sparks et al. (1997, 1998) evaluated 10th and 11th grade students to determine the best

predictors of FL proficiency. In the first study, the authors found that word decoding in the FL and measures of receptive vocabulary in the native language were among the best predictors. In the second study with the same group of high-school students, Sparks et al. (1998) compared overall FL proficiency and performance on measures of native-language, including receptive vocabulary and reading comprehension. Their findings again confirmed that students who had higher performance in their native language also attained higher FL proficiency.

More conclusive evidence on the importance of native language proficiency was revealed in a 10-year longitudinal study that tracked 54 1st grade elementary students through 10th grade to determine best native language predictors of FL proficiency and FL aptitude (Sparks, Patton, Ganschow, Humbach, Javorsky, 2006). The students were tested at the beginning and end of 1st grade, and again at the end of their 2nd, 3rd and 5th grades by a battery that included reading, receptive vocabulary and cognitive ability (verbal IQ) measures. Results revealed that native language written measures (readiness, reading, spelling) were the best predictors of later FL proficiency, whereas, native language receptive vocabulary was only a good predictor of FL proficiency in the 1st and 2nd grades. Native language reading proficiency measures were the best predictor of FL proficiency at the end of 5th grade. Native language spelling measures were found to account for most of the variance in FL aptitude. The authors concluded that students who read more, over time have better native language skills which result in stronger FL aptitude. This conclusion led them to speculate on the link between longitudinal relationships among early home literacy experience, FL aptitude and FL proficiency.

Early native language literacy has a positive effect on native language literacy in the school years, which in turn influences oral and written FL proficiency.

Given the link between native language proficiency and FL learning, research shows that efficient teaching can result in cross-language transfer. In addition, teaching techniques that help dyslexic L1 learners can also help L2 learners who find L2 learning difficult. Specifically, FL teaching that addresses building the language skills in L1 has sustained benefits in the learning of a FL. The use of a multisensory structured language (MSL) teaching approach of the sort often used to help dyslexic L1 learners (Orton-Gillingham, Slingerland, LiPS) in the areas of phonology-orthography, grammar and vocabulary has been found to be the most effective in improving language performance across L1 and the FL being learned (Sparks and Miller, 2000). An MSL approach in the teaching of a FL includes simultaneous use of the students' visual, auditory and tactile-kinesthetic skills. It emphasizes the teaching of phonology-orthography relationships and the grammar-morphology systems of the FL. The lessons are generally taught in both the L1 and the FL and they follow a carefully sequenced approach from the most simple to the most complex sound-spelling relationships, grammatical rules and morphological awareness. Sparks et al. (1992c) reveal the effectiveness of MSL teaching in a study with English-speaking high-school students at-risk in the learning of Spanish as a FL.

Participants in this study made gains in native language phonology-orthography, vocabulary and verbal memory when taught through a multisensory teaching approach that first addressed phonology-orthography and grammar in L1 and then explained these skills in the FL language (Spanish). This same group of students retained their benefits in both L1 and in Spanish one year later when they were examined in a subsequent study

(Sparks & Ganschow, 1993). For a comprehensive review of the effectiveness of MSL in the teaching of FL, see Sparks and Miller (2000).

Research that aims to identify the causes of FL learning difficulty and to determine the effectiveness of remedial teaching is particularly relevant to educators. In a study by Downey, Snyder and Hill (2000), college students identified as having FL learning difficulty were compared with successful FL learners. The students with FL learning difficulty were found to score low on all measures of phonological coding skills. For example, these students performed significantly lower than successful FL learners ($p<.001$) on a pig-latin task that required isolation of the initial sound in a word, placing the initial sound at the end of the word, adding 'ay' to the word and phonetically blending the resulting string. These students also scored significantly lower than successful FL learners on single-word decoding and on English spelling. They had difficulty repeating nonwords, however, they showed no difference from good FL learners on measures of real-word repetition. Students with FL learning difficulty did not differ from the successful FL learners in measures of reading comprehension (on the Nelson-Denny Test) or in vocabulary, suggesting that they used semantic knowledge to compensate for phonological deficits in their daily L1 performance.

In reviewing the Sparks & Ganschow studies and Downey et al.'s research, we find that measures of receptive vocabulary in L1 are not always predictive of a FL learning problem. Several reasons may account for this variability, however, the age of the participants at testing seems to make a difference. In the Sparks & Ganschow studies, the participants were high-school students (10th grade), whereas in the Downey et al. study the participants were college-level students. In the Sparks et al. (2006) longitudinal

study, native language receptive vocabulary was found to be a good predictor of later FL proficiency only in the early grades, again suggesting that the experience that comes with age may diminish the predictability of L1 vocabulary in determining FL learning success. These differences suggest that even when L1 vocabulary levels improve with additional years of education, core deficits in phonological processing remain present and interfere with FL learning.

To summarize, there is a substantial body of literature linking problems in learning a second or a foreign language and reading difficulties. Deficits in phonological processing and in establishing phonology-orthography associations are reported as common core deficits in students who find learning a second or a FL to be difficult. These studies are apparently tapping into core linguistic-orthographic processes that are accessed both in learning a FL and in reading. Among the teaching methods that allow students to compensate for these deficits, the use of a multisensory approach linking phonology and orthography, has been found to be successful. A more detailed exploration of what constitutes dyslexia or reading impairment and the neurocognitive basis of reading and reading disorders follows.

2.2. Research-based definition of dyslexia

Reading is a complex process that involves the function and integration of several subprocessing skills ranging from lower-level processes (e.g., decoding, word identification, etc.) to higher-level abilities (e.g., syntactic parsing, extracting structures from text, etc.). Given the multicomponential nature of this process, the separate skills required in different orthographies, and the variety of deficits that have been reported among dyslexics, a unitary definition of dyslexia within a developmental perspective is

particularly difficult. Rayner and Pollatsek (1989) ascribe this failure in reaching a consensus to two main factors: the samples of so called "dyslexic individuals" studied often include poor readers who are not dyslexic, and the belief of many researchers that all dyslexics are alike. Rayner and Pollatsek posit that these two factors have influenced which the tasks are selectively chosen so that the deficits shown by dyslexics are likely to be in accordance with the particular theoretical biases of the experimenter.

In 1968, the World Federation of Neurology (WFN) attempted to promote consensus by elaborating a definition of dyslexia based on broad guidelines, exclusionary criteria (e.g.: to be identified as dyslexic, a child must have conventional instruction, normal intelligence and socio-cultural opportunity), discrepancy between reading performance and intelligence, and the biological nature of the deficits:

> "Dyslexia is a disorder manifested by a difficulty in learning to read despite conventional instruction, adequate intelligence and socio-cultural opportunity. It is dependent upon fundamental cognitive difficulties, which are frequently of a constitutional character."

Building upon this early definition of dyslexia and in response to more recent research, Lyon (1995) and Lyon, Shaywitz and Shaywitz (2003) provided the following definition of dyslexia, which is endorsed by the National Institutes of Child Health and Human Development (NICHD):

> "Dyslexia is a specific learning disability that is neurobiological in origin. It is characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction. Secondary consequences may include problems in reading

comprehension and reduced reading experience that can impede growth of vocabulary and background knowledge."

Among the changes evident in the more recent definition when compared with the WFN definition, intelligence or IQ are no longer included. In the guidelines to interpreting the definition, Lyon et al. state that "unexpectedness" should be assessed via comparisons of reading age with chronological age and/or by comparing reading ability to educational level and professional level of attainment. Another important change in this definition is the substitution of the vague terms "conventional instruction" with "effective classroom instruction". The researchers specifically explain the need to carefully document the individual's instructional history, particularly because "lack of response to scientifically informed instruction" is one of the factors that differentiate severe reading deficits from reading failure due to inadequate instruction.

Whereas the Lyons et al. definition is more comprehensive and precise than earlier definitions of dyslexia, it can be subsumed under the category of "unitary" definitions because it ascribes the presence of reading deficits to one underlying cause, the "phonological component of language". However, Coltheart and Jackson (1998) disagree with defining dyslexia as requiring the presence of demonstrable phonological difficulty because of the many reported cases in the literature of children whose main difficulty is in establishing sight vocabulary while having normal ability to map from letters to sounds (Castles and Coltheart, 1993; Manis et al. 1996; Manis, Seidenberg and Keating, 1999). One of the purely orthographic tasks used in testing for surface dyslexia (which manifests as difficulty with sight vocabulary) is to identify a real word from pseudohomophones, as in, "which is a word, rain or rane?" Coltheart and Jackson argue

that if a genetic influence on dyslexia has been demonstrated on tasks involving phonological coding, there is also ample evidence of orthographic coding deficits on tasks as the above, which require only orthographic recognition because both words have the same phonological structure.

A more realistic conceptualization of dyslexia than the one provided in unitary explanations and in definitions that use exclusionary criteria to predetermine who is or is not "dyslexic" is one that provides an interpretation of the reading process and its alterations in one or more of its subprocessing systems. According to Coltheart and Jackson, inquiring about what is wrong, "which subsystem or subsystems is the reader having difficulty using" provides a hypothesis on the proximal cause of the reading problems. Inquiring as to "why" the individual has not developed an adequate reading system provides a hypothesis on the distal causes of the disorder. In following this format, we may find that in answer to "what is wrong" (which subsystem is altered) a reader may have difficulty with the establishment of grapheme-to-phoneme associations (mappings between letters and letter-strings to phonology). When we ask "why", it may be that the individual comes to the task with poorly specified phonological representations. However, for another reader with the same proximal cause (difficulty establishing grapheme to phoneme associations) the distal cause may be instruction that eschewed the teaching of phonics. Coltheart and Jackson's approach of looking at proximal and distal causes eliminates the need for exclusionary criteria in the diagnosis of reading disorder. Reading problems can only be explained by analyzing proximal causes or the main processes underlying reading.

2.3. The neurocognitive basis of reading and reading impairment

Our knowledge of how reading is processed comes in great measure from cases of acquired dyslexia (impaired reading after brain damage in someone who was able to read premorbidly) and also from cases of developmental dyslexia (difficulty learning to read in spite of normal intelligence and educational opportunities). The early interpretations of developmental dyslexia centered on visual deficits as exemplified by the term "congenital word blindness" (Pringle-Morgan, 1896; Hinshelwood, 1917). More recent interpretations attribute dyslexia to a language deficit (e.g., Vellutino, 1979). The multicomponential aspects of reading have generated difficulty in reaching a uniform interpretation of the disorder. Coltheart (2001) cautions against a unitary characterization of dyslexia by pointing out that in order for reading development to proceed smoothly, several reading subsystems must operate and interact (i.e.: a letter-recognition system, a word recognition system, a letter-to-sound rules system, etc.).

2.3.1. Dual-route processing

Reading can be described as deriving meaning from print. Whereas skilled readers can access semantic, syntactic and phonological forms from print, cognitive models of reading attempt to delimit these processes by focusing on word recognition (see Ellis, 1999). In dual-route models of reading (Coltheart, Patterson & Marshall, 1980b, 1987b) new or unfamiliar words and nonwords can be decoded and "sounded-out" by grapheme-to-phoneme conversion through a sub-lexical route. Familiar words, which have often been encountered in print are 'recognized' without the need for decoding and irregularly spelled words must also be 'recognized' to be read. Familiar and irregularly spelled

words are accessed via a lexical route, which allows immediate access to their meaning. Whereas both cognitive routes are known to play important roles in reading acquisition, the lexical route (word recognition) is the primary mechanism that proficient readers use. The sublexical route (decoding) plays a greater role at beginning reading stages and remains as an alternative mechanism used by proficient readers when orthographically-mediated lexical access fails.

A recently revised conception of dual route theories, the Dual Route Cascaded (DRC) model, provides feedback and interaction along the sublexical and lexical routes. When the reader encounters print, letter representations activate their corresponding phonemes while the orthographic lexicon is activated in parallel. Interaction among parallel modules includes excitatory and inhibitory connections to and from lower and higher levels. Regular words, exception words and nonwords are then processed by one or the other routes (Coltheart et al., 2001).

2.3.2. Visual-lexical processing

The visual recognition of printed words has been the topic of much research in the psychology of language and reading (Rayner and Pollatsek, 1989; Willows, Kruk and Corcos, 1993; McCandliss, 2006). One of the reasons why sight word recognition is so important is that fluency and reading comprehension are largely dependent on the effectiveness with which readers are able to rapidly and accurately recognize words as they read. A well-grounded understanding of the underlying cognitive processes involved in word recognition is basic to the study of higher reading processes and also to the evaluation and diagnosis of reading deficits.

According to Ellis (1998) the *visual analysis system* is the first module involved in processing a printed word. It must first identify different letters of the alphabet on a printed page by activating abstract letter identities and also by noting the position of each letter within a word. It is in this way that the reader can differentiate between words such as POT and TOP that contain the same letters but in different positions. Once the visual analysis system has encoded letter identities and positions, this information is relayed to the *visual input lexicon*, which contains representations of the written forms of all familiar words. It is estimated that by 3rd grade, children are able to recognize 80,000 words (Carroll et al., 1971; Adams, 1990). Ellis describes these orthographic representations (sight vocabulary) as "word recognition units". Beginning readers acquire word recognition units through repeated encounters with words. For instance, Reitsma (1983) found that beginning readers were able to develop a memory for "sight words" and significantly decrease their reading time in as few as four encounters with most words. It is unclear whether Reitsma establishes if these newly acquired "sight words" are already part of the child's spoken vocabulary prior to the reading exposure, a factor that should influence the "ease" with which sight words are achieved.

2.3.4. Dyslexia classifications

Categorization of those impaired reading subskills that are present in dyslexic readers has lead to quite similar descriptions of developmental dyslexia. The main dyslexia classifications that emerge from the literature focus on deficits in the areas of auditory-phonological and/or in visual-orthographic processing. For example, Coltheart & Castles (2003) describe dyslexic readers who experience difficulty in establishing the mappings between letter strings and phonology, a skill that requires auditory-

phonological processing (developmental phonological dyslexia). By contrast, other dyslexic readers experience difficulty in establishing a large sight vocabulary and their main difficulty appears to be visual-orthographic (developmental surface dyslexia). The two main categories of auditory-phonological and visual-orthographic processing have also been identified and described over the years by different researchers.

Boder (1973), for example, identified three subtypes of dyslexic readers: two similar to those identified by Coltheart and Castles and a combination of these two. She described the "dysphonetic" whose main difficulty is in associating symbols with sounds and who are very poor spellers (they make-up the majority of dyslexic readers); the "dyseideitic" who have particular difficulty in vision and memory for letters and word shapes, thus, having great difficulty in developing a sight vocabulary; and the mixed dyseidetic-dysphonetic dyslexic readers who experience deficits in both developing a sight vocabulary and in phonetic skills.

More recently, Wolf & Bowers (1999) took a similar approach and proposed the double-deficit hypothesis in which two main deficit categories and a combined one are described. The categories described in the double-deficit hypothesis are, however, markedly different from those of Coltheart & Castles and Boder. In the double-deficit hypothesis, the "phonological-deficit readers" experience phonological processing problems. Their main difficulty lies in establishing the phonological representation of words and in learning sound-to-letter correspondences. Conversely, the "naming-speed deficit readers" experience naming-speed problems for visually presented symbols. They have difficulty automatizing the reading of familiar words and must therefore rely on decoding. The combined-deficit type constitutes the most impaired readers. They

experience difficulty in both, phonological processing and in naming-speed. In this double-deficit form, impaired readers have few compensatory strategies and remediation is more difficult.

The classification of dyslexia subtypes is controversial because in most developmental dyslexic readers the distinction between phonology and orthography is not entirely clear. Castles & Coltheart (2003) state that the reading deficit should be evaluated as an "imbalance" between the phonological and word recognition processes, since both deficits may be present in the same reader but one deficit will be prevalent . On the other hand, Stanovich et al. (1996) contend that only phonological deficits constitute true "deviancy" in reading and that the "surface" dyslexia type (difficulty in establishing word recognition) should be interpreted as a developmental lag. Their position is sustained by the fact that the child who experiences difficulty in learning to read will not have sufficient exposure to print in order to learn to "recognize" familiar words. By their analysis, it is therefore unjustified to ascribe the word recognition deficit to an "impaired lexical route".

The neuropsychological models discussed above date from the 1970's. Interestingly, over the past 30 years the focus of many researchers has narrowed to identifying deficits in phonological processing as the principal cause in developmental dyslexia (see National Reading Panel, 2001) . A core deficit in phonological processing interferes with encoding, retrieving and using phonological codes in memory. It may also be evident as poor phonological awareness and errors in speech production (Kamhi, 1992). A comprehensive account of the core phonological deficit in dyslexic readers is found in the phonological representations hypothesis formulated by Snowling (2000).

This proposal ascribes a wide range of cognitive and verbal problems to the fact that dyslexic readers store "fuzzy" or imprecise phonological representations for words. Among the consequences of the phonological representations deficit, dyslexic readers encounter limitations in verbal short-term memory, naming difficulties and poor repetition ability. Poor reading performance is, however, the direct result of deficits in phonological awareness and in paired-associate learning, both tasks that are closely related to the phonological representations deficit.

To summarize, theoretical models of dyslexia, clinical observations and experimental studies consistently report that dyslexic readers experience auditory-verbal deficits in the areas of phonological processing, short-term and long term verbal memory, and even in speech production. Deficits in the visual-orthography domains have also been recognized and are primarily evident in serial rapid-naming tasks, difficulty establishing word recognition and in spelling deficits. An obvious conclusion from these theoretical positions is that phonology and orthography constitute highly interactive and closely linked processes in the acquisition of reading.

2.4. Reading processes in different orthographies

Languages have different orthographies that place various levels of cognitive-linguistic processing demands on their readers. In an alphabetic orthography such as English, letters may represent more than one phoneme and phonemes may be represented by more than one letter. In addition, readers must learn several spelling-pronunciation rules, e.g., GPC and spellings for vowels, the use of final 'e', letter combinations and digraphs, homophone differentiation, the presence of silent letters in many words, and the underlying representation of grammatical morphemes. In contrast, Spanish orthography

maintains a consistent phoneme-to-grapheme correspondence and the pronunciation of words can be easily derived from their written form. Readers face few challenges, with the exception of a number of letters (v, b, y, ll, c, s) that can correspond to more than one phoneme. In addition, the number of syllables and the final consonants in words help to determine the rules for stress and the placement of most diacritic accents. Thus, Spanish presents few orthographic difficulties when compared with English. Characteristics such as these help to determine why some orthographies are perceived as more or less consistent than others.

A main difference in how readers derive meaning from print in an inconsistent orthography when compared with a more consistent one, is that in addition to decoding, the reader must learn to recognize irregularly spelled words. For example, Foorman et al., (1997) estimate that approximately 13% of words in English are unpredictable from the way they are spelled and must be memorized to be effectively recognized and read. Hanna et al. (1966) point out that only in approximately 50% of English words can pronunciation be predicted from the way words are spelled. The phonology-orthography demands that are placed on English-readers are thus much greater than those for readers of consistent orthographies who can rely on univocal, or nearly univocal, sound-to-letter correspondences.

An important focus of research on the relationship between orthography and reading processes is whether dual-route processing is present in languages with varying degrees of orthographic transparency. In a consistent orthography, reading can generally be sustained by relying on decoding strategies and the "recognition" of words or large orthographic units can be avoided. Ardila, Roselli and Lecours (1993) and Ardila (1999)

posit that decoding and syllabic reading are the main strategies used by readers of Spanish. In a study which analyzed both word-frequency and word-length effects on lexical decision tasks, Ardila et al. (1993) found comparable strong effects for word frequency and for the number of syllables within words. The authors reported that the correlation between word frequency and the number of syllables was higher than the correlation between word frequency and the number of letters in words. These findings were interpreted as evidence in support of syllabic processing rather than letter-by-letter processing in Spanish readers.

Another argument in favor of sublexical reading in Spanish rests on the fact that semantic paralexias (i.e.: reading "table" instead of 'desk') are virtually absent in cases of acquired dyslexia among Spanish-readers who have suffered brain damage (Ardila, 1991). Semantic paralexias are evident when the sublexical route is impaired and the reader can only access a word's pronunciation through its meaning via the lexical route. Without phonological input, the reader often activates same-category candidates and produces semantic errors, which are widely reported in English. The virtual absence of semantic paralexias in Spanish is explained by the strong grapheme-phoneme correspondence and the regularity of the orthography, which always allows the reader some use of the sublexical route.

In a dissenting view from that proposed by Ardila, the universality of dual-route processing for reading in Spanish was investigated by Valle-Arroyo (1996). In this study, the use of sublexical and lexical processing was put to the test on lexical decision tasks with 2nd, 3rd, and 5th grade elementary students in Spain. Valle-Arroyo found that the 3rd and the 5th grade students made more mistakes than the 2nd graders in the

reading aloud of pseudowords (real words that had been altered in one letter). Whereas the reaction times were faster for the older readers, particularly the 5th graders, their reading accuracy decreased when compared with their younger peers. However, when analyzing these errors, it was revealed that rather than reading letter by letter these older students focused on recognizing the entire word, thus, often missing the alteration of a single letter. The older readers tended to "lexicalize" or read as real words the altered target words. Valle-Arroyo interpreted these findings as showing a shift from decoding to the automatization of reading processes and an increased use of the lexical route (word recognition) as readers become faster and more efficient.

Results congruent with those of Valle-Arroyo (1996) that, moreover, demonstrate increased use of "lexical" reading strategies by older readers in Spanish were found by Carrillo, Calvo & Alegria (2001). In an analysis of 46 poor readers in Spain, the authors found that students in the 5th and 6th grades were able to read non-words faster but with less accuracy than the 4th graders. At the same time, the older students performed better than the 4th graders on a lexical decision task requiring the identification of correct words from pseudohomophones (i.e.: vaso/baso). Their results were explained in relation to the influence that additional schooling provides in acquiring a better orthographic lexicon in a transparent orthography like Spanish. The authors noted, however, that in impaired readers the phonological processing problem was evident in relation to the speed of reading non-words.

A conceptualization of reading that departs from the influence of the orthography and centers on the experience of the learner is that proposed by Share (1995). He posits that in learning to read, children self-teach by learning the associations between letters

and phonemes which in turn allows them to decode and derive the meaning of words. As children progressively apply this procedure and are successful, these words become fixed into an orthographic lexicon and are used in the future for lexical reading in which words are recognized as wholes. Under this conception, both regular and irregularly spelled words become part of the orthographic lexicon and the use of the lexical route in reading depends more on experience than on the spelling regularity. The self-teaching hypothesis helps to explain why children who have more schooling demonstrate increased use of lexical processing as evident in the Valle-Arroyo and Carrillo et al. studies.

In summary, orthographic differences in writing systems influence reading processes and the strategies used in learning to read. Highly consistent alphabetical writing systems facilitate sublexical processing, whereas less consistent orthographies require more use of lexical processing for the reading of irregularly spelled words. Even with these underlying differences, dual route processing predominates across alphabetic orthographies and increased lexical processing is used by the more experienced readers.

2.4.1. Biliterates with dissociations in impaired-reading

More conclusive evidence in support of dual-route processing in reading can be found in the few but highly revealing clinical case-studies that show a dissociation between the sublexical and lexical routes (decoding and word recognition). Given the varying demands that writing systems impose on readers, it comes as no surprise that some bilingual and/or biscriptal readers may experience more reading problems in one than the other languages they know, particularly when differences in the orthographic consistency between the two scripts are present.

Consider for example the case of FE reported by Meara & Coltheart (1985). FE was a bilingual (Spanish/English) native from Colombia, residing in England for fourteen years and attending college in England. FE spoke fluent English, however, he had severe reading and spelling problems in English but only mild (mostly spelling) problems in Spanish. FE made twice as many errors reading irregular words compared with regular words in English. He also made spelling errors on more than fifty percent of the words in a spelling test and most of these errors were phonological in nature, i.e.: "serch" for search, "coff" for cough. FE also had great difficulty identifying target words from homophone pairs, i.e.: "beach" and "beech". When tested in Spanish, FE showed few reading errors for both words and nonwords. However, spelling errors in Spanish were present on words in which there was not a direct mapping between graphemes and phonemes (some letters in Spanish have more than one phoneme equivalent, i.e.: "c" = /s/ and /k/). The authors concluded that FE relied too heavily on a phonological strategy without use of a lexical route (word recognition), a pattern typical of surface dyslexia. FE showed essentially the same symptoms in English and in Spanish, but his overall performance reflected the regularity of the Spanish orthography and the reading deficit could therefore pass undetected in his native language's orthographic system.

Orthographic consistency and dual-route processing in reading apply not only to alphabetic writing systems but also to other scripts. Wydell and Butterworth (1999) report the case of AS, a bilingual (Japanese/English) adolescent who experienced severe difficulties reading in English but near normal reading in Kana and Kanji. In order to account for the dissociation that AS revealed in his ability to read Japanese (both Kana and Kanji) and English, the authors proposed the hypothesis of transparency and

granularity, which posits that irrespective of the granule or unit size (i.e.: phoneme, syllable or character), phonological dyslexia cannot be present as long as there is a one-to-one correspondence between the unit and sound. This hypothesis predicts that the occurrence rate of developmental dyslexia, particularly phonologically-based dyslexia, should be low in consistent orthographies and also unlikely in orthographies with large granules of print-to-sound mapping (such as Kanji or Chinese). The case of AS, who was an early Japanese-English bilingual schooled in the three types of script provided clinical evidence in support of this hypothesis.

Several cases of developmental dyslexia are reported in biliterate speakers of Hindi-English and Kannada-English (Karanth, 1998; Karanth, 2003) showing a similar pattern to that found in the above cases-studies. Both Hindi and Kannada use syllabic scripts with highly consistent orthographies. Increased difficulty reading and writing English as compared to either Kannada or Hindi were evident in all dyslexic readers. Moreover, the errors in reading English words reflected a reliance on phonological strategies and poor use of orthographic strategies (i.e.: "fond"/found, "does"/did). The spelling errors of these dyslexic-readers reflected phonological recoding and confirmed difficulties recalling orthographic forms (i.e.: "laf"/laugh, "tabel"/table). Most of the errors in the reading and writing of Hindi and Kannada were visual in nature and far fewer than the number of errors noted in English.

To summarize, case studies of bilingual and biscriptal readers who show a dissociation in reading one writing system better than the other, provide clear evidence of dual-route processing in reading. Dyslexia can go unnoticed in the more consistent writing systems that facilitate one-to-one print-to-sound mappings. Difficulty in reading

only becomes apparent in less consistent orthographies that require increased use of those lexical processes involved in word recognition.

2.4.2. Influence of first-reading system on subsequent learning

Bilingual speakers bring knowledge from their native language to the reading of a second language. In considering the many variables that play a role in reading and reading disorders, how a reader first learns to read may largely determine the reading strategies used by that reader when learning to read in another language. The influence of first-language reading strategies that are largely mediated by the orthography and how these first-learned reading strategies influence the learning of another language was evident in a study by Ijalba and Obler (2002). The authors compared two groups of monoscriptal readers, Spanish-readers and English-readers, on the learning of two versions of a novel writing system. In one version, the orthography of this novel writing system was consistent and maintained univocal grapheme-to-phoneme correspondence. In the second version, the orthography was rendered less consistent by allowing multiple grapheme-to-phoneme mappings with the vowels, such that each syllabic unit could have two possible pronunciations. The task of the reader was to learn the multiple grapheme-to-phoneme correspondences and to memorize only one pronunciation for the target words in the orthographically less consistent version.

Findings from this study revealed that everyone learned the orthographically consistent version of the novel writing system with greater ease than the orthographically less consistent version. However, the Spanish-readers learned the orthographically consistent version with greater ease than the English-readers, and a trend in the opposite

direction was also noted whereby English-readers outperformed the Spanish-readers in learning the orthographically less consistent version of this novel writing system.

It can be inferred that when readers are faced with the task of learning a new orthography, they tend to apply or to transfer the most reliable and/or predominant strategies used in their native language orthography. The learning of a FL and its writing system are challenging enough tasks that they require the learner to apply only those most effective reading strategies from the native language, a decoding or sub-lexical strategy for the Spanish-readers, and both sub-lexical and lexical strategies by the English-readers. The conflict may arise, however, the more that the first-language orthography and the second-language orthography differ in essential aspects, such as the grapheme-to-phoneme relationship. Research findings concur in showing that language transfer across many levels (from phonological awareness to semantic and syntactic aspects) is implicated in second language acquisition (Bialystok & Hakuta, 1994; Bialystok, 2001; August, Calderon & Carlo, 2004). August & Hakuta (1998) point out that it takes longer to learn a language that is typologically very different from the native language than one that is relatively similar, a conclusion that is borne out orthographically in the Ijalba & Obler study.

2.4.3. Impact of orthographic consistency on reading impairment

Given the differential demands that consistent orthographies vs. less consistent orthographies place on their readers, we could predict a higher incidence of dyslexia in less consistent orthographies when compared with more consistent orthographies. In fact, a significant body of research supports the claim that in more consistent orthographies than the English one, there is less severity in the manifestation of the

disorder (Lindgren et al., 1985; Wimmer, 1996; Landerl, Wimmer and Frith, 1997; Landerl and Wimmer, 2000; Landerl, 2001; Paulesu et al., 2001; Karanth, 2004).

The impact of orthographic consistency on reading impairment was studied by Landerl, Wimmer & Frith (1997) in a crosslanguage comparison between German-speaking and English-speaking dyslexic readers aged 11-13 who exhibited at least 3-4 years reading delay when compared to their peers. The main strategy used in this study was to contrast reading words with reading nonwords using stimuli that were highly similar in both orthographies in terms of meaning, spelling and pronunciation. The items varied in terms of length (one, two and three syllables) and in terms of frequency (high- and low). The groups were also confronted with a complex spoonerism task that involved phonological processing in which the onsets of two words had to be exchanged (i.e.: man and hat become han and mat).

Results confirmed the hypothesis that the same underlying phonological processing deficit would be found in both groups of impaired readers. However, the English dyslexic children suffered from much more severe impairments in reading than did the German dyslexic children. For example, the German dyslexics (N=18) read the three-syllable nonwords, which were the most difficult items, more accurately than the English dyslexic readers (N=18) read the one-syllable words. English dyslexic readers had 324 instances of incorrect pronunciation on the first vowel grapheme and the German dyslexic readers only had twenty such misreadings. An unexpected finding was that the German dyslexic readers read both high-frequency and low-frequency words with few errors, whereas English dyslexic readers had, as expected, particular difficulty with low-frequency words (10% errors on high-frequency words vs. 50% errors on low-frequency

words). The reading of nonwords posed even greater difficulty for the English dyslexics, 70% errors in three-syllable nonwords, whereas the German dyslexics had a 10% error rate. These results indicate that the German and English dyslexic readers were using different reading strategies. The German dyslexic readers effectively relied on a sublexical strategy, reading both high and low frequency words accurately. The English dyslexic readers relied on a lexical strategy, encountering great difficulty with the reading of low-frequency words. Furthermore, English dyslexic readers had great difficulty using sublexical processing in the reading of nonwords whereas the German dyslexic readers performed this task with relative ease.

In spite of these differences between the groups, the authors did find support for their hypothesis that the same underlying processing deficit would be found across the two populations. Both the German and the English dyslexic readers found the phonological processing task (spoonerisms) to be difficult. The two groups performed lower than their reading-level control groups (readers who were 4 years younger). This was a surprising finding for the German dyslexics because the same group performed relatively well on the reading of nonwords and on a spelling task, indicating recoding skills that were much higher than in those of the English dyslexic readers. The main conclusion of this study is that despite the less severe manifestation of reading problems in the German dyslexic children, the underlying neurocognitive deficit is the same.

An important cross-language comparison that also found phonological processing deficits at the core of dyslexia across more consistent and less consistent orthographies was undertaken by Paulesu et al. (2001). A central question explored in their work was whether dyslexia would show similar or different neural manifestations in dyslexic

readers of Italian, French, and English. Their research question was particularly important given the subtle manifestation of dyslexia in consistent orthographies when compared to the more severe deficits reported in English. The first hurdle that the investigators had to overcome in this study was the difficulty of identifying undiagnosed Italian dyslexic readers among college students. Their diagnostic measures included phonological-orthographic tasks used to diagnose dyslexia in inconsistent orthographies and also speed-of-naming tasks reported to be good diagnostic measures in more consistent orthographies.

In order to first identify dyslexic individuals, 1200 randomly selected students were given group tests of spelling and word-stress assignment in which they were required to mark the stressed syllable in 90 multisyllabic words. Students scoring in the bottom 10% were then assessed individually on word and nonword reading speed, digit naming, short-term memory, and spoonerisms (swapping initial consonants in word pairs). Those who performed in the bottom 10% of a normative sample on three or more of the six tasks were classified as dyslexic. Italian students with dyslexia performed better on reading tasks (particularly in the accuracy of reading words and nonwords) than did comparable English and French dyslexics. However, Italian dyslexic readers performed just as poorly as English and French dyslexic readers on reading and phonological tasks when their performance was compared to that of typical Italian readers in the control group. The authors also pointed out that the English, French and Italian dyslexic readers showed a similar pattern of poor performance on subtests that involved phonological short-term memory (digit span, arithmetic, and digit symbol) from the Wechsler Adult Intelligence Scale.

The phonological processing deficits evident in the three orthographies were also revealed on the neuroimaging measures employed, indicating a common neurobiological basis for dyslexia in spite of the degree of orthographic consistency. The Paulesu et al. study was heralded as the first one to provide evidence in support of a universal neurocognitive basis for dyslexia. It should be kept in mind, however, that in spite of a common phonological processing deficit in readers from the three orthographies, the ease or difficulty that dyslexic readers encounter is mediated by the orthography. Dyslexia may thus go largely "unnoticed" in a consistent script and only generate difficulty for the reader when learning a script that is not as consistent as the native language script.

2.5. Diagnostic-experimental tasks in identifying reading deficits across orthographies

Most of the literature on reading impairment originates from research conducted on English-readers. Ziegler et al. (2003) point out that two-thirds of all publications on developmental dyslexia since 1998 have come from English-speaking countries, which raises the question as to whether results from these studies can be generalized to orthographies that are different from English. This question acquires more relevance when considering data indicating that the manifestation of reading disorder varies across orthographies (Landerl, Wimmer & Frith, 1997; Wimmer & Mayringer, 2002; Wimmer, Mayringer & Landerl, 2000; Jimenez Gonzalez & Hernandez Valle, 2000; Rodrigo Lopez & Jimenez Gonzalez, 1999; Tressoldi, Stella & Faggella, 2001; Bowers & Wolf, 1993; Wolf, Bowers & Biddle, 2000; Paulesu et al. 2001). Whereas slow-reading rate (fluency), problems in rapid serial naming, and some degree of phonological-orthographic deficit are the most prevalent reading problems in consistent orthographies,

poor decoding and poor word recognition (particularly for irregularly spelled words) are additionally present in a less consistent orthography, such as English.

In a study comparing English and German dyslexic readers (9-13 years), Ziegler et al. (2003) used three psycholinguistic measures relevant in understanding underlying reading processes. The lexicality effect (difference in word and nonword reading) was selected to investigate phonological decoding deficits across the orthographies. The length effect was chosen to quantify serial processes in word and nonword decoding and the large-units effect was selected to identify sensitivity to body neighborhood effects (words that share same orthographic rime, e.g., street, meet, feet). Results showed that reading-speed and slow, serial phonological decoding deficits were of similar size across the two orthographies. For instance, both groups of dyslexic readers showed significant effects for length (but not lexicality) in the reading of words and nonwords, (processing costs per letter were up to 11 times greater than in normal readers). The English-readers, however, made more decoding errors than the German-readers and relied more on larger orthographic units than the German dyslexics, reflecting the facilitatory effects of the German orthography.

The measures that best discriminated between dyslexic readers and normal readers in a consistent orthography were studied by Landerl (2001) in a large sample of German 3rd graders. Dyslexic readers were first selected from a large group of students by using measures of timed-reading comprehension that indirectly measured reading-speed. Those who performed lowest were then individually assessed with a standardized battery that included tests of word and non-word reading, the Raven's Colored Progressive Matrices, spelling, reading speed, phoneme deletion, nonword repetition,

rapid automatized naming, and visual processing speed (processing of letter-like characters).

Findings from this study revealed that on measures of word and nonword reading, German dyslexic readers read accurately but slowly and there were no differences between the two tasks. The reading-speed measure consisted of a sentence reading test in which participants silently read simple sentences and indicated if the content of the sentence was right or wrong. The performance of the dyslexic readers was within the 4th percentile when compared with the nomal control group. In the phoneme deletion task participants were asked to say a word without the first phoneme, e.g.: for "brief" →/reef/. Dyslexic readers commited twice as many errors as the normal readers on this task. The nonword repetition task was meant to assess short-term verbal memory. It consisted of repeating items that contained two or three syllables. There were no significant differences between the groups on this measure.

On the spelling measure (single words that were dictated), dyslexic readers performed significantly lower when compared with the normal readers from the control group. Dyslexic readers also showed phonetic spellings, suggesting difficulty recalling orthographic forms. The visual processing measures consisted of two tasks assessing visual processing speed. The child was required to cross out a letter-like character within a word-like sequence of seven characters. Dyslexic readers performed significantly worse than normal readers on this task, indicating the presence of visual processing deficits in addition to phonological processing problems in their reading. Finally, the rapid automatized naming task consisted of rapidly naming 5 items (pictures of animals and single digits) randomly repeated and presented serially within a matrix format. This

task was found to be the most discriminative in differentiating between the dyslexic and normal readers. In conclusion, German dyslexic readers had extremely slow reading speed and severe delays in spelling. The most prominent cognitive deficits in this group were reduced rapid naming speed, followed by deficits in phonological awareness.

Measures known to tap into language skills that can transfer between L1 and L2 or L2 and L1 may be particularly useful in the crosslinguistic analysis of reading. The value of psycholinguistic tasks able to predict reading problems in L2 by measuring skills in the more proficient language (i.e.: PA tasks and rapid naming in the L1; decoding and fluency in L1; vocabulary in L1, syntax in L1) or even the ability to learn words (orthographic recognition) in L1 or L2, independently of L2 proficiency levels, have been an important focus of research in many of the studies reviewed. For instance, effective use of grapheme-to-phoneme correspondence (GPC) rules necessary for decoding and important in building word recognition not only differentiate good from poor readers in L1 but also apply to reading in L2. Geva et al. (1997) found a strong correlation between reading speed and accuracy in L1 and L2 for young readers. Nassaji (2003) found that decoding and word identification measures differentiated good from poor readers in advanced adult ESL students and similar findings are reported from the literature in foreign language learning (Sparks and Ganschow, 1998). Lindsey, Manis and Bailey (2003) found that phonological awareness in L1 (Spanish) was predictive of word-identification skills in L2 (English) among first-grade Spanish-speaking English learners. Other L1 variables that showed high correlation with L2 reading were word knowledge (picture vocabulary), memory for sentences, and rapid object naming which was the task that evidenced the greatest significance even when tested one year later.

In summary, the tasks used in reading research are generally aimed at uncovering underlying reading processes that may explain how we are able to derive meaning from print. The basic processes of establishing grapheme-to-phoneme mappings and achieving word recognition are typically assessed through the decoding of nonwords, reading of regularly spelled words, exception words (e.g., irregularly spelled ones), and spelling tasks, among others. The influence of phonemic awareness and orthographic knowledge is also highly correlated with the encoding and recoding processes that allow reading and writing. Word frequency, lexicality and orthographic neighbors have an effect on reading performance, across consistent and less consistent orthographies. The effects of fluency, automaticity and word recognition are correlated with readers' performance on rapid naming tasks across orthographies. A more detailed review of phonology-orthography measures and rapid naming tasks follows.

2.5.1. Phonemic–orthographic processing and sublexical mediation

Many studies identify phonemic awareness (PA) as a pre-requisite to reading. The National Reading Panel (2001) found a causal relationship between training in PA and reading and spelling development. Phonemic awareness (PA) refers to an individuals's ability to segment and manipulate phonemes within spoken words. This ability to reflect upon the sound elements of words is a metaphonological skill that has been identified as one of the key predictors of reading achievement in young readers across orthographies (Landerl et al., 1997, Durgunoglu, et al. 1993) and is also correlated with the building of word recognition in adult readers (Carlo and Skilton Sylvester, (1996). In a study comparing phonological processing in English and German children (10-12 years) with severe dyslexia, spoonerisms tasks (first sounds are swapped between

two words) were found to be similarly challenging for both groups. This highly demanding PA task was found to be more discriminatory of reading deficits than were spelling tasks and the reading of nonwords.

Several researchers argue that PA develops as a consequence of reading and it is not necessarily a precursor to reading achievement (Manis et al., 1999, Morais et al. 1979, Goswami, 2002, Castles and Coltheart, 2003). Manis et al. found that PA among dyslexic young readers improved after one year of reading instruction. Morais et al. found that adult illiterates who performed very poorly in PA tasks, improved significantly after just five months of literacy instruction. Goswami (2002) points out that English- and Italian-speaking young children are first aware of the number of syllables within words and that phonemic awareness (segmentation) comes later and is concurrent with the beginning of reading instruction.

In reviewing research that focuses on PA, Castles and Coltheart (2003) question the status that PA has received in much of the literature as an independent metalinguistic skill able to predict reading performance. The authors found that in most PA studies the researchers failed to account for prior orthographic knowledge among their participants. Given that PA tasks implicate sound-letter associations that may be present from a very early age, Castles and Coltheart argue that what most of these studies are in fact measuring is the individuals' phonology-to-orthography associations. These findings indicate that the development of metaphonological skills is easily influenced and even partly mediated by print, a fact that may explain the importance of early literacy experiences in predicting future reading achievement. The mediation of print and the

influence of L1 on the performance in PA tasks must be especially considered when these tasks are used with adult readers.

The following is a list of some of the PA measures most commonly used in research and in clinical practice:

Phoneme deletion

e.g.: say “bus” without /b/

Phoneme counting

e.g.: tap out sounds in “sing”

Phoneme blending

e.g.: what does /k/ /a/ /t/ say?

Phoneme reversal

e.g.: say the sounds of “skin” backward

Pig-latin task (example from Downey, Snyder and Hill, 2000)

isolate initial sound in a word

place initial sound at end of word

add “ay”

phonetically blend resulting string

i.e.: bus--> usb--> “usbay”

Spoonerisms:

Swap initial sounds in two words or names

e.g.: boy - tag --> toy - bag

e.g.: John Lennon--> Lon Jenon

Phonological processing with larger orthographic units:

Syllable segmentation

e.g.: say each syllable in “table”

Rhyme oddity

e.g.: select the odd one out: “play”, “say”, “boy”

Rhyme judgment

e.g.: determine if “sheep” rhymes with “keep”

Differentiating between orthographic and phonological processing is relevant in determining the underlying causes of a reading disorder. Coltheart and Castles recommend using pseudohomophones in which the reader is asked to identify the correct word, i.e.: "rain - rane". An adaptation of this task in Spanish was used by Carrillo, Calvo and Alegria (2001) by including letters with similar phonemic value in words and asking readers to identify the real word, i.e.: "banco – vanco", "sesta – cesta".

2.5.2. Rapid naming of visually presented objects or symbols

One of the key factors in efficient reading is the ability to readily activate lexical codes or to automatize reading, a process that is mediated by rapid word recognition. Many dyslexic readers experience difficulty in rapid automatized naming tasks (RAN), which involve naming highly familiar objects under speeded conditions (see Denckla & Rudel, 1976 a and b; Wolf & Bowers, 1999). There is some debate as to what RAN tasks actually measure and whether the naming speed deficit constitutes problems with word retrieval that may be subsumed as part of a general phonological processing deficit. For example, many dyslexic readers experience word retrieval problems related to difficulties in retrieving information from long-term memory (Snowling, 2001).

Wolf & Bowers (1999) posit that serial-naming or rapid-naming must be categorized separately from phonological tasks because the naming tasks recruit an "ensemble of lower-level visual perceptual processes and higher-level cognitive and linguistic subprocesses" that are independent of phonological processing. Different readers' profiles provide evidence for the separateness of rapid naming skills from phonological tasks. Bowers (1995) and Wolf (1997) found reading impaired subgroups in which either naming speed deficits, phonological-based deficits or both were evident.

Denckla (cited in Wolf & Bowers, 1999) conceptualizes rapid-naming tasks as partially replicating processes involved in reading and as providing "a window on how rapid visual-verbal connections -essential to reading- are made in the developing child's system".

The type of RAN tasks most frequently used include presentation of a matrix containing 50 targets (five items each repeated four times and randomly distributed in a five by ten array) that must be named rapidly and serially from left to right. The items can be familiar objects, colors, letters or digits and the main requirement is that these targets be highly familiar to the reader. In a study by Wimmer et al. (2000), two naming tasks were used, one in which words for the objects to be named began with different consonant clusters, and another in which the words for the objects to be named began with the same single consonant. The measure proved to be effective in differentiating phonological from naming speed readers and phonological from double deficit readers. The authors also suggested that naming speed ability uncovered with the RAN tasks to be a precursor to reading fluency.

Wile and Borowsky (2004) used rapid automatized naming tasks designed to bridge the gap between measures of phonological processing such as nonword decoding and measures of visual processing such as irregular words. Two types of RAN tasks were created, one that required the naming of letters and was expected to correlate highly with visual processing and another that required naming of the sounds of the letters (phonemes) and was expected to correlate with phonological tasks. Findings confirmed that rapidly naming letter-names reflects sight vocabulary processing in that its variance was only accounted for by exception word naming and lexical decision latencies.

Conversely, the RAN-letter sounds latency reflected phonological processing in that its variance was accounted for by pseudohomophone and nonword naming latencies. These results support underlying lexical and sub-lexical processes that may show breakdown in readers. Whereas this study was only conducted in English, the theoretical construct and the type of tasks could easily be adapted for testing in an orthography like Spanish, as, indeed, was done in the current study.

2.5.3. Summary and conclusions of the review of the literature

This review of the literature had two main purposes: to discuss dyslexia and to trace research on the problems of learning ESL, and more generally the learning of a foreign language. Similarities arise between both fields, indicating that native language proficiency influences how a second language is learned and that native language reading abilities impact on how a foreign language is learned. A common finding in the literature is that reading problems are frequently present among second language learners and FL learners who experience problems in learning a new language.

The consensus in the literature is that lower-level processes within the phonological-orthographic systems and the automaticity of phonological recoding in lexical access (rapid naming) may be highly related on a variety of language and reading tasks, including decoding, word recognition and fluency. There is also literature reporting that whereas the same underlying cognitive processes facilitate reading within different writing systems, there are important differences in how orthography interacts with these processes. In fact, there is a well defined group of bilingual-biliterate individuals who show a dissociation between oral language and reading by demonstrable difficulty in only one script and not the other.

The literature reveals that the problems of many English language learners and even of those inmersed in the learning of a FL may be very specific (Meara et al., 1985; Ganschow et al., 1991; Karanth, 1992; Landerl et al., 1997; Ganschow et al, 1998; Sparks et al., 1998; Wydell and Butterworth, 1999; Ganschow and Sparks, 2000; Sparks and Miller, 2000; Downey et al., 2000; Geva et al., 2000; Goswami, 2000; Lindsey et al., 2003, Sparks et al., 2006). Learning about the specificity of those altered processes has theoretical and practical relevance, from improving our understanding about cognitive and language processing to preventing and remediating those reading and language deficits that influence the quality of life for so many individuals. It behooves us to understand the way language is processed in individuals who know and identify themselves as having difficulty in learning English; what is it about their language, more specifically, their processing and reading abilities, that makes learning English particularly difficult? Do they evidence features characteristic of dyslexia?

Chapter II: Method

The goal of the present study was to select enough Spanish-speaking participants across a broad range of English-learning abilities in order to include a sizable group who reported difficulties in learning English and reading in general. All participants had a background that included reasonable opportunities to learn English. They were then tested in their first language, Spanish, for the markers of dyslexia. The specific markers of dyslexia identified in the literature reviewed above include phomemic awareness, impaired ability to form grapheme-to-phoneme mappings (decoding and spelling), impaired ability to establish word recognition units (sight vocabulary), and impaired ability to readily gain lexical access in the phonological recoding of serial stimuli (rapid automatized naming). These processes are part of phonological and visual processing and are exemplified in both the dual-route model of reading and in the double-deficit hypothesis.

Determining the presence of dyslexia in a subset of Spanish-speakers who are English language learners will inform us about their specific problems in learning English. As noted above, the literature shows that reading difficulties in L1 are frequently associated with problems in learning an L2 or a FL. Predicting these reading problems in L2 by analyzing reading processes in L1 should assist us in the early identification of this group of at-risk English language learners. Based on the core reading processes implicated in dyslexia and how these may impact on the learning of English as a second language, the following predictions were made:

3.1. Hypotheses and testing

I. Spanish-speakers who report great difficulty in learning English will experience phoneme-level processing problems in L1 that will interfere with their ability to establish phonology-orthography associations. Their deficits will be evident in phonological awareness, decoding and spelling tasks.

II. Spanish-speakers who report great difficulty learning English will experience word-level lexical processing problems in L1 that will interfere with their ability to readily recognize printed words. Their deficits will be evident in the speed of reading sentences and in their ability to differentiate real words from homophonous pseudowords.

III. Spanish-speakers who report great difficulty learning English will experience delays in the speed with which they can establish visual-verbal associations in L1. Their deficits will adversely influence the automaticity in the serial naming of visually presented symbols.

In order to test Hypothesis I, participants were asked to complete three main tasks involving phonological processing in Spanish. They had to complete a phonological awareness task involving initial phoneme deletion. They had to use decoding strategies in a timed task for the reading of pseudowords. They also had to spell words to dictation. If Hypothesis I held, we expected that participants who were poor English language learners (PELL group) would encounter difficulty in these tasks and would perform significantly lower than the rest of the sample: Good English language learners (GELL) and Peer, normal, English language learners (PEER) with comparable levels of education on the same set of tasks.

In order to test Hypothesis II, participants were asked to complete two main tasks involving printed word recognition in Spanish. They had to complete the Test of Reading Efficiency in Spanish, which required them to rapidly read and complete sentences. They also had to identify correctly spelled words from target word pairs, each including a correctly spelled word and an incorrectly spelled homophone. Both of these tasks were timed and the number of errors was recorded. If Hypothesis II held, we expected that participants who were poor English language learners (PELL group) would encounter difficulty in these language-reading tasks and would perform significantly worse than the rest of the sample (GELL and PEER groups) with comparable levels of education on the same set of tasks.

In order to test Hypothesis III, participants were asked to rapidly and accurately name a sequence of visually presented symbols. Each of the three rapid automatized naming tasks differed in that one was based on naming the pictures of familiar objects, another on naming the pictures of familiar colors, and the last one on the naming of alphabet letters. These tasks were timed and the number of errors was recorded. If Hypothesis III held, we expected that participants who were poor English language learners (PELL group) would encounter difficulty in these tasks and would perform significantly worse (i.e., take longer than the rest of the sample, GELL and PEER groups) with comparable levels of education on the same set of tasks.

3.1.1. Tasks employed

The Test of Reading Efficiency (Test de Eficiencia Lectora, Marin and Carrillo, 2001) was used as a a global measure incorporating word recognition and reading comprehension for sentences. It required participants to read rapidly and accurately each

of a set of 64 incomplete sentences (the last word is missing) and to complete these sentences by adding the missing word. This missing word must be selected from a set of 4 candidates that are orthographic neighbors; two are real words and two are pseudowords. One point was credited for each correct response and the time to complete the task was recorded. See Appendix I for a more complete description of the task.

The Test of Reading Pseudowords (Test de Lectura de Pseudopalabras, by Carrillo 2002) was used in order to measure decoding and to contrast the efficiency of this reading strategy with that of whole word recognition in reading familiar words. This task consists of a list of pseudowords (nonwords) following the syllabic structure of true words. The list of pseudowords is made up of 12 two-syllable nonwords, 12 three-syllable nonwords and 12 four-syllable nonwords. Each participant read these items aloud and responses were tape-recorded. Response time and number of errors were measured. See Appendix I for a more complete description of the task.

The Test of Dictation (Test the Dictado, by Carrillo, 2002) was used to determine spelling ability in Spanish. Sources of spelling difficulty in Spanish are when different letters can represent the same phoneme; when the same letters can represent different phonemes and when words contain the letter "h", which is silent. Please note the following examples:

Same phoneme/different letter:

/s/ as in "cesto" and in "siesta" (basket and nap

/y/ as in "lluvia" and in "yerba" (rain and grass)

/v/ as in "banco" and "vaca" (bank and cow)

/h/ as in "gitana" and "jinete" (gypsy and rider)

Same letter/different phoneme:

/k/ and /s/ as in "cama" (bed) and "cielo" (sky)

Silent letter "h:

"hijo", "hermano", "habitacion" (son, brother, room)

but not in the following:

"idea", "ermita", "alimentacion" (idea, chapel, food)

In this test participants were asked to spell 36 familiar words in Spanish, representative of the above sources of difficulty. Responses were scored for the number of correctly spelled words. See Appendix I for a more complete description of the task.

The Orthographic Decision Test (Test de Decisión Ortográfica, by Carrillo, 2002) was used to measure each participants' ability to rapidly identify correctly spelled words from word pairs that included a misspelled homophone. The words presented were the same ones used in the Dictation task, which focused on sources of spelling difficulty in Spanish. The speed with which participants completed the Orthographic Decision task was timed and participants were also rated on their accuracy in word identification. See Appendix I for a more complete description of the tas.

The Subtest of Deletion from the Test of Phonological Awareness in Spanish (TPAS by Riccio et al., 2004) was administered to determine our participants' ability to segment and to manipulate phonemes within spoken words. In this task participants were asked to eliminate part of a target word in order to make up another word. Each correct response was credited one point and there were a total of 30 items. See Appendix I for a more complete description of the task.

The Rapid Automatized Naming of Colors, Naming of Objects and Naming of Letters are subtests from the Comprehensive Test of Phonological Processing (CTOPP by Wagner, Torgessen and Rashotte, 1999). The items in each of these naming tasks can be

named in any language and the only necessary adaptation was to provide instructions in Spanish. Participants were asked to name as rapidly and as accurately as possible each of a set of familiar objects, familiar colors, and alphabet letters. There were 72 items in each task randomly arranged in four rows and nine colums. Participants were scored on naming speed and accuracy on each of these subtests. See Appendix I for a more complete description of the task.

3.1.2. Supplemental measures:

There were additional characteristics we wanted to know about our English language learners who have a range of language and reading abilities. These included knowledge of vocabulary, auditory discrimination, word reading and cognitive ability. These areas were not covered under the specific phonology-spelling, orthography-lexical and rapid automatized naming, and were thus, added as supplemental measures to provide additional linguistic and cognitive information about our participants. Each of these tasks is briefly described below and more detailed descriptions are available on Appendix I.

Receptive native language vocabulary should be a measure of our participants' overall native language proficiency, which could impact on their ability to learn a foreign language. We used the Test de Vocabulario en Imágenes Peabody (TVIP) with this purpose in mind. The equivalent measure in English is the Peabody Picture Vocabulary Test (PPVT-III) which was administered to gauge receptive vocabulary knowledge in English. This was the only measure that was administered to test language levels in English.

Since phonological processing is one of the variables we are specifically testing in this study, we wanted to test our participants' ability to auditorily perceive phonemic contrasts in syllable pairs differentiated by only one phoneme. For this purpose, we used the Test of Auditory Discrimination for Minimal Pairs in Spanish (Test de Pares Minimos, by Carrillo, 2002).

Overall word reading ability was also measured to determine that all of our participants had acquired the ability to read basic words in their native language. This was measured by using the Test of Word Reading (Test de Lectura de Palabras, by Carrillo, 2002) which consisted of a list of familiar words that participants had to read aloud.

Cognitive ability or a general measure of intelligence was evaluated by using a nonverbal measure, the Standard Progressive Matrices (Ravens). The main purpose of this task was to consider whether low overall IQ might explain why some participants had particular difficulty in language and reading tasks.

Questions regarding overall language learning and reading were explored using a comprehensive Reading and Language History Questionnaire. The aim of these questions was to obtain overall information regarding early learning, native language reading, reading in English and learning of English as a second language.

3.2. Participants

As mentioned above, the approach in this study was to attract a wide array of English language learners. Participation was therefore open to any Spanish-speaker within the age range of 19-49 years, with a minimum of 6th grade education, who was in the process of learning English as a second language and who had been living in the US

for at least 3 years and had studied English for at least 2 years. Forty-three female and 17 males with an average age of 39 years (S.D. 8.91) were recruited. The average level of education was 10th grade (S.D. 3.03); the average number of years studying English was 3.06 (S.D. 1.78) and the average number of years residing in the United States was 8.73 (S.D. 6.24). (See Table 1)

Recruitment was carried out by contacting English-teaching schools and by posting fliers written in Spanish at community centers. Two types of fliers were posted. One type requested the participation of Spanish-speakers who were in the process of learning English as a second language. The other type requested the participation of Spanish-speakers learning English as a second language who were experiencing difficulty in learning English. The purpose of the second flier was to recruit a greater number of English language learners with difficulty as part of our sample. ESL teachers encouraged their students to take part in the study, however, participation remained entirely optional. All participants were enrolled in formal English classes through adult ESL programs. They were in classes for beginner-intermediate levels. These participants volunteered to be tested and most were curious to know about their abilities to learn English. Compensation for participation in this study consisted of privately sharing individual results when requested. None of the participants had a history of neurological disorder, mental retardation, or uncorrected sensory impairment that could interfere with their participation in any of the tasks presented.

3.3. Group classification

3.3.1. The first two groups: Poor vs. Good English language learners (PELL vs. GELL)

A total of 60 participants were included in this study. In order to determine the participants' relative strengths in learning English, students were asked to self-rate their English learning ability by selecting one of 3 categories: "normal learners", "worse than most", and "better than most". In addition, their ESL teachers were asked to rate each participant into one of the same 3 categories.

The "worse than most learners" (PELL) were selected when the students' and the teachers' ratings were similar in indicating that these were "poor English language learners". A total of 16 "poor" English language learners were selected this way. A review of their educational histories revealed wide educational differences within the group. Nine out of the 16 participants had completed an average of 6.88 years of education, while the other 7 had achieved an average of 12.57 years of education. Therefore, in order to control for educational variables influencing English learning and reading ability, only the 7 participants with 12 years of education or more were included into the poor English language learners group (PELL).

The "better than most learners" group (GELL) were selected by including two matching forms of student and teacher rating: That in which students self-rated themselves as particularly "good English language learners" and whose teachers rated them the same way (N=1); and that in which students modestly self-rated themselves as "average English language learners" but whose teachers rated them as particularly good English language learners (N=5). Four out of these 6 participants had achieved an

average of 13.75 grades of education and the other 2 had completed an average of 8.50 grades of education. Since everyone in this group reported good or at least average English learning ability, there was no need to control for educational differences and the two participants with below 12th grade education were kept as part of the group. The GELL group was thus composed of 6 participants.

Scores on the Peabody Picture Vocabulary Test (PPVT-III) in English confirmed that the groups were well chosen. Receptive vocabulary scores were significantly lower in the PELL than in the GELL group (mean raw scores: 27.57 vs. 72.50; U =.50; $p < .001$) despite the fact that participants in these groups were matched for the number of years they had resided in the US and for comparable years of experience in learning English. (See Table 2)

Responses on a comprehensive Background History Questionnaire also confirmed that our groups were well chosen. Two questions focused on English language learning ability and responses indicated the level of difficulty that each group reported experiencing. Question 9 asked: "How easy or difficult is learning to read in English for you?" Question 40 asked: "How easy or difficult is learning to speak in English for you?" Significant differences between the two groups were found in response to both of these questions (U=.000, p<.001). Whereas the PELL group indicated severe difficulty learning to read and learning to speak English, the GELL group indicated normal to better than average ability in both of these areas.

3.3.2. The third group: Peer learners (PELL vs. PEER)

The "peer" group was determined by excluding the PELL and GELL participants and grouping the rest of the sample with 12th grade education of higher into one group

that included various combinations of self-ratings and teacher-ratings on English language learning abilities. The PEER group (N=17) was thus conceived as a variety of English language learners who did not include extreme differences, such as those individuals and their teachers reporting extreme learning difficulty or those who were deemed as better than most learners in the PELL and GELL groups. Determining if there were differences between the PELL group and this overall "average" group of learners with similar levels of education would more clearly assist in identifying what specifically, if anything, differentiates the PELL group from the rest of the sample.

Scores on the Peabody Picture Vocabulary Test (PPVT-III) in English confirmed that there could be differences between the groups. Responses were significantly lower in the PELL than in the PEER group (mean raw scores: 27.57 vs. 50. 23; U =19; $p < .009$) despite the fact that participants in these groups were matched for the number of years they had resided in the US and for comparable years of experience in learning English. (See Table 2)

Responses on a comprehensive Background History Questionnaire also confirmed that our groups were well chosen. Two questions focused on English language learning ability and responses indicated significant differences in the level of difficulty that each group reported experiencing. In fact, since only the PELL participants' self-rating and teachers' rating were considered in determining the "poor learners" group, it was surprising to find differences in how the PELL responded on these questions, when compared with the variety of participants in the rest of the sample. Question 9 asked: "How easy or difficult is learning to read in English for you?" (PELL vs. PEER: $U=18.50$, $p<.007$; PELL vs. GELL: $U=.000$, $p<.001$); whereas Question 40 asked: "How

easy or difficult is learning to speak in English is for you?" (PELL vs. PEER: U=26.50, p<.034; PELL vs. GELL: U=.000, p<.001). Whereas the PELL group consistently reported severe difficulty learning to read and learning to speak English, the PEER and GELL groups indicated less difficulty in these areas.

3.3.3. Additional groups: PEER subsets and Low-education groups (AELL, APELL, PAELL, PEER Low-ed. and PELL Low-ed.)

As discussed in the previous sections, the main group classification in this study focused on first identifying the two extremes within the sample (PELL and GELL) and then grouping the rest of the participants with 12th grade or higher educational level (PEER). Since there were various self-rating and teacher-rating combinations within the PEER group, it was important to determine if these ratings indicated within group differences that could further help us to identify how PELL was different from the rest of our sample.

The PEER group was therefore subdivided in the following way: Those who reported being "average" English learners and whose teachers also described them as "average", were called AELL (N=8); those who reported being "average" English learners and whose teachers described them as "poor" learners, were called APELL (N=3); those who reported being "poor" English learners and whose teachers described them as "average" learners, were called PAELL (N=6).

Finally, we wanted to look at those participants in the rest of our sample who were not included in the main groups because they had lower than 12 years of education. These included the PELL low-education participants (N=9) and PEER low-education participants (N=21).

The PELL low-education group (N=9) averaged 6.99 years of education. The average number of years of U.S. residency was 8.66 and the average number of years of English study was 2.55. The calculated mean for scores in receptive English vocabulary was 24.77 and these scores were not significantly different from those obtained by the PELL high-education group.

The PEER low-education group (N=21) averaged 8.52 years of education. The average number of years of U.S. residency was 9.00 and the average number of years of English study was 2.80. The calculated mean for scores in receptive English vocabulary was 42.14 and these scores were not significantly different from the PELL or PEER groups with high education. (See Table 3)

3.3.4. General Administration procedures in testing for dyslexia

Participants were tested individually. All testing was conducted in Spanish with the exception of the Test of Vocabulary in English (PPVT-III). Testing lasted 2-3 hours, depending on the speed of each participant. Testing took place in rooms with adequate lighting and quiet conditions. All participants were tested in the evening which is when they attended ESL classes. Particular instructions for each task are provided in "Appendix IV" under the section describing each of the tests that were administred.

3.3.5. Questionnaire on Language and Reading History

This questionnaire was included as part of a structured interview to explore early language and learning history in the native language and later language and learning history, including some of the present problems in reading and learning English. The questionnaire consists of 40 questions to be answered via a five-point rating scale. The questions were designed to inquire about participants' difficulties encountered when

learning to read in the native language, history of articulation problems, academic difficulties, self-ratings on native language vocabulary and on English vocabulary, questions on English learning ability, and several questions on attitudes toward living in the United States. See Appendix I for additional description of this task and Appendices II and III for the task itself.

Chapter III: Results

4.1. Strategies on selection of statistics and presentation of resuts

In this investigation we tested 60 participants on various language and reading processes associated with dyslexia. We first selected two groups, PELL (N=7) and GELL (N=6), based on participant- and teacher- ratings of English-learning ability. The purpose of this first comparison was to identify the two extreme groups in our overall participant sample, those who were "worst than most" and those who were "better than most", aiming to distinguish characteristics that discriminated "poor" English language learners from "good" English language learners.

Our next goal was to determine whether there were differences distinguishing the PELL group from those participants who were neither "worst than most" nor "better than most" learners, but who fell in the average range according to their self-ratings and/or those of their teachers. This overall group, PEER (N=17) excluded PELL and GELL participants and was composed of those among the remainder of the sample who had 12th grade or higher years of education. Comparisons of this group with the PELL group permitted us to determine the ways in which poor English language learners were significantly different from those who represented a range of "average" English language learners on markers of dyslexia in their native language.

Additional analysis included contrasting the PELL group with subsets within the PEER group derived from participant- and teacher-ratings: AELL (N=8), APELL (N=3) and PAELL (N=6). These paired contrasts (PELL vs. AELL, PELL vs. APELL and

PELL vs. PAELL) were helpful in pointing out specific differences distinguishing the PELL from more average learners.

The final comparison presented in this study was aimed at exploring the influence of education on FL learning and native language reading ability. This comparison focused on the PELL group against those participants not included in any of the main groups due to lower than 12 years of education. Based on the original group selection, we derived the PELL-Low education group (N=9) and the PEER-Low education group (N=21).

Since the number of participants within the various groups was small, a nonparametric method was used to conduct pair-wise comparisons. The Mann-Whitney U test determines whether two samples are drawn from the same population. Given that our groups were taken from a single population, the null hypothesis would predict that there are no differences between the groups. The purpose of comparing our samples was, thus, to determine that the probability of their distributions being equal was smaller than .05 ($p<.05$). In addition to the paired-comparisons using the Mann-Whitney U test, we used the Kruskal-Wallis Test to compare more than two groups at one time. This measure was necessary when no differences were found between the paired comparisons among the PELL and the GELL groups.

In order to lower the possibility of a Type I error, i.e., rejecting the null hypothesis and accepting that there are differences between our groups when in fact there are no differences, the Bonferroni correction for multiple comparisons was employed by raising the p values required for significant differences in our results. Bonferroni correction for multiple comparisons is achieved by dividing the alpha value 0.05 by the

number of tasks used to test each hypothesis. The rationale for this correction is to maintain the 0.05 value, which may fluctuate when establishing several comparisons, thus increasing the probability of finding a difference when there is none and incorrectly rejecting the null hypothesis. Thus, for Hypothesis I, three statistical comparisons were established and our alpha value was lowered this way: 0.05/3 = .016 (Ho $\leq$ .016). For Hypothesis II, two statistical comparisons were established and our alpha value was lowered this way: 0.05/2 = .025(Ho $\leq$ .025). Finally, for Hypothesis III, three statistical comparisons were established and our alpha value was also lowered this way: 0.05/3 = .016 (Ho $\leq$ .06).

In presenting our results, we begin by comparing the performance of the PELL and GELL groups on all native language and reading tasks. We then present results as they relate to each of our three hypotheses and discuss how the PELL group is different from the GELL group. Recall that responses from these two groups on tasks that require phonological knowledge and spelling are aimed to test Hypothesis I, which predicts that poor English language learners have deficits in phonological processing and in establishing sound-to-letter correspondences important for decoding and spelling

Responses from our two groups on tasks that require recognition of printed words test Hypothesis II, which predicts that poor English language learners have deficits in establishing a sight word repertoire necessary for efficient reading.

Finally, our groups' responses on rapid automatized naming tasks (RAN), which require rapid visual recognition and verbal retrieval, test Hypothesis III, which predicts that poor English language learners have deficits in the automaticity of visual-verbal

integration, a task that can be likened to the processes involved in fluent or online reading.

We then proceed to compare the PELL group against the PEER group, following the same format described above. Here too, the results are aimed at elucidating differences between the two groups by identifying phonological and spelling problems, deficits in word recognition and/or in the reading of sentences, and problems in rapid automatized naming.

Our analysis continues by presenting comparisons between the PELL group and subsets within the PEER group (PELL vs. AELL; PELL vs. APELL; PELL vs. PAELL). The purpose of these comparisons is to determine if differences between the groups can be found in relation to the English-learning ratings provided by participants and their teachers.

The final comparisons presented in Section 4.5 are between the PELL group and the PEER-Low education and PELL-Low education groups. Again, results follow the same format, showing the findings as they relate to each of the three hypotheses named above. The purpose of these comparisons is to determine the role of education in setting the PELL group apart from participants with a wide range of abilities.

4.2. Results on PELL vs. GELL groups

4.2.1. Hypothesis I : Phonological-spelling ability

Recall that three tasks were administered to test for phonological-spelling ability in Spanish: reading aloud of pseudowords, spelling familiar words to dictation and phonological awareness. The prediction was that phonological deficits in the native language would adversely influence decoding, spelling and phonological processing, on

each of these three corresponding tasks in Spanish. The PELL group (N=7) performed significantly worse than the GELL group (N=6) on the reading aloud of nonwords, both in terms of time to complete the task (PELL 89.00 vs. GELL 54.66 seconds; U=4, p<.014) and in terms of accuracy (PELL 25.57 vs. GELL 35.00; U=.000, p<.001). Please note that both of these findings are significant even after applying the Bonferroni correction ($p \leq .016$). See Figures 1-2.

Our groups did not evidence spelling differences in the dictation task (PELL 55.42 vs. GELL 62.00; U = 9.00; $p < .101$). See Figure 3.

Similarly, there were no significant differences in phonological awareness between the PELL and GELL groups when measured on an initial consonant deletion task from the Test of Phonological Awareness in Spanish (PELL 24.42 vs. GELL 26.66; U=12; p<.234). See Figure 4.

In summary, the measure of phonological processing that differentiated the PELL and GELL groups was the Reading of Pseudowords. Decoding of "Spanish" nonwords proved to be difficult for poor English language learners, with differences between the groups in terms of both accuracy and reading time levels. The measures of dictation and phonological awareness did not yield significant differences between PELL and either of the other two groups.

4.3.2. Hypothesis II: Orthographic-Lexical processing

Recall that two main tasks were used to test for orthographic-lexical processing. The prediction was that orthographic-lexical processing deficits would interfere with the ability to readily recognize printed words in Spanish. These problems would adversely

influence the recognition of correct spellings or actual words and the reading of sentences.

When comparing the PELL and the GELL groups on the reading of sentences, we find that the PELL group took longer and was less accurate than the GELL group. Results revealed significant differences between the two groups, both in terms of the time each group took to complete the task (PELL 15.23 vs. GELL 6.82 minutes; $U=1.00$; $p < .002$) and in accuracy (PELL 59.28 vs. GELL 63.16; $U=1.00$; $p < .002$). See Figures 5 and 6.

The Orthographic decision task was administered as a measure of spelling and visual word recognition. Significant differences between the groups were evident in the time it took to complete the task (PELL 3.35 vs. GELL 1.41 minutes.; $U = .000$; $p < .001$). However, there were no significant differences between the groups in accuracy levels ($U=14$, $p<.366$). See Figures 7 and 8.

In summary, the measures of lexical and orthographic processing that differentiated the GELL and PELL groups were the reading of sentences in the Test of Reading Efficiency in Spanish, both in terms of reading time and accuracy levels. The time to recognize correct word spellings (Orthographic Decision task) was longer in the PELL group than in the GELL group but there were no differences between the two groups in terms of accuracy.

4.3.3. Hypothesis III: Rapid Automatized Naming (RAN)

Recall that three tasks were administered to test for the ability to rapidly name aloud visually presented symbols: rapid naming of colors, rapid naming of objects and

rapid naming of letters. Responses were recorded in terms of time to complete each task and accuracy.

Results on the Rapid Naming of Colors task revealed significant differences between the PELL and GELL groups in terms of time to complete the task (PELL 32.57 vs. GELL 22.33 seconds; $U = .000$; $p < .001$). Accuracy levels approached significance (35.00 vs. 36.00; $U = 6.00$; $p < .035$) but cannot be accepted, as they exceed the Bonferroni correction of $p \leq .016$. Thus, the GELL participants were able to name colors faster than the PELL participants and had a trend toward more accurate performance. See Figures 9 and 10.

Results on the Rapid Naming of Objects task revealed significant differences between the PELL and GELL groups, in terms of accuracy (PELL 35 vs. GELL 36; $U = 3.00$; $p < .008$). The PELL group also showed a trend to naming objects more slowly than the GELL group, although results cannot be accepted as significant because they exceed the Bonferroni correction of $p \leq .016$ (PELL 34.57 vs. GELL 23.83 seconds; $U = 5.00$; $p < .022$). See Figures 9 and 10.

Results on the Rapid Naming of Letters revealed significant differences between the PELL and GELL groups, both in terms of time to complete the task (PELL 23.15 vs. GELL 16.66 seconds; $U = 3.50$; $p < .008$) and in accuracy (PELL 34.14 vs. GELL 36.00; $U = 3.00$; $p < .008$). The GELL participants were able to name items faster and more accurately than the PELL participants. See Figures 9 and10.

In summary, rapid naming tasks targeting the speed and accuracy with which visual-verbal associations are established were found to be sensitive measures differentiating the PELL and GELL groups. The PELL group was less accurate than the

GELL group in naming objects and letters. The PELL group took longer than the GELL group in naming colors and letters. Four out of the 6 rapid automatized naming tasks yielded significant differences between the groups, either in terms of time or in terms of accuracy. When significance was not reached, moreover, trends in the expected direction were evident.

4.3. PELL vs. PEER groups

4.3.1. Hypothesis I : Phonological and spelling ability

Recall that three main tasks were administered to test for phonological and spelling ability in Spanish. The prediction was that phonological problems in the native language would adversely influence phonological processing, decoding and spelling on each of three corresponding tasks in Spanish. The PELL group (N=7) showed a trend toward lower performance than the PEER group (N=17) on the time for the reading aloud of nonwords (PELL 89.00 vs. PEER 69.29 seconds; U=27.50, p<.040) but not for the accuracy with which nonwords were read (PELL 25.57 vs. PEER 29.17; U=35.00, p<.130). See Figures 1-2.

A trend was also present in the spelling to dictation task. The PELL group, on average, scored lower in spelling than the PEER group (PELL 55.42 vs. PEER 61.23; U=25.50, p<.028). Please note that when applying the Bonferroni correction ($p \leq .016$) these findings are not significantly different. See Figure 3.

There were no significant differences between the two groups in phonological awareness when measured on the initial consonant deletion task from the Test of Phonological Awareness in Spanish (PELL 24.42 vs. PEER 24.82; U=55; p<.804). See Figure 4.

In summary, trends denoting difficulties in decoding and spelling were evident in the PELL group when compared with the PEER group. These differences did not reach significance levels when the Bonferroni correction was applied. Thus, phonological awareness did not reveal differences between the two groups.

4.3.2. Hypothesis II: Orthographic-Lexical processing

Recall that two tasks were administered to test for orthographic-lexical processing. The prediction was that orthographic-lexical processing problems would interfere with the ability to readily recognize printed words in Spanish.

When comparing the PELL and the PEER groups on the reading of sentences with the Test of Reading Efficiency in Spanish, results revealed significant differences between the two groups in terms of reading time (PELL 15.23 vs. PEER 8.87 minutes; U=13; p<. 002) but not in accuracy (PELL 59.28 vs. 60.76; U=36.50; p <. 147). See Figures 5 and 6.

The Orthographic decision task was administered as a measure of visual word recognition. Significant differences between the groups were evident in the time it took to complete the task (PELL 3.35 vs. PEER 2.08 minutes; U = 12; p <.001). However, there were no significant differences between the groups in accuracy levels (PELL 62.00 vs. PEER 63.82; U = 41.5, p<.260). See Figures 7 and 8.

In summary, lexical-orthographic processing on average took longer for the PELL group than for the PEER group. The measures that differentiated the PELL and PEER groups were the sentence completion and the orthographic decision tasks. The PELL group took longer than GELL group in the completion of each task. There were no

differences between the two groups in accuracy for either the completion of sentences or in orthographic decision.

4.3.3. Hypothesis III: Rapid Automatized Naming

Recall that three tasks were used to test for the ability to rapidly name aloud visually presented symbols: rapid naming of colors, rapid naming of objects and rapid naming of letters. Responses were recorded in terms of time to complete each task and accuracy. Results on the Rapid Naming of Colors task revealed significant differences between the PELL and PEER groups in terms of time to complete the task. The PELL group took longer on average than the PEER group (PELL 34.57 vs. PEER 27.41 seconds; $U = 15.50$; $p < .003$). There were no differences between the groups in terms of average accuracy scores (PELL 35 vs. PEER 35.58; $U = 33$; $p < .099$). See Figures 9 and 10.

Results on the Rapid Naming of Objects task revealed significant differences between the PELL and PEER groups in terms of accuracy (PELL 35 vs. PEER 36; $U = 14.5$; $p < .003$). There was a trend denoting slower performance among the PELL group than among the PEER group in completing this task (PELL 34.57 vs. PEER 27.41 seconds; $U=24.5$, $p<.024$). These levels are not significant when applying the Bonferroni correction, as they exceed $p<.016$. See Figures 9 and 10.

Results on the Rapid Naming of Letters revealed significant differences between the PELL and PEER groups, both in terms of time to complete the task (PELL 23.15 vs. PEER 18.29 seconds; $U = 21.5$; $p < .013$) and in accuracy (PELL 34.14 vs. PEER 35.47; $U = 22.5$; $p < .016$). The PEER participants were able to name items faster and more accurately than the PELL participants. See Figures 9 and 10.

In summary, the PELL group took longer than the PEER group in naming colors and letters. The PELL group was less accurate than the PEER group in naming objects and letters. Four out of the 6 rapid naming tasks targeting the speed and accuracy of visual-verbal associations were found to be sensitive measures differentiating the PELL and PEER groups. From these six, the Rapid Naming of Letters distinguished the groups in both time and accuracy.

4.4. PELL vs. subsets of the PEER group: AELL, APELL, PAELL

Results in this next section focus on identifying how the PELL group may be different from other participants with comparable levels of education who rated themselves or were rated by their teachers within a range of English language learning ability. Recall that these participants, who do not constitute the extreme cases of our sample (Good or Poor English language learners), were first clustered under the overall PEER group. They are now subdivided according to how they and their teachers rated their English learning abilities. Thus, in this section we are comparing how the PELL group performs on the various native language and reading tasks when compared against the Average English Language Learners (AELL, N=8), the Average-Poor English Language Learners (APELL, N=3) and the Poor-Average English Language Learners (PAELL, N=6). Comparing the PELL's performance in this way should give us insight into whether the self-ratings and the teacher-ratings are related to how our groups perform on the various native language and reading tasks associated with each of the hypotheses being explored in this study.

4.4.1. PELL vs. AELL

4.4.1.1. Hypothesis I: Phonological and spelling ability

Recall that three tasks were employed to test for phonological processing and spelling ability (spelling to dictation, decoding nonwords and phonological awareness). The PELL group (N=7) performed lower than the AELL group (N=8) in terms of spelling ability in the dictation task (PELL 55.42 vs. AELL 63.37; $U=3.5$, $p<.002$). See Figure 11.

Decoding ability in the PELL group showed a trend indicating longer processing when compared with the AELL group. On the task of reading nonwords, the PELL group took on average 89.00 seconds in reading aloud these items, whereas the AELL group took on average 64.12 seconds ($U=8.5$, $p<.021$). These findings approach significance levels but do not reach it when Bonferroni correction is applied, since these results are higher than $p<.016$. There were no significant differences in terms of accuracy between the two groups. See Figures 12 and 13.

There were no significant differences between the two groups in terms of phonological awareness on the initial consonant deletion task from the TPAS ($U= 26$; $p<.867$). See Figure 14.

In summary, the PELL group performed significantly worse than the AELL group in terms of spelling ability. The PELL group also showed a strong trend toward slower decoding than the AELL group when reading aloud nonwords. Phonological awareness did not reveal differences between the two groups.

4.4.1.2. Hypothesis II: Orthographic-lexical processing

Recall that two tasks were used to test for orthographic-lexical processing (silent reading of sentences and identifying correct word spellings). Significant differences between the PELL (N=7) and the AELL group (N=8) were evident in reading time on a

global measure of reading in Spanish, suggesting poor word recognition in reading. On the Test of Reading Efficiency in Spanish the PELL took on average significantly longer to read than the AELL group (15.23 minutes vs. 8.42 minutes; U=5, p<.006). The groups did not reveal significant differences in terms of accuracy, suggesting that when the PELL took more time to complete the task, they were able to read and to complete the target sentences with accuracy. See Figures 15 and 16.

The two groups were also significantly different in terms of their ability to recognize correct word spellings. On the orthographic decision task, the PELL group took an average of 3.35 minutes to complete this task, whereas the AELL group took on average 1.69 minutes (U=1, p<.001). The groups did not reveal significant differences in terms of accuracy, thus although the PELL participants took more time to complete this task, they were able to identify the correct spelling of familiar words. See Figures 17 and 18.

In summary, the PELL group took significantly longer than the AELL group in reading sentences and in identifying correct word spellings. However, there were no differences in terms of accuracy between the groups.

4.4.1.3. Hypothesis III: Rapid automatized naming

Rapid automatized naming tasks distinguished the PELL group (N=7) and the AELL group (N=8) both in terms of time to complete the task and in accuracy levels. The rapid naming of objects was slower and more inaccurate among the PELL participants than among the AELL participants. On average, object naming time was 34.57 seconds for the PELL group and 24.25 seconds for the AELL group (U=6.5, p<.009). Even when taking longer time in naming objects, the PELL group made more

mistakes than the AELL group (PELL 35 vs. AELL 36.87; U=7, p<.014). See Figures 19 and 20.

Rapid naming of colors was slower for the PELL group who took on average 32.57 seconds, whereas the AELL group took on average 24 seconds (U=1.5, p<.001). Accuracy levels in naming colors were not different between the groups (PELL 35.00 vs. AELL 35.37; U=19; p =.336). The rapid naming of letters was not significantly different between the groups in terms of time or accuracy. A trend indicating faster letter naming in the AELL group when compared with the PELL group was noted (U=8, p<.021). PELL participants took on average 23.14 seconds to name letters, whereas the AELL participants took on average 17.37 seconds. Although it approaches significance, this is not a significant difference when the Bonferroni correction is applied, as the p value exceeds $p \leq .016$ Accuracy levels for the letter naming task were not significantly different between the groups (PELL 34.14 vs. AELL 35.12; U=15, p =.152. See Figures 19 and 20.

In summary, rapid automatized naming tasks indicated that the PELL group named objects, colors and letters more slowly and sometimes less accurately than the AELL group.

4.4.2. PELL vs. APELL

4.4.2.1. Hypothesis I: Phonological and Spelling ability

There were no significant differences between the PELL (N=7) group and the APELL group (N=3) on the measure of phonological awareness (U=6.50; p<.383). See Figure 14.

There were no significant differences between the two groups on spelling to dictation (U=9.50; p<.833). See Figure 11.

There were no significant differences between the two groups in terms of the time in reading nonwords (U = 7-; p<.517) or in the accuracy of reading nonwords (U = 8; p<.667). See Figures 12 and 13.

In summary, there were no significant differences on any of the measures when comparing the PELL and the APELL groups. This finding is consistent with the rating that ESL teachers provided, describing both PELL and APELL participants as poor English language learners.

4.4.2.2. Hypothesis II: Orthographic-lexical processing

There were no significant differences between the PELL (N=7) group and the APELL group (N=3) on the reading of sentences (time U=6; p<.383; accuracy U=9.5, p<.383). See Figures 15 and 16.

There were no significant differences between the two groups on the orthographic decision task (time U=9; p<.833; accuracy U=7, p<.517). See Figures 17 and 18.

In summary, there were no significant differences on any of the measures when comparing the PELL and the APELL groups. This finding, too, is consistent with the rating that ESL teachers provided, describing both PELL and APELL participants as poor English language learners.

4.4.2.3. Hypothesis III: Rapid automatized naming

There were no significant differences between the PELL group (N=7) and the APELL group (N=3) on the rapid naming of objects (time U=7, p<.517; accuracy U=4.5, p<183). There were no significant differences betwen the groups on the naming of colors

(time U=7, p<.517; accuracy U=7, p<.183). There were no significant differences between the two groups on the naming of letters (time U=6.5, p<.383; accuracy U=4.5, p<.183). See Figures 19 and 20.

In summary, no significant differences in rapid automatized naming were evident between the PELL and the APELL group.

4.4.3. PELL vs. PAELL

4.4.3.1. Hypothesis I: Phonological and spelling ability

No differences were evident between the PELL group (N=7) and the PAELL group (N=6) on the measure of phonological awareness (PELL 24.42 vs. 24.83; U=18.50, p<.731). See Figure 14.

There were no differences between the groups in spelling to dictation (PELL 55.42 vs. PAELL 60.83; U=10.50, p<.138). See Figure 11.

There were no differences in decoding nonwords time (PELL 89.00 vs. PAELL 72.16 seconds; U=12, p<.234) or in nonword accuracy (PELL 25.57 vs. PAELL 30.16; U=10, p<.138). See Figures 12 and 13.

In summary, the PELL and the PAELL groups did not reveal differences in phonological or spelling ability, consistent with the self- ratings the students provided.

4.4.3.2. Hypothesis II: Orthographic-lexical processing

When comparing the PELL group (N=7) with the PAELL group (N=6), we find that the PELL group took significantly longer on average than the PAELL group in reading sentences on the Test of Reading Efficiency in Spanish (PELL 15.23 min. vs. PAELL 8.19 minutes, U=2, p<.005). There were no significant differences in accuracy

levels between the two groups (PELL 59.28 vs. PAELL 62.00; U=8, p<.073). See Figures 15 and 16.

The PELL group was also different from the PAELL group in terms of orthographic decision time (U=2, p<.005). Whereas the PELL group on average took 3.35 min., the PAELL group took on average 2.04 min. to complete this task. There were no significant differences in terms of accuracy in indentifying correct word spellings (PELL 62.00 vs. PAELL 64.33; U=12, p<.234). See Figures 17 and 18.

In summary, in spite of comparable accuracy levels, the PELL group was significantly slower than the PAELL group in reading sentences and in identifying correct word spellings.

4.4.3.3. Hypothesis III: Rapid automatized naming

When comparing the PELL group with the PAELL group, we find that on average the PELL group was less accurate than the PAELL group in rapidly naming objects (PELL 34.57 vs. PAELL 29.66; U=3, p<.008). Significant differences between the two groups were also evident in accuracy for the rapid naming of letters (PELL 34.14 vs. PAELL 36.00; U=3, p<.008). There were no significant differences between the two groups in terms of time for the rapid naming of letters (PELL 23.14 vs. PAELL 18.00; U=7, p<.051) or in the time for the rapid naming of objects (U=12.5, p<.234). There were no significant differences between the two groups in the time for the rapid naming of colors (PELL 32.57 vs. PAELL 27.33; U=7, p<.051) or in the accuracy for the rapid naming of colors (PELL 35.00 vs. 35.83; U=8.5, p<.073). See Figures 19 and 20.

In summary, the PELL group was less accurate than the PAELL group on the rapid naming of objects and letters but not colors. There were no differences in terms of time to complete any of the rapid naming tasks between the two groups.

4.5. PELL vs. PEER-Low education and PELL-Low education

4.5.1. PELL vs. PEER-Low education

4.5.1.1. Hypothesis I: Phonological processing and spelling ability

There were no statistically significant differences between the PELL group (N=7) and the PEER-Low education group (N=21) in the task of phonological awareness (PELL 24.42 vs. PEER-Low ed. 24.28; U=73.50, p<1.00). See Figure 21.

There were no differences between the two groups in spelling ability for the dictation task (PELL 55.42 vs. PEER-Low ed. 56.04; U=68.00, p<.796). See Figure 22.

We found a trend favoring the PEER group in terms of the time to decode and read aloud nonwords (72.57 vs. 89.00 seconds). This trend approximated statistically significant levels (U=34.50, p<.036) but did not reach them when the Bonferroni correction was applied (p<.016). There were no differences between the two groups in terms of accuracy levels for the reading of nonwords (PELL 25.57 vs. PEER-Low ed. 72.57; U=41.50, p<.090). See Figures 23 and 24.

In summary, only a trend denoting extended decoding time for the reading of nonwords was evident in the PELL group when compared with the PEER- Low education group. No other differences were evident between the groups in terms of phonological processing and spelling ability.

4.5.1.2. Hypothesis II: Orthographic-lexical processing

There were no statistically significant differences between the PELL group (N=7) and the PEER-Low education group (N=21) in the time for the reading of sentences (PELL 15.23 vs. PEER-Low ed. 12.84 minutes; U=43.00, p =.113). Similarly, there were no differences between the two groups in the accuracy for the reading of sentences (PELL 59.28 vs. PEER-Low ed. 57.19; U=71.00, p= .917). See Figures 25 and 26.

There were no differences between the two groups in the time to complete the orthographic decision task (PELL 3.35 vs. PEER-Low ed. 3.42 minutes; U=73.50, p<1.00) or in the accuracy for orthographic decisions (PELL 62.00 vs. PEER-Low ed. 60.38; U=73.50, p<1.00). See Figures 27 and 28.

In summary, there were no differences between the PELL and the PEER-Low education group in their ability to read sentences or in the recognition of correct word spellings.

4.5.2.3. Hypothesis III: Rapid automatized naming

There were no significant differences in any of the three rapid automatized naming tasks when comparing the PELL group (N=7) with the PEER Low-education group (N=21). No differences were found on the time for the rapid naming of objects (PELL 34.57 vs. PEER-Low ed. 30.52 seconds; U=43.50, p<113) or in the accuracy for the rapid naming of objects (PELL 35.00 vs. PEER-Low ed. 35.52; U=38.00, p<.062). There were no differences between the two groups on the time for the rapid naming of colors (PELL 32.57 vs. PEER-Low ed. 28.76 seconds; U=41.00, p<.090) or in the accuracy for the rapid naming of colors (PELL 35.00 vs. PEER-Low ed. 35.52; U=46.00; p<.155). Similarly, no differences between the two groups were found in the time for the rapid naming of letters (PELL 23.14 vs. PEER-Low ed. 20.76 seconds; U=44.00,

p<.126) or on the accuracy for the rapid naming of letters (PELL 34.14 vs. PEER-Low ed. 35.09; U=41.00, p<.090). See Figures 29 and 30.

In summary, there were no differences on any of the RAN tasks among the PELL group and the PEER-Low education group.

4.5.2. PELL vs. PELL- Low education

4.5.2.1. Hypothesis I: Phonological processing and spelling ability

There were no differences between the PELL group (N=7) and PELL-Low ed. group (N=9) in the time taken for the reading aloud of nonwords (PELL 89.00 vs. PELL-Low ed. 77.11 seconds; U=23.00, p<.408) or in the accuracy to complete this task (PELL 25.57 vs. PELL-Low ed. 26.11; U=30.50, p<.918). See Figures 23 and24.

There were no differences between the two groups in terms of phonological awareness (PELL 25.50 vs. PELL-Low ed. 20.88; U=20.00, p<.252). See Figure 21.

The PELL group showed a trend indicating better performance than the PELL Low-education group on a word dictation task. Differences between the two groups approached a p value of .05: Mean 55.42 vs. 47.88 (U=13.5, p<.055). However, since we are only accepting a reduced alpha value (Bonferroni correction to p $\leq$.016), spelling of words to dictation cannot be accepted as significantly different between our two groups in this condition. See Figure 22.

In summary, a trend indicating better spelling performance was evident on average for the PELL group with more years of education when compared with the PELL-Low education group. No other differences were evident among the groups.

4.5.2.2. Hypothesis II: Orthographic-lexical processing

There were no significant differences between the PELL group and PELL-Low ed. group in the time for the reading of sentences (PELL 15.23 vs. PELL-Low ed. 19.21 minutes; U=17.00, p<.142) or in the accuracy to complete this task (PELL 59.28 vs. PELL-Low ed. 55.88; U=16.50, p<.114). See Figures 25 and 26.

There were no differences between the two groups in the time to complete the orthographic decision task (PELL 3.35 vs. PELL-Low ed. 4.37 minutes; U=19.50, p<.210). However, significant differences were found between the two groups in the recognition of words that were spelled correctly. Orthographic decision was more accurate among PELL participants with higher education than among the PELL participants with lower education (PELL 62 vs. PELL-Low ed. 51.33; (U=4, p<.002.) See Figures 27 and 28.

In summary, the PELL group with higher education was more accurate than the PELL group with less years of education in identifying correct word spellings. No other differences were found among the groups.

4.5.2.3. Hypothesis III: Rapid automatized naming

There were no significant differences between the PELL group and the PELL-Low ed. group on the time for the rapid naming of objects (PELL 34.57 vs. PELL-Low ed. 32.33 seconds; U=22.00, p<.351) or in accuracy (PELL 35.00 vs. PELL-Low ed. 35.44; U=19.50, p<.210). There were no differences between the two groups on the time for the rapid naming of letters (PELL 23.24 vs. PELL-Low ed. 21.20 seconds; U=18.00, p<.174) or in accuracy (PELL 34.14 vs. PELL-Low ed. 34.77; U=23.50, p<.408). There were no differences between the two groups in accuracy for the rapid naming of colors (PELL 35.00 vs. PELL-Low ed. 35.11; U=20.00, p<.837). Surprisingly, the PELL

participants took on average, longer than the PELL-Low education participants in the time to complete the rapid naming of colors (PELL 34.57 vs. PELL-Low ed. 26.11 seconds; U=5.5, p<.003). See Figures 29 and 30.

In summary, the PELL-Low education group named colors faster than the PELL group. No other differences in rapid naming were evident among the two groups.

4.5.2.4. Other Group differences

4.5.2.4.1. Receptive vocabulary (English and Spanish)

The PELL group (N=7) often demonstrated lower knowledge of English vocabulary than the other groups with comparable education and years of residence in the United States, a finding that is consistent with their self-report and their teachers' evaluations as poor English language learners. The PELL group was different from the GELL group (N=6) in terms of receptive English vocabulary. Whereas the PELL group obtained average scores of 27.57 on the Peabody Picture Vocabulary Test (PPVT-III), the GELL group obtained average scores of 72.50 (U=5, p<.001). The PELL group also obtained lower average scores on receptive English vocabulary than the PEER group (N=17) who scored on average 50.23 (U=19.00, p<.009). See Figure 31.

Along the same line, the PELL group scored lower in receptive English vocabulary than the AELL group (N=8) who obtained average scores of 45.37 (U=8.5; p<.021). Differences in knowledge of receptive English vocabulary approximated significance levels between the PELL group and the PAELL group (N=6) (U=7.5; p<.051). Whereas the PELL obtained average scores of 26.57 on the Peabody Picture Vocabulary Test (PPVT-III), the PAELL group obtained average scores of 57.28. See Figure 32.

There were no significant differences for average scores in knowledge of English receptive vocabulary when the PELL group was compared against the PEER-Low education group (42.14) or the PELL-Low education group (24.77). See Figure 33.

Differences in native language vocabulary stand out when comparing the PELL group (N=7) with higher education (12.75 years of education on average) with the PELL-Low education participants (6.88 years of education on average). The PELL group obtained average scores of 104.85 whereas the PELL Low-education participants obtained average scores of 94.66 ($U=.5$, $p<.000$) in their knowledge of native language vocabulary. See Figure 33.

In summary, the PELL group scored lower in receptive English vocabulary than the GELL, PEER and AELL groups and a trend showing lower performance was evident when compared with the PAELL group. There were no differences in receptive English vocabulary among the groups with lower education. However, the PELL group evidenced lower native language vocabulary scores when compared with the PELL-Low education group.

4.5.2.4.2. Questionnaire on reading and language history

Recall that our participants were given a questionnaire that included questions about their English learning and reading ability and difficulties learning to read in Spanish. Responses were given on a 5 point-scale, with 0 being the "no difficulty" and the other extreme being "severe difficulty" (all were converted to a single scale for the purposes of analysis). Differences in how our participants responded on all these questions were evident among the PELL and the GELL groups, whereas among the

PELL and the PEER groups only problems in English learning and reading ability were reported.

Two of the questions related to English learning and reading ability. The responses that were provided confirm that our groups were well selected. Question 9 posed: How easy or difficult is to read English? The PELL group reported having more difficulty reading English than the GELL group (PELL 3.71 vs. GELL 1.66; U=.000, p<.001) and than the PEER group (PELL 3.71 vs. PEER 2.64; U=18.50, p<.007). Question 40 posed: How easy or difficult is to learn English? The PELL group reported having more difficulty learning English than the GELL group (PELL 3.71 vs. GELL 1.83; U=.000, p<.001) and than the PEER group (PELL 3.71 vs. PEER 2.82; U=26.50, p<.034.

A different set of questions focused on Spanish reading ability. Question 2 posed: How much difficulty learning to read (in Spanish) did you have during elementary school? The PELL group reported having had more difficulty learning to read in their native language than the GELL group (PELL 2 vs. GELL 0; U=3.0, p<.008). However, there were no differences among the PELL and the PEER group (PELL 2 vs. PEER 1.11; U=34.00, p<.114). Question 16 posed: Do you have many spelling problems in Spanish? The PELL group reported to have more difficulty in spelling ability than the GELL group (PELL 2.57 vs. GELL 1; U=2.50, p<.005). However, there were no differences among the PELL group and the PEER group (PELL 2.57 vs. PEER 1.76, U=36.00, p<.147). See Figure 34.

In summary, the PELL group reported to have more difficulty learning English and reading in English than both the GELL and the PEER groups. Differences in

learning to read in the native language and in spelling ability in Spanish were evident among the PELL and the GELL groups but not between the PELL and the PEER group. The PELL group on average reported a history of difficulty learning to read and to currently have spelling problems in Spanish.

4.5.2.4.3. Auditory discrimination for minimal contrasts

Recall that our participants were also tested on their ability to discriminate phonetic contrasts within minimal pairs for syllables presented in Spanish. Ability to discriminate these sound differences, we anticipated, might determine how our participants processed or understood word stimuli used in many of the tasks administered. Auditory discrimination for minimal contrasts can also be influential in building reading and spelling abilities, particularly sound-to-letter correspondences. It was thus chosen as a complementary task to rule out problems in this area that could explain language or reading difficulties.

Our results indicate that there were no differences among our groups in the auditory discrimination for minimal pairs task. The Kruskal Wallis test was used as a way to compare several groups at one time in order to find whether there were any differences. Comparison of the primary groups, PELL, GELL and PEER yielded no differences $p<.341$ (Means: PELL 44.57, PEER 45.52 and GELL 46.00). There were no differences among the PELL and the low education groups, PEER-Low ed. and PELL-Low ed. $p<.889$ (Means: PELL 44.57, PEER-Low ed. 45.00 and PELL-Low ed. 45.11). Nor were there any differences among the PELL and the AELL, APELL and PAELL groups $p<.331$ (Means: PELL 44.57, AELL 46.00, APELL 45.00 and PAELL 45.16). See Figures 35, 36 and 37.

In summary, in spite of expecting differences among our groups, no differences were found in auditory discrimination for minimal pairs among any of the groups in our sample.

4.5.2.4.4. List-WordReading

Recall also that one of the task administered to our participants was that of reading aloud a list of familiar words in Spanish. The purpose of this task was to determine that in fact, all of our participants had the basic ability to read words in their native language. Basic reading ability was expected from all our participants, lest the language learning and reading problems in English could be attributed to obvious reading problems in their native language. Part of the selection criteria for participants in this study was also not to have been diagnosed with dyslexia or any reading problems at any point in their life. The reading word-list task was thus a complementary measure to lend support to basic reading ability in the native language.

Results reveal that there were no differences among our groups in the measure of Word-List Reading aloud, which was scored for reading time and accuracy. The Kruskal Wallis test was again used to compare more than two groups at one time to determine if there were differences. When comparing the primary groups, PELL, GELL and PEER there were no differences found for time $p<.362$ (Means: PELL 38.14, PEER 41.11 and GELL 34.33 seconds) or for accuracy $p<.184$ (Means: PELL 35.12, PEER 35.52 and GELL 36.00). There were no differences among the PELL and the low education groups, PEER-Low ed. and PELL-Low ed. for time $p<.189$ (Means: PELL 35.14, PEER-Low ed. 36.95 and PELL-Low ed. 45.66 seconds) or for accuracy $p<.397$ (Means: PELL 35.14, PEER-Low ed. 36.09 and PELL-Low ed. 34.22). There were no differences among the

PELL and the AELL, APELL and PAELL groups for time p<.616 (Means: PELL 34.14, AELL 37.12, APELL 51.66 and PAELL 41.16 seconds) or for accuracy p<.909 (Means: PELL 35.14, AELL 35.12, APELL 35.00 and PAELL 35.66). See Figures 38, 39, 40 and 41.

In summary, there were no differences among our groups on basic reading ability for words in the native language.

4.5.2.4.5. Standard Progressive Matrices Test (Raven)

Recall that the Standard Progressive Matrices test was used as a nonverbal measure of cognitive ability or general intelligence. The main purpose of this task was to consider whether low overall IQ might explain why some participants had particular difficulty in language and reading tasks.

We did not find differences among our groups on this nonverbal measure of cognitive ability. The Kruskal Wallis test was again used as the method to compare several groups at one time to determine whether there were any differences among the groups. Comparison of the primary groups, PELL, GELL and PEER yielded no differences p<.349 (Means: PELL 44.14, PEER 45.23 and GELL 46.50). There were no differences among the PELL and the low education groups, PEER-Low ed. and PELL-Low ed. p<.091(Means: PELL 44.14, PEER-Low ed. 42.23 and PELL-Low ed. 42.55). Nor were there any differences among the PELL and the AELL, APELL and PAELL groups p<.554 (Means: PELL 44.14, AELL 44.87, APELL 45.66 and PAELL 45.50). See Figures 42, 43 and 44.

In summary, there were no differences among our groups on nonverbal cognitive ability as measured by the Standard Progressive Matrices (Ravens).

4.5.3. Conclusions

In summary, there were no differences between the PELL group and the PEER and GELL groups, or between the PELL group and the PEER-Low education and PELL-Low education groups, or between the PELL group and the AELL, APELL and PAELL groups on the measures of auditory discrimination, word-list reading aloud and Standard Progressive Matrices. However, the PELL group demonstrated lower receptive English vocabulary knowledge that the GELL and the PEER groups. The PELL group also scored lower than the AELL group on receptive English vocabulary and there was a trend favoring the PAELL group. Differences in native language receptive vocabulary knowledge showed the PELL-Low education group scoring lower on average than the PELL group who had higher education levels. The PELL group reported more difficulty than the GELL and the PEER groups in their ability to learn English and in their ability to read in English. Along the same line, the PELL group reported more difficulty learning to read in Spanish and more spelling problems in their native language when compared with the GELL group, but no differences were found with the PEER group.

Chapter IV: Discussion

5.1. Introduction

This section will proceed with a discussion focused on each of the hypotheses tested. The aim of this analysis will be to determine how the results obtained relate to the research questions and whether these findings support the hypotheses linking dyslexia in the native language and difficulty learning English as a second language in a subgroup of English Language Learners.

We begin with a discussion on how our groups performed on phonological processing-spelling ability (see sections 4.2.1, 4.3.1, 4.4.1.1, 4.4.2.1, 4.4.3.1, 4.5.1.1, 4.5.2.1), orthographic-lexical processing (4.2.2, 4.3.2, 4.4.1.2, 4.4.2.2, 4.5.1.2, 4.5.2.2.) and in fast visual-lexical retrieval (4.2.3, 4.3.3, 4.4.1.3, 4.4.2.3, 4.5.1.3, 4.5.2.3). This part of the discussion is centered on how these results relate to the literature on second language learning and dyslexia. Our discussion proceeds similarly to explore how our groups performed on a variety of complementary tasks, namely, receptive vocabulary, auditory discrimination, word reading, nonverbal cognitive ability and self-reported difficulty in learning English, reading English and native language reading (see section 4.5.2.4).

A second part of our discussion expands on how this study adds to the literature on dyslexia and second language learning. An entire section (5.5) is dedicated to assessing the sensitivity of the tasks used in testing for dyslexia in order to determine which ones were more effective. We also include a section (5.6) to analyze the accuracy of self- and teacher- ratings in determining English learning ability since this can be a

practical measure to include in future studies. A section (5.7) is included covering the role of education in reading and second language learning. Finally, a section (5.8) is added reflecting on the limitations of this study and what future research it calls for.

5.2. Phonological processing and spelling ability in the native language

Recall that Hypothesis I predicted that Spanish-speakers who report great difficulty in learning English would experience phonological processing problems in L1 that would interfere with their ability to establish phonology-orthography associations. Their deficits would be evident in phonological awareness, decoding and spelling tasks in Spanish.

In our study we found that the PELL group stood out relative to other groups with comparable years of education on non-word decoding and spelling, but not on phoneme awareness. The PELL group on average read non-words more slowly ($U=4$, $p<.014$) and with more errors ($U=0$, $p<.001$) than the GELL group. Trends showing increased reading time for non-words ($U=27.50$, $p<.040$) and difficulty spelling words to dictation ($U=25.50$, $p<.028$) were also evident when the PELL group was compared with the PEER group. However, the PELL group did not perform differently on the phonological awareness task when compared with other groups in our sample.

Recall that the primary comparisons in our study involved the PELL group vs. the GELL group and the PELL group vs. the PEER group. These two initial comparisons were followed by comparisons between the PELL group and subsets within the PEER group (AELL, APELL and PAELL) that were based on student and teacher ratings. It is interesting to note that phonological-orthographic deficits were sustained when we compared the PELL group with subsets within the PEER group. We found that the PELL

group had difficulty spelling familiar words to dictation and performed lower than the AELL group on dictation ($U=3.5$, $p<.002$). Phonological-spelling problems were also evident in the PELL's poor decoding skills. A strong trend denoting decoding difficulty ($U=8.5$; $p<.021$) was found when comparing the PELL and the AELL groups in the reading of non-words. These findings come together when we compare the PELL group's performance on a global reading task, such as the Test of Reading Efficiency in Spanish. The PELL group was found to read significantly slower than the AELL group ($U=5.00$, $p<.006$) and the PAELL group ($U=2$, $p<.005$) on the reading of sentences in this test.

Our findings are consistent with Hypothesis I, which predicts difficulty in the ability to establish phonology-orthography associations by those participants who reported great difficulty learning English. The phonological awareness task did not yield significant differences in our study, a finding contrary to the links between phonological awareness and reading ability. However, a number of factors may explain why this task did not reveal differences among the groups. First, our participants were adults and phonological awareness has been shown to be predictive of reading failure in beginning readers (Carrillo, 1994; Goswami, 2002; Lindsey et all, 2003) but less is known about the role of phonological awareness in adult readers. Second, it has been shown that adult learners through years of reading-writing experience often learn to compensate for early phonological deficits (Morais, Alegria and Bertelson, 1979). Third, the fact that Spanish orthography has such a consistent phoneme-to-grapheme correspondence would facilitate reading practice and thus, increase the possibility that adult readers learn to overcome phonological awareness deficits in their native language. Fourth, a circumscribed

phonological awareness task (initial phoneme deletion) was used in this study. It may be that the task was too simple and not challenging enough to show differences in performance among the groups. Indeed, all our groups performed at ceiling on this task.

Our results on the decoding of non-words and poor spelling ability are consistent with the NICHD definition for dyslexia (2003): "Dyslexia is characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities." The performance of our poor English Language Learners is also consistent with many of the studies by Ganschow and Sparks (1991), Sparks et al. (1992, 1997), Sparks and Miller (2000) and Downey and Hill (2000) in which spelling ability is pointed out as important in developing native language proficiency and FL learning ability. However, our study goes beyond their findings, indeed, beyond what is known in the L2 learning field, by showing the strong non-word decoding problem in the native language.

There is a limited body of literature that explores the role of decoding and non-word reading in consistent orthographies such as Spanish. Recall that since Spanish orthography has a closer one-to-one phoneme-to-grapheme correspondence than other orthographies (e.g., English) some researchers have claimed that decoding is favored over lexical processing when reading in Spanish (see Ardilla, 1991, 1993, 1999). However, in spite of the advantages Spanish readers may have when compared with readers of less consistent orthographies, phonological processing deficits have been reported among Spanish readers with dyslexia. Carrillo, Calvo and Alegria (1991) found that "poor" Spanish readers in elementary grades tended to read non-words with less accuracy than normal readers. Paulesso et al. (2001) also found that Italian students with dyslexia performed just as poorly as English and French dyslexic readers on reading and

phonological tasks when their performance was compared to that of typical Italian readers in their control group. Ziegler et al. (2003) showed that reading-speed and slow, serial phonological decoding deficits were of similar size when comparing English and German dyslexic readers. The consensus is that even when decoding may be favored in more consistent writing systems than English, phonological processing deficits involving decoding and spelling (especially where the one-to-one phoneme-to-grapheme rules are violated) are also found as the main causes for reading deficits in consistent orthographies such as Spanish. Our poor English language learners show such deficits in their native language reading ability.

The findings in this study indicate that we can accept Hypothesis I, that Spanish-speakers who report great difficulty in learning English experience phonological-spelling problems in their L1. These problems are exemplified in poor decoding of non-words and in spelling problems that interfere with the establishment of phonology-orthography associations. These deficits were present when comparing the two extreme groups, PELL and GELL, and strong trends approaching significance levels were present when comparing the PELL and the PEER groups.

5.3. Orthographic-lexical problems in the native language

Recall that Hypothesis II predicted that Spanish-speakers who report great difficulty learning English would experience orthographic lexical processing problems in L1 that would interfere with their ability to readily recognize printed words. Their deficits would be evident in the speed of reading sentences in Spanish and in their ability to differentiate real words from homophonous pseudowords in Spanish.

In our study we found that the PELL group stood out relative to other groups with comparable years of education on word identification and in their ability to read sentences. The PELL group on average identified correct word spellings more slowly than the GELL group (U=.000, p<.001) and the PEER group (U=12, p<.001) in a timed orthographic decision task wherein they were asked to determine which words were spelled correctly.

We also found that the PELL group read significantly slower than the GELL group (U=1, p. <.002) and the PEER group (U=12, p<.002) and they were less accurate than the GELL group (U=1, p <.002) in a global reading task (Test of Reading Efficiency in Spanish). These deficits can be seen as interdependent. Since our PELL participants had a reduced orthographic lexicon in their native language, they failed to rapidly recognize familiar words such as those used in the orthographic decision task. In spite of these deficits, they were nevertheless able to achieve accuracy for orthographic word recognition when taking longer time to complete the task. They were, however, unable to compensate for their orthographic processing deficits under the more strenuous demands of rapid sentence reading in which they also had to complete these sentences by selecting the correct word from a group that included non-words. Under this more stressful condition, our PELL participants performed significantly worse than the GELL group in terms of time and accuracy and worse than the PEER group in terms of time to complete the task (see above for p valus).

Recall that we first compared in our study the PELL group and the GELL group, followed by the PELL group and the PEER group. We then compared the PELL group with subsets of the PEER (AELL, APELL and PAELL) based on self- and teacher-

ratings. In comparing the PELL group with subsets within the PEER group, we found that the PELL group read significantly slower than the AELL group ($U=5$, $p<.006$) and the PAELL ($U=2$, $p<.005$) groups on a global silent reading measure (Test of Reading Efficiency in Spanish). The PELL group also took longer than the AELL group ($U=1$, $p<.001$) in completing the orthographic decision task.

Our findings are consistent with Hypothesis II, which predicts difficulty in orthographic-lexical processing and the ability to readily recognize printed words by those participants who reported great difficulty learning English. Both, the orthographic decision task and the reading of sentences distinguished the PELL group from the other groups. The PELL group on average took longer and was less accurate in identifying correct word spellings and in the reading of sentences.

Interestingly, the influence of education on becoming better spellers is evident when comparing the PELL group with high-education and the PELL group with low education (PELL-Low ed.). Those with higher education were significantly more accurate in identifying correctly spelled words than those with lower education ($U=4$, $p<.002$), a finding that is only present in this group.

The poor English language learners in our study clearly demonstrate native language deficits in orthographic-visual word recognition or lexical processing, which may contribute to both difficulties in foreign language learning and dyslexia. The fact that Spanish orthography lends itself so well to decoding may predispose readers with difficulty in lexical processing to rely solely on decoding when reading. This can be seen among our PELL participants who consistently took longer than other groups in the reading of non-words. Our PELL participants also responded significantly slower than

the GELL group on both an orthographic decision task and slower than both the GELL and PEER groups in a sentence completion task (see above for p values). This finding suggests that they were relying on inefficient decoding strategies, most likely combined with weak orthographic-word recognition skills. This conclusion is supported by the PELL's poor performance in the non-word decoding task, revealing their deficits in this area as well (see results for Hypothesis I).

There is a body of literature in reading that supports the relevance of orthographic or lexical processing in reading. Different theoretical perspectives converge in pointing out the importance of word recognition or lexical processing in reading. Dual-route processing models highlight lexical processing in the reading of familiar words. Reitsma (1983) points out that typical children learn to recognize entire printed words after only 3 to 4 exposures as they are learning to read. It is estimated that by 3rd grade, children are able to recognize 80,000 words (Carroll et al., 1971; Adams, 1990). Recall that Ellis describes these orthographic representations (sight vocabulary) as "word recognition units". Coltheart & Castles (2003) describe some dyslexic readers as experiencing difficulty in establishing a large sight vocabulary. Their main difficulty appears to be visual-orthographic (developmental surface dyslexia as opposed to developmental phonological dyslexia). As early as 1973, Boder described "dyseideitic" readers who have particular difficulty in their vision and memory for letters and word shapes and have difficulty developing a sight vocabulary. Taking a somewhat different but related perspective, Wolf and Bowers (1999) described "naming-speed deficit readers" who experience naming-speed problems for visually presented symbols. These poor readers have difficulty automatizing the reading of familiar words and must therefore rely on

decoding. Indeed, the data on the current study points to deficits in naming-speed and in word recognition among the poor English Language Learners.

In our study, the PELL group experienced difficulty in orthographic-lexical recognition of printed words, both when reading sentences and when required to recognize correct word spellings. It could be argued that printed word recognition is not an important skill when reading in Spanish, given its highly consistent phoneme-to-grapheme correspondence. The literature, however, points out that Spanish readers develop more efficient word recognition skills as they become mature readers. In a study with school-aged children, Valle-Arroyo (1996) described 3rd and 5th grade readers as showing a shift from decoding to the automatization of reading processes. This "shift" meant an increased use of the lexical route (word recognition) as readers became faster and more efficient. Carrillo, Calvo & Alegria (2001) also found that older school-age readers consistently performed better than younger readers on lexical decision tasks, again reflecting the influence of additional years of education. Share (1995) further posits that children develop an orthographic lexicon through increased reading practice. Research from a developmental reading perspective points to the importance of developing lexical or word recognition reading strategies in both writing systems, English and Spanish.

We know, however, that word recognition or lexical strategies can be particularly difficult for readers of consistent orthographies, perhaps because of their over-reliance on decoding processes. Recall the case of FE (Spanish-English bilingual) reported by Meara and Coltheart (1985) who had difficulty distinguishing target words from homophone pairs in English such as "beach" and "beech". He also had spelling problems in Spanish,

suggesting poor orthographic representations. Recall also the case of AS, a bilingual (Japanese/English) adolescent, reported by Wydell and Butterworth (1999). AS experienced severe difficulties reading in English but near normal reading in the highly regular Kana. Recall also the several cases of differential dyslexia in Hindi-English and Kannada-English reported by Karanth (1998, 2003). More errors in reading English words reflected over-reliance on phonological strategies and poor use of lexical or word recognition strategies. The consensus is that dyslexic readers in more consistent writing systems than English may favor decoding strategies when lexical strategies are weak. Dyslexic readers tend to read slowly due to difficulty recognizing words and they have spelling errors. Our poor English language learners show such deficits in their native language reading ability.

The findings in this study indicate that we can accept Hypothesis II, that Spanish-speakers who report great difficulty learning English experience orthographic-lexical processing problems in L1. These deficits interfere with their ability to readily recognize and read printed words. Significant differences were evident when comparing our poor English language learners with the GELL and the PEER groups, indicating deficits in their ability to readily and accurately recognize correct word spellings and in their ability to read entences.

5.4. Fast lexical retrieval problems in the native language reflected in rapid automatized naming tasks

Recall that Hypothesis III predicted that Spanish-speakers who report great difficulty learning English would experience delays in the speed with which they can

access visual-verbal associations in L1. Their deficits would adversely influence the automaticity in the serial naming in Spanish of visually presented symbols.

In our study we found that the PELL group stood out relative to other groups with comparable years of education on rapid naming tasks in their native language, both in terms of their time to complete the task and in the accuracy with which items were named.

The PELL group on average required longer than the GELL group ($U=.000$, $p<.001$) and the PEER group ($U=15.50$, $p<.003$) in the time to rapidly name colors. The PELL group also required longer time in the rapid naming of letters when compared with the GELL group ($U=3.50$, $p<.008$) and the PEER group ($U=21.5$, $p<.013$). In addition to taking longer, the PELL group on average was less accurate than the GELL group in the rapid naming of objects ($U=.003$, $p<.008$) and letters ($U=3.00$, $p<.008$ and $p<.016$) and than the PEER group in the rapid naming of objects ($U=14.5$, $p<.003$) and letters ($U=22.5$, $p<.016$). The performance of the PELL group on these tasks highlight difficulty in the accessing of visual-verbal associations that are needed for fluent reading.

Our findings, thus, are consistent with Hypothesis III, which predicts difficulty in the ability to establish visual-verbal associations and rapid retrieval by those participants who reported great difficulty learning English.

Recall that we first compared the PELL group with the GELL group and the PELL group with the PEER group. We subsequently compared the PELL group with subsets of the PEER (AELL, APELL and PAELL) based on self- and teacher- ratings. In comparing the PELL group with subsets within the PEER group, we found that the PELL group took longer in rapidly naming objects ($U=6.5$, $p<.009$) and colors ($U=1.5$,

p<.001) when compared with the AELL group. They were less accurate than the AELL (U=7.00, p<.014) and the PAELL (U=3.00, p<.008) groups in the rapid naming of objects. The effects of high or low education may not determine rapid naming ability, as was obvious when the PELL group took longer in rapidly naming colors than the PELL Low-education group (U=5.5, p<.003). No other differences in rapid naming were found when comparing the PELL with the PELL-Low education or the PEER-Low education groups. This unexpected finding favoring a group with lower education should be interpreted with caution, as it only happened in one of the rapid naming tasks and may simply reflect unrelated conditions at the time of testing.

Given the strong support found in this study for the presence of rapid naming deficits in those who report difficulty learning English as a second language, we should address how rapid naming is related to reading. Young readers who exhibit difficulty in their ability to rapidly name serially presented visual symbols (colors and objects), were first reported by Denckla and Rudel in 1972 (see History and Significance of Rapid Automatized Naming by Denckla and Cutting (1999) for a comprehensive history of RAN tasks). The finding that some readers with difficulty experience longer latencies in online naming led to research by Wolf and Bowers, who in 1999 proposed the double-deficit hypothesis to classify different dyslexic readers. In their research they describe poor readers who experience naming-speed problems for visually presented symbols. These readers have particular difficulty "automatizing" the reading of familiar words and must therefore rely on decoding. The combined-deficit type, "phonological" and "naming-speed", constitutes the most impaired readers. In this double-deficit form, impaired readers have few compensatory strategies and remediation tends to be difficult.

The automaticity in visual-verbal associations can be likened to the efficiency with which words are recognized and recoded during online reading. Whereas rapid automatized naming focuses on the temporal aspects of recognizing and retrieving lexical codes, word recognition focuses on the orthographic match that the reader should be able to establish. It would appear that these are related processes. If the orthographic match is accurate, the visual-verbal association should be immediate. When the orthographic match is less clear, visual-verbal retrieval may take longer. These are questions in need of further researh.

The findings in this study reveal that we can accept Hypothesis III, which predicted that Spanish-speakers who report great difficulty learning English would experience deficits in the speed with which they can establish visual-verbal associations in L1. Our poor English language learners experienced deficits in the automaticity with which they rapidly named serially presented visual stimuli in their native language. These deficits were evident when they were compared against the GELL and the PEER groups for the rapid naming of colors, objects and letters.

5.5. Dyslexia and second language learning

This investigation was designed to explore why some Spanish-speakers experience severe difficulty in the learning of English as a second language. The guiding premise in this study was that there could be individuals with undiagnosed dyslexia in Spanish, a language with a highly consistent orthography. Since dyslexia is a language-based disorder that may include deficits in phonological-orthographic processing, word recognition and problems in rapid lexical retrieval, the learning of a second language becomes particularly difficult when any or a combination of these

deficits is present. Recall research by Sparks et al. (2006), Ganschow and Sparks (2000) and Sparks and Ganschow (1993a and 1995a) wherein they studied different groups of foreign language students on the Linguistic Coding Differences Hypothesis (LCDH). The main premise in this studies is that individual differences in FL learning derive from inefficiency in the phonological, syntactic, and semantic codes. These deficits may be overt or subtle in the native language and are likely to also affect the learning of a FL.

Orthographic differences between the native language and the second language, as is the case between Spanish and English, pose additional levels of difficulty (Ijalba and Obler, 2003). The English Language Learner who has native language reading deficits will face particular challenges in learning grapheme-phoneme correspondences, memorizing irregular spellings, establishing phonological representations, and gaining rapid lexical retrieval in the second language. Since most of these subtle language-learning problems often go unrecognized, many English Language Learners with related difficulties fail to benefit from specialized instruction. The contribution of this study lies in identifying that there is indeed such a group of people and in firmly establishing how the native language-based deficits associated with dyslexia may be at the root of their English language learning problems.

Results from this investigation reveal that testing for dyslexia in Spanish may in fact diagnose language-based problems that would interfere with the learning of a second language, such as English. However, not every task administered was sensitive in identifying English language learners with difficulty.

5.6. Sensitivity of the tasks used in testing for dyslexia

Several tasks were administered in testing for dyslexia and not all of them differentiated our groups. Only those tasks that tended to reveal significant differences between the main groups (PELL vs. GELL and PEER) were deemed to be "sensitive" in identifying some aspect of dyslexia, such as deficits in phonological-spelling ability, orthographic-lexical processing and word retrieval (See Table 4).

The Test of Reading Efficiency in Spanish (TEL) was among the tasks that most clearly differentiated the PELL group from the rest of the sample. This task provided an overall measure of reading ability in terms of reading time and reading accuracy for sentences. Poor English language learners (PELL) read more slowly and made more errors in responding when compared with the two main groups with comparable education levels in our sample (GELL and PEER). It can be inferred that basic reading problems in the areas of phonological-orthographic processing, including the ability to rapidly recognize words and their meanings, would be magnified when attempting to read in a less familiar script such as English. The Test of Reading Efficiency in Spanish was thus, considered to be a highly sensitive task in terms of differentiating the PELL group from the other English language learners in our sample.

Problems in phonological processing were evident among those English Language Learners who reported difficulty in their ability to learn and to read in English. The reading aloud of pseudowords or Non-words in Spanish was a sensitive task in identifying problems in phonological processing. This task requires the deployment of grapheme-to-phoneme conversions necessary for decoding, a sublexical process that is often at the root of dyslexia. Poor English language learners were able to readily identify

and to read familiar words in Spanish, showing that they had acquired a sight vocabulary in their L1. They were less able, however, to readily engage phonological-orthographic processes necessary for decoding. They read pseudowords very slowly and with many errors, showing significant differences from the group of Good English language learners and a trend when compared with the PEER group. Not all measures of phonological processing were as sensitive in telling our groups apart. The subtest of phoneme deletion from the Test of Phonological Awareness in Spanish (TPAS) did not yield significant differences between the PELL group and any of the groups with comparable years of education. It may be that adult English language learners with higher education levels require a more challenging task than this one, particularly when testing in Spanish, where the orthography is highly regular.

The test of Auditory discrimination for minimal pairs also proved to be inefficient in differentiating the groups. Recall that in this task, participants were asked to listen to pairs of syllables which differed in only one phoneme, i.e. "ta-da" and asked to say if the two syllables were the same or different. Interestingly, even though the Poor English language learners' had difficulty in establishing the association between phonemes and letters (poor phonological- orthographic processing), this difficulty does not appear to be related to how well they can hear or discriminate phonemic differences.

The Orthographic decision task was sensitive in revealing differences between the groups. Poor English Language Learners had difficulty rapidly recognizing correct word spellings. On the Orthographic decision task, Poor English language learners took significantly longer than the PEER and GELL groups in identifying correct word spellings from word pairs than contained a mispelled homophone. There were no

differences among the groups in accuracy levels on this task, except in the PELL-Low ed. group, again denoting the influence of education. Poor English language learners who had not attained a high school education were worst than their PELL counterparts in determining correct word spellings ($U=4$, $p<.002$). A similar trend was also evident in their ability to write these same words to dictation ($U=13.5$, $p<.055$), suggesting that our group of Poor English language learners (PELL) with more years of education, in spite of their phonology-orthography deficits, had established a sight vocabulary for familiar words.

All of the rapid naming tasks (objects, colors, letters) were sensitive in revealing significant differences between the PELL group and the PEER and GELL groups, both in terms of time and/or in accuracy levels. This is a particularly interesting result, since the participants in this study were adults and rapid naming tasks have been primarily evaluated in developing readers, where they are highly predictive of reading success. The Poor English language learners in this study took longer than the Good English language learners in rapidly naming items. They also made many more errors than their counterparts in the GELL and PEER groups. In spite of taking longer than both the GELL and PEER groups in two out of three of these tasks, the PELL participants were also less accurate than the other two groups. These findings may indicate that automatic or rapid lexical retrieval in the native language is a subtle deficit. This deficit may be most evident when poor readers are placed under pressure to rapidly read sentences or rapidly identify correct word spellings, as was the case among participants in our study.

Our groups were also differentiated in terms of their receptive vocabulary scores, both in their native language and in English. Significant differences were evident

between the Poor English language learners and the Good English language learners. The PELL group scored significantly lower than the GELL group in native language receptive vocabulary. These findings are congruent with research that indicates that much of our vocabulary knowledge is incidentally acquired through reading exposure. The Good English language learners also demonstrated that they had higher receptive vocabulary scores in English when compared with the PEER and PELL groups, confirming their self-reported proficiencies and learning abilities in English.

In conclusion the most sensitive tasks in differentiating the PELL group from the GELL and PEER groups were the Test of Reading Efficiency in Spanish, the Reading aloud of Nonwords, the Orthographic Decision task, and the Rapid Automatized Naming tasks. The PELL group took longer in responding on these tasks, denoting processing deficits on all of these measures.

5.7. Accuracy of self-rating and teacher-ratings in determining English language learning ability

Self-ratings and teacher-ratings were accurate in predicting language learning and reading abilities and in differentiating the PELL and GELL groups. In addition to differences in reading performance, scores in receptive English vocabulary were higher in the GELL group than in the PELL group despite the fact that two participants in the GELL group had lower than 12 years of education (average 8.50 years). Receptive vocabulary scores were also higher among the PEER group, thus, confirming that when students and their teachers concurred in a "poor English learner" rating, the accuracy of their combined ratings was high. Scores in many of the measures that were used to test for dyslexia also confirm that the PELL group had specific native language reading

deficits that could adversely influence their ability to learn English.The accuracy of self- and teacher-ratings was also evident when we further subdivided the PEER group into average, average-poor and poor-average English language learners. From these subdivisions, the average learners (AELL group, N=8) performed closer to the GELL group on more of the language and reading tasks than the other two subgroups (APELL and PAELL). Recall that only those students rated by their teachers as "better-than-most" English language learners and rated by the students themselves as "better-than-most" or "average" comprised the GELL group. Participants whose self-ratings and teacher-ratings coincided in describing them as "average" English language learners comprised the AELL group. When these "average" learners (AELL) are compared with the "poorest" learners (PELL), we find that they performed better on spelling ability and showed a trend denoting better decoding ability for the reading aloud of non-words. The AELL group was also faster than the PELL group at reading and completing sentences (Test of Reading Efficiency) and at identifying correct word spellings. They were also faster and more accurate than the PELL group on the rapid naming tasks (objects, letters and colors). We can conclude from our groups' performance that when the teachers' and students' ratings coincided, the judgment in terms of learning ability tended to be accurate.

When reviewing the group of "average-poor" learners (APELL, N=3), those participants whose self-ratings described them as "average" and whose teachers' ratings described them as "poor", we find support for the teachers' rating. There were no differences between the APELL group and the PELL group on any of the language or

reading tasks. It may also be that the number of APELL participants was too small to establish comparisons between the groups.

When looking at the group of "poor-average" learners (PAELL, N=6), whose self-ratings were "poor" and whose teachers' ratings were "average", we again find support for the ratings provided by the teachers. The PAELL group read and completed sentences faster than the PELL group. They also identified correct word spellings faster than the poor learners. They were more accurate than the PELL group on two of the rapid naming tasks and faster in one.

We can conclude that when comparing the relevance of self- and teacher-ratings, the latter tend to be more accurate than the former. Teachers adequately rated the "better-than-most" (GELL) learners, the "average-poor" (APELL) learners, and the "poor-average" (PAELL) learners. Students overall tended to be modest in self-rating their abilities (except in the AELL group). Recall also that in the GELL group only one student provided a self-rating of "better-than-most" and the rest of the GELL group was comprised of "average" self-ratings. Teachers were also on target when describing students as "average" learners in the PAELL group, whereas these students modestly judged themselves as "poor" learners.

In summary, when "teacher-rating" and "self-rating" coincide, the combined judgment can be particularly accurate in predicting performance, as evidenced in this study. Teachers tended to be more accurate than students in predicting performance, while students tended to modestly self-rate their abilities.

5.8. The role of education in reading and second language learning

In this investigation we have seen that the role of education plays an important factor in native language proficiency and in the ease or difficulty that many individuals experience in learning English as a second language. One characteristic that readily stood out among our groups was native language receptive vocabulary differences. The PELL group had lower native language receptive vocabulary scores when compared with the GELL group, in spite of having achieved the same educational levels. This finding is consistent with the report that reading ability plays an important role in building a receptive vocabulary repertoire (Beck and McKeown, 1991; Carlisle and Rice, 2002). However, it is also consistent with the possibility that poor vocabulary acquisition results in poor reading ability (Biemiller, 1999a). When the PELL group is compared with the PELL-Low education group, we again find differences in receptive vocabulary, this time favoring the PELL group. In this case, we can conclude that additional years of education contribute to receptive vocabulary

There were no differences among the groups when we compared the PELL with the PEER-Low education group. This is a very interesting finding because it highlights the importance of reading ability in building vocabulary. We have already seen how years of education contribute to expanded vocabulary when comparing the two groups, Maybe those with poor vocabulary tend to drop out of school. Or maybe those from vocabulary-rich homes tend both, to have better vocabulary and to be motivated to stay in school in spite of their reading problems. However, by not finding differences among the PELL group and the PEER-Low education group, we can also conclude that lower

reading ability, over time, may have similar effects as fewer years of education can have on an individual.

We can see that the PELL-Low education participants are the most challenged English language learners in our sample, as indicated by their poor performance. Whereas the PELL group with high education levels experienced difficulty on specific language and reading tasks, such as decoding of non-words and timed orthographic decision, the PELL Low-education group had increased difficulty in other tasks. For example, spelling to dictation and accuracy in orthographic decision tasks were all more difficult for the PELL-Low education group than for the PELL group with 12th+ grade education. Recall that in a study by Sparks et al. (1997) receptive vocabulary in the native language was one of the best predictors of FL learning among high school students. In a second study with the same group of high school students, Sparks et al. (1998) found that overall FL proficiency was related to performance on measures of native language, including receptive vocabulary and reading comprehension. It is, thus, not surprising to note that the PELL Low-education participants in our study also scored the lowest among the groups on receptive English vocabulary scores, which is consistent with their reported difficulties in learning English.

In summary, years of education are important in overall knowledge of native language receptive vocabulary, spelling and reading accuracy. In our study, poor English Language Learners who had not achieved at least 12 years of education showed additional native language and reading deficits when compared with poor English Language Learners with high education. What was more surprising to find was that poor

English Language Learners with high education performed similarly to average English Language Learners who had fewer years of education (PEER-Low education).

5.9. Limitations of this study

There are two limitations in this study that should be addressed in future research. The main one concerns its external validity, given the relatively low number of participants that made up the groups. Increasing the sample size would yield decreased variance and facilitate finding differences among the groups. However, in this study we found significant differences between the PELL and the GELL groups on 9 out of 14 tasks with p values ranging from .001 to .014 (see section 4.2). We also found differences between the PELL and the PEER groups on 6 out of the 14 tasks employed and the p values ranged from .001 to .016 (see section 4.3). It should also be noted that 2 out of the 14 tasks did you reveal any differences among our groups, in fact, all our groups scored at ceiling. Apart from these two tasks in which participants scored at ceiling, these are strong findings, both for the tasks that revealed significant differences and for those that did not reveal any differences.

A second limitation in this study was in the choice of tasks to measure phonological processing. The phonological awareness task did not yield differences among our groups. Recall that we obtained ceiling responses by all groups on this task. A more challenging instrument may be needed to find differences among adult readers. There are several spoonerisms tasks (see section 2.5.1) in which phonemes are swapped between two words, and the processing demands are higher than in the simple phoneme deletion task we used in this study. An additional task that should be included in future studies would be one on phonological memory, also a related skill that is associated with

dyslexia (Wagner, Torgesen, Rashotte, 1999) and we did not include in this study due to timing constraints in testing.

In summary, two limitations in this study were sample size and the use of a phonological awareness task that was not challenging enough to yield group differences. Testing for phonological memory would also improve the measures used under phonological processing.

5.10. Differences in this study from prior research

Recall that much of the research in Foreign Language learning and in Second Language learning focuses on college students (see studies by Sparks, Ganschow et al.) and on school-aged bilingual populations (see studies by Cummins, Byalistok, August, Hakuta). Our study is different from their research because it explores performance on specific language and reading tasks in an adult population of English Language Learners who were unaware of having any reading or language learning problems in their native language. Our findings reveal that subtle phonological-orthographic problems in L1 can create life-long difficulty in the learning of a second language.

Our study is also different from prior research, in that it uses a combination of reading tasks in L1 that range from sentence reading (global measure) to word and pseudoword reading (decoding and word identification) to the automaticity in visual-verbal associations (rapid automatized naming). No known prior research in foreign language learning or in second language learning looks at reading performance from such a comprehensive perspective. It is also noteworthy that, whereas prior research has focused on "performance", a variable that was closely scrutinized in this study was processing time. In fact, a key finding in our study was that Poor English Language

Learners take a long time in processing written language or in making visual-verbal associations.

Finally, our research is different from prior studies in that it used self- and teacher- ratings in determining the groups that were studied. It is interesting to note that both, participants and teachers provided accurate ratings describing who was a poor English Language Learner vs. who was a good English Language Learner. Whereas these ratings were supported by other measures, such as receptive vocabulary in English and responses on a comprehensive learning and reading history questionnaire, the relevance of using rating scales with English Language Learners was evident in this study.

In summary, our research is different from prior studies because it explored an adult population of English Language Learners who were unaware of having reading-language problems in their native language, Spanish. We also used a comprehensive battery of reading tests in the native language and predicted deficits in phonology-orthography and in visual-verbal automaticity that could interfere with second language learning. We looked at processing time as indicative of reading difficulty and found significant differences between our groups. We also used self- and teacher- ratings to identify poor vs. good English Language Learners.

5.11. Future research

Results from this investigation provide evidence that for some Spanish-speakers who report severe difficulty in learning and reading English, language-based problems associated with dyslexia are present in their native language, Spanish. These deficits tend to be subtle and may not be obvious in everyday language use, such as in conversation, or

even when they are reading in Spanish. Only when specific tests are administered, tapping directly into language areas prone to problems in dyslexia, is the true nature of these deficits revealed.

A key finding in this research has been that aspects in the processing of the linguistic input tend to be slow and inefficient in poor English Language Learners. This inefficient processing can be traced to phonological processing and its links to orthography. We find that poor second language learners may have lifelong difficulty with decoding, spelling and building word recognition for familiar words. They may also have difficulty with rapid lexical retrieval in naming tasks, a skill associated with reading fluency. These deficits may often go unrecognized, particularly in highly consistent orthographies such as Spanish.

An important aspect of further research should focus on effective teaching methodology to be used with poor English Language Learners. There is a substantial body of research focusing on the use of a structured multisensory approach in the teaching of a second language (see Sparks and Miller (2000) for a review of the effectiveness of using multisensory structured language techniques in the teaching of a foreign language). The hallmark of this approach is to teach the orthography-phonology connections by engaging multiple modalities (writing, reading, listening, oral) and progressing from the simple sound-to-letter levels to the more complex levels. Typical areas of instruction would be phonemes, phoneme-letter combinations, word structure and grammatical morphology, such as the application of suffixes and grammatical rules.

In structured multisensory language instruction, the sound-to-symbol relationship is carefully taught in slow incremental levels and constantly reviewed using the various

modalities. Daily lessons target each area specifically. For example, Sparks and Miller (2000) describe a typical ESL classroom as beginning with oral warm up drills, followed by blackboard writing to reinforce phoneme-to-letter skills, followed by grammar instruction and morphology, then dialogue drills and finally reading-communication practice focusing on the learned concepts. Further study on the best teaching methodology to support foreign language learning would not only be beneficial for those students trying to learn English as a second language but also for English-speakers struggling to learn another language. Different pairs of languages, may also present specific problems for different students, such as Spanish vs. Arabic. In the case of English-speakers or Spanish-speakers learning a language with a different script, such as Arabic, their native laguage skills are also likely to influence how they learn the new language. Determining these differences is an increasing necessity in a multilingual society.

Another area of related research would be in the early identification of ESL learning and/or reading problems in bilingual children. Early identification (prior to the 2nd grade) and appropriate intervention, would help in preventing reading failure and it would enhance ESL learning. The use of multisensory structured language intervention may be particularly well suited to work with English Language Learners who experience reading difficulty, since their problems may be rooted in how they process the phonology-orthography components of language.

Broader research questions regarding English Language Learners can directly address proficiency vs. disorder in each of their languages. At what point does lack of proficiency become a deficit? How do children make the transition from one

phonological system to another? How do children build strong phonological-orthographic representations when they come to school with a phonological system and grammar that is different from the language of instruction?

Future research should also explore the role of phonological awareness and the transition to written language. We need to find out how these areas develop in the native language and how they influence second language learning.

Finally, the role of fluency and rapid automatized naming processes need to be further studied in English Language Learners. Of particular importance is how rapid naming and fluency interface with phonological-orthographic-processing.

Identification of language and reading deficits is essential in at risk English language learners, in both, adults and children. Specific training focusing in phonology-orthographic processing across modalities and fluency may hold promising results in working with the growing population of English language learners in our society.

Appendix I: List of testing materials, task description and administration instructions

- Test of Reading Pseudowords (Test de Lectura de Pseudopalabras, by Carrillo 2002)
- Test of Dictation (Test the Dictado, by Carrillo, 2002)
- The Subtest of Deletion from the Test of Phonological Awareness in Spanish (TPAS, by Riccio et al., 2004)
- Test of Reading Efficiency in Spanish (Test de Eficiencia Lectora, by Carrillo and Marin, 2002)
- The of Orthographic Decision Test (Test de Decisión Ortográfica, by Carrillo, 2002)
- The Rapid Automatized Naming of Colors, Naming of Objects and Naming of Letters from the Comprehensive Test of Phonological Processing (CTOPP by Wagner, Torgessen and Rashotte, 1999).
- Test de Vocabulario en Imágenes (TVIP by Dunn et al., 1986)
- Peabody Picture Vocabulary Test (PPVT-III by Dunn and Dunn, 1997)
- Test of Auditory Discrimination for Minimal Pairs in Spanish (Test de Pares Minimos, by Carrillo, 2002)
- Word-List Reading Test (Test the Lectura de Palabras by Carrillo, 2002)
- Standard Progressive Matrices Test (Ravens)
- Questionnaire on Reading and Language History

Task description and administration instructions

Test of Reading Pseudowords (Test de Lectura de Pseudopalabras, by Carrillo 2002)

Task description

The processes that mediate the decoding of less familiar printed words are critical to efficient reading. Tasks in which the reader is asked to read aloud a set of nonwords can be found in reading batteries in English and Spanish (i.e.: WRMT-R, GDRT, PROLEC). The reading of nonwords involves decoding and it measures the efficiency with which readers can rapidly establish sound-to-letter associations in order to read utterances that have never before been encountered in print.

The test of Lectura de Pseudopalabras (Reading of pseudowords) by Carrillo (2002) was selected in order to measure decoding and to contrast the efficiency of this strategy with that of reading familiar words. This task consists of a list of pseudowords (nonwords) that resemble a list of familiar words that must also be read aloud in a different task. The list of pseudowords is made up of 12 two-syllable nonwords, 12 three-syllable nonwords and 12 four-syllable nonwords. Each participant read these items aloud and responses were tape-recorded. Response time and number of errors were measured. One point was credited for each pseudoword read correctly. The following items are illustrative of the pseudowords in this test:

Examples: "litón", "tranchama", "litoda" ,"lafeciojes"

Test administration procedures

Each participant was given this set of instructions in Spanish (see actual Spanish text below this translation):

"You must read aloud a list of invented words. Remember that these are invented words and you must read them carefully and correctly. I will tape-record your reading as part of this task. I will also measure the time you take in reading these words. We can begin when you are ready."

Please note the exact instructions that were provided in Spanish:

"Usted deberá leer en voz alta una lista de palabras inventadas. Recuerde que son palabras inventadas y por lo tanto, deberá leerlas con cuidado y correctamente. Gravaré su lectura como parte de esta tarea. También mediré el tiempo que tome en leer estas palabras inventadas. Podemos comenzar cuando este lista(o)."

(See Appendix A for a full version of the Test of Reading of Pseudowords)

Test of Dictation (Test the Dictado, by Carrillo, 2002)

Task description

The Test of Dictation (Carrillo, 2002) contains familiar words representative of the above sources of difficulty in Spanish. The same words were first presented to participants through dictation and were later reintroduced in the Orthographic Decision task. In the Dictation task, participants were required to spell by writing 36 words that included spelling irregularities such as those depicted above. The dictation task was only scored on the number of correctly spelled words.

Test administration procedures

Each participant was given the following set of instructions in Spanish (see actual Spanish text below this translation):

"You must write down words that will be dictated to you. These are familiar words in Spanish that you already know. Spell them carefully and correctly. Write one word in each line, making a list. We can begin when you are ready."

Please note the exact instructions that were provided in Spanish:

"Usted deberá escribir palabras que serán dictadas. Estas son palabras es español que usted ya conoce. Escribalas con cuidado y correctamente. Escriba una palabra en cada linea, haciendo una lista. Podemos comenzar cuando este lista."

The Subtest of Deletion from the Test of Phonological Awareness in Spanish (TPAS by Riccio et al., 2004)

Task description

Phonological awareness (PA) refers to an individuals's ability to segment and manipulate phonemes within spoken words. This ability to reflect upon the sound elements of words is a metaphonological skill that has been identified as one of the key predictors of reading achievement in young readers across orthographies (Landerl et al., 1997; Durgunoglu, et al. 1993; Goswami, 2002; Lindsey et al., 2003) and is also correlated with the building of word recognition in adult readers (Carlo and Skilton Sylvester, 1996). In this study, the subtest of Deletion from the Test of Phonological Awareness in Spanish (TPAS) by Riccio et al., (2004) was administered. In this task participants were asked to eliminate part of a target word in order to make up another

word. Each correct response was credited one point and there were a total of 30 items. See the example below:

Say “anoche” without saying /a/: the response would be “noche”

Test administration procedures

Each participant was given this set of instructions in Spanish (see actual Spanish text below this translation):

“In this task we will start with a word and we will then remove part of the word in order to form a new word. We will start with a few examples.” (Participant must be able to complete well all four of the sample items prior to proceeding with the rest of the task.)

Please note the exact instructions that were provided in Spanish:

“En esta tarea comenzaremos con una palabra y después vamos a quitar parte de la palabra para formar otra palabra. Empecemos con algunos ejemplos.”

Test of Reading Efficiency in Spanish (Carrillo and Marin, 2004)

Task description

Reading text involves not only word recognition but also the ability to integrate the meaning of the words being read in order to make sense of larger syntactic units. In order to determine reading performance on a global measure incorporating word recognition and reading comprehension for sentences, the Test of Reading Efficiency (Marin and Carrillo, 2001) was administered. This task requires participants to read rapidly and accurately each of a set of 64 incomplete sentences (the last word is missing) and to complete these sentences by adding the missing word. This missing word must be selected from a set of 4 candidates that are orthographic neighbors; two are real words and two are pseudowords. One point is credited for each correct response and the time to

complete the task is recorded. The first page of this test includes two practice items that the participant must complete in order to understand the task. The rest of the questions are contained in subsequent pages. The following example is illustrative of the items in this test (the underlined word is the correct response):

El caballo tenía la pata… (The horse's leg was …) (broken)

ropa rola <u>rota</u> roka

(clothes) (pseudoword) (broken) (pseudoword)

Test administration procedures

Each participant was given this set of instructions in Spanish (see actual Spanish text below this translation):

"You will have to read a set of sentences in Spanish. Each of these sentences is missing the last word. Your task is to select the missing word from a set of four choices under each sentence. In order to learn this you will complete two practice items and you can ask any questions prior to reading the rest of the sentences. You must read and complete the sentences as rapidly and as accurately as you can. I will be measuring the time you take to complete all the sentences and will then score them to see how many were completed correctly. If you come across a sentence that you cannot understand, do not stop but continue on to the next sentence. Remember that your time is being measured, therefore, do not stop and continue to the end. After you complete the two practice sentences, you can turn over the page and continue reading and completing the rest of the sentences. You can turn over the test when you are ready to start."

Please note the exact instructions that were provided in Spanish:

"Usted tendrá que leer un grupo de oraciones en español. En cada una de estas oraciones falta la última palabra. Su tarea consiste en seleccionar la palabra que falta, de las cuatro palabras debajo de cada oración. Para aprender a hacer bien esto, usted debe completar dos ejemplos y puede preguntar lo que necesite antes de proseguir a leer el resto de las oraciones. Usted deberá leer y completar las oraciones tan rápido y correctamente como pueda. Mediré el tiempo que usted demore en completar todas las oraciones y también contaré cuantas oraciones fueron completadas correctamente. Si usted encuentra alguna oración que no puede comprender, no pare y continue hacia la próxima oración. Recuerde que estaré midiendo su tiempo, por lo tanto, no pare y continue hasta el final. Cuando complete las dos oraciones de práctica, usted podrá dar vuelta la página y continuar leyendo y completando el resto de las oraciones. De vuelta el examen cuando cuando quiera comenzar."

The Orthographic Decision Test (Test de Decisión Ortográfica, by Carrillo, 2002)

Task description

In the Orthographic Decision task participants had to rapidly identify the correctly spelled word from word pairs that included a correctly spelled word and its misspelled homophone. The speed with which participants completed the Orthographic Decision task was timed and participants were also rated on their accuracy in word identification.

Test administration procedures

Each participant was given this set of instructions in Spanish (see actual Spanish text below this translation):

"You have to select the correctly spelled word from each pair in a list of words. Mark with your pencil the correctly spelled word from each word pair as you read down

the list. Do this well and as rapidly as you can because I will be timing you. We can begin when you are ready."

Please note the exact instructions that were provided in Spanish:

"Usted debe elegir la palabra que esté bien escrita de cada par de palabras en una lista. Marque con el lápiz la palabra bien escrita de cada par de palabras en lo que usted lee esta lista. Haga esto bien y tan rápidamente como pueda porque estaré midiendo el tiempo que demore en hacerlo. Podemos comenzar cuando esté lista(o)."

The Rapid Automatized Naming of Colors, Naming of Objects and Naming of Letters from the Comprehensive Test of Phonological Processing (CTOPP by Wagner, Torgessen and Rashotte, 1999).

Measures of rapid naming have been found to be good predictors of reading fluency across orthographies, particularly in consistent writing systems in which reading disorders may be more difficult to identify. Research by Bowers, 1993, 1995; Wolf and Bowers, 1999; Wagner et al., 1999; Wimmer et al., 2000; Wolf et al., 2000; Wile and Borowsky, 2004 point out the importance of rapid lexical retrieval in online reading. The rapid naming of colors, objects and letters is part of the Comprehensive Test of Phonological Processing (CTOPP) by Wagner, Torgessen and Rashotte, 1999. The items in these measures can be named in any language and the only necessary adaptation was to provide instructions in Spanish. Participants were instructed to name as rapidly and accurately as possible each of a set of familiar objects, familiar colors, and alphabet letters. Practice items in a single row were first presented and then the page was turned to present a grid with several rows of the target items which the participant had to name rapidly. Separate tasks were provided for naming colors (Form A), naming familiar

objects (Form B) and naming letters (Form C). In each of these tasks responses were tape recorded, scored for accuracy and time via use of a stopwatch. Please see Appendix A for examples of each of these rapid automatized naming tasks.

Rapid naming of colors: Task description

The rapid color naming task consists of 72 items presented as a series of different colored squares arranged in four rows and nine colums of six randomly arranged color squares (red, yellow, blue, green, brown, orange). Participants were asked to name these colors aloud beginning on the first row from left to right and proceeding to subsequent rows until the last item. A practice sheet containing one row of colored squares was first shown.

Test administration procedures

Each participant was given this set of instructions in Spanish (see actual Spanish text below this translation):

"Tell me what colors you see in this row. Start here." (Point to first item and continue pointing if necessary. If the participant makes any errors, correct the participant and have her/him repeat all the colors again. If the participant continues to make errors, discontinue testing). After the practice items have been completed, say, "You will be saying the names of some colors as fast as you can. Now I want you to say the names of the colors on this page as fast as you can. When I tell you to start, you will begin here (point to upper left corner on Form A), and name this row (point to top row) before you go to the next row. Just name the colors in each row as fast as you can until you come to the end. Try not to skip any boxes. Do you understand? The examiner should put a blank sheet on top of Form A to cover the colors for about 5 seconds. Upon lifting this

sheet, the examiner should say: "You will begin as soon as I uncover the page. Ready? Begin." The examiner will begin timing as soon as the participant names the first color and stop timing when the last color is named. Errors will be tracked by tape-recording responses and by putting a slash through each color named incorrectly.

Please note the exact instructions that were provided in Spanish:

"Digame que colores ve en esta fila. Comienze aquí. Usted tendrá que decir los nombres de algunos colores tan rápidamente como pueda. Ahora, quiero que me diga los nombres de los colores en esta página tan rápidamente como pueda. Cuando le diga que comienze, usted empezará aquí y nombrará esta fila antes de nombrar la próxima fila. Simplemente digame los colores en cada fila tan rápidamente como pueda hasta que llegue al final. Trate de no saltar ningun color. ¿Comprende?"

Rapid naming of objects: Task description

The rapid object naming task consists of 72 items presented as a series of different familiar objects arranged in four rows and nine colums of six randomly arranged pictures of objects (pencil, star, fish, chair, boat, key). Participants were asked to name these objects beginning on the first row from left to right and proceeding to subsequent rows until the last item. A practice sheet containing one row of pictures of objects was first shown.

Test administration procedures

Each participant was given this set of instructions in Spanish (see actual Spanish text below this translation):

"What objects do you see in this page?" (Point to first item and continue pointing if necessary. If the participant makes any errors, correct the participant and have her/him

repeat all the colors again. If the participant continues to make errors, discontinue testing). After the practice items have been completed, say, "You will be saying the names of some objects as fast as you can. Now I want you to say the names of the objects on this page as fast as you can. When I tell you to start, you will begin here (point to upper left corner on Form B), and name this row (point to top row) before you go to the next row. Just name the objects in each row as fast as you can until you come to the end. Try not to skip any objects. Do you understand? The examiner should put a blank sheet on top of Form A to cover the objects for about 5 seconds. Upon lifting this sheet, the examiner should say: "You will begin as soon as I uncover the page. Ready? Begin." The examiner will begin timing as soon as the participant names the first object and stop timing when the last object is named. Errors will be tracked by tape-recording responses and by putting a slash through each object named incorrectly.

Please note the exact instructions that were provided in Spanish:

"Digame que objetos ve en esta fila. Comienze aquí. Usted tendrá que decir los nombres de algunos objetos tan rápidamente como pueda. Ahora, quiero que me diga los nombres de los objectos en esta página tan rápidamente como pueda. Cuando le diga que comienze, usted empezará aquí y nombrará esta fila antes de nombrar la próxima fila. Simplemente digame los objetos en cada fila tan rápidamente como pueda hasta que llegue al final. Trate de no saltar ningun color. ¿Comprende?"

Rapid naming of letters: Task description

The rapid letter naming task consists of 72 items presented as a series of different letters arranged in four rows and nine colums of six randomly arranged letters (a, c, k, n, s, t). Participants were asked to name these letters beginning on the first row from left to

right and proceeding to subsequent rows until the last item. A practice sheet containing one row of pictures of letters was first shown.

Test administration procedures

Each participant was given this set of instructions in Spanish (see actual Spanish text below this translation):

"What letters do you see in this page?" (Point to first item and continue pointing if necessary. If the participant makes any errors, correct the participant and have her/him repeat all the colors again. If the participant continues to make errors, discontinue testing). After the practice items have been completed, say, "You will be saying the names of some letters as fast as you can. Now I want you to say the names of the letters on this page as fast as you can. When I tell you to start, you will begin here (point to upper left corner on Form C), and name this row (point to top row) before you go to the next row. Just name the letters in each row as fast as you can until you come to the end. Try not to skip any letters. Do you understand? The examiner should put a blank sheet on top of Form A to cover the letters for about 5 seconds. Upon lifting this sheet, the examiner should say: "You will begin as soon as I uncover the page. Ready? Begin." The examiner will begin timing as soon as the participant names the first letter and stop timing when the last letter is named. Errors will be tracked by tape-recording responses and by putting a slash through each letter named incorrectly.

Please note the exact instructions that were provided in Spanish:

"Digame que letras ve en esta fila. Comienze aquí. Usted tendrá que decir los nombres de algunas letras tan rápidamente como pueda. Ahora, quiero que me diga los nombres de las letras en esta página tan rápidamente como pueda. Cuando le diga que

comienze, usted empezará aquí y nombrará esta fila antes de nombrar la próxima fila. Simplemente digame las letras en cada fila tan rápidamente como pueda hasta que llegue al final. Trate de no saltar ninguna letra. ¿Comprende?"

Test de Vocabulario en Imágenes (TVIP)

Task description

Measures of receptive vocabulary in the native language are associated with reading proficiency and with second language learning abilities (See Artzer et al., 1997; Ganschow et al., 1998). It is also known that students with good oral vocabulary but poor reading skills tend to develop deficits in vocabulary as they get older because they cannot benefit from the incidental vocabulary learning that comes with reading (Carlisle, 2002). In order to find out if there were receptive vocabulary differences between the Good English learners and the Poor English learners, the Test de Vocabulario en Imágenes (TVIP) (Dunn, L.M, Padilla, E.R., Lugo, D.E., Dunn, L.M. 1986) was administered. This test consists of 125 items ranging from high frequency familiar words to low frequency words. Each word is accompanied by four picture choices and the participant must select the correct picture for the word that is presented by the examiner. See Appendix A for an example of this task.

Test administration procedures

Each participant was given this set of instructions in Spanish (see actual Spanish text below this translation):

"I want to find out about the vocabulary you know". Show practice series D and say: "There are four pictures in this page. Each picture has a number (point and say 1, 2, 3, 4). Continue saying, " I will say a word and I want you to tell me the number or point

to the picture of the word I say. Let us try with one word. Tell me the number or point to the picture of this word." If the participant responds correctly, say "good" and administer the next practice item. If the participant makes a mistake, correct and administer more practice items until obtaining two correct consecutive responses.

Please note the exact instructions that were provided in Spanish:

"Quiero averiguar sobre su vocabulario. Hay cuatro imágenes en esta página. Cada dibujo tiene un número (1, 2, 3, 4). Yo diré una palabra y quiero que usted me diga el número o señale el dibujo de la palabra que yo diga. Practiquemos con una palabra que yo diga. Digame el número o señale el dibujo para la palabra."

Peabody Picture Vocabulary Test (PPVT-III)

Task description

Measures of receptive vocabulary in the second language are associated with native language oral and reading proficiency (See Sparks et al., 2006). In order to find out if there were receptive vocabulary differences in English between the Good English learners and the Poor English learners, the Peabody Picture Vocabulary Test (PPVT-III) was administered. This test consists of 160 items ranging from high frequency familiar words to low frequency words. Each word is accompanied by four picture choices and the participant must select the correct picture for the word that is presented by the examiner. See Appendix A for an example of this task.

Test administration procedures

Each participant was given this set of instructions in Spanish (see actual Spanish text below this translation):

"I want to find out about the vocabulary you know in English". Show practice items and say: "There are four pictures in this page. Each picture has a number (point and say 1, 2, 3, 4). Continue saying, " I will say a word in English and I want you to tell me the number or point to the picture of the word I say. Let us try with one word. Tell me the number or point to the picture of this word." If the participant responds correctly, say "good" and administer the next practice item. If the participant makes a mistake, correct and administer more practice items until obtaining two correct consecutive responses.

Please note the exact instructions that were provided in Spanish:

"Quiero averiguar sobre su vocabulario en inglés. Hay cuatro imágenes en esta página. Cada dibujo tiene un número (1, 2, 3, 4). Yo diré una palabra y quiero que usted me diga el número o señale el dibujo de la palabra que yo diga. Practiquemos con una palabra. Digame el número o señale el dibujo para la palabra."

Test of Auditory Discrimination for Minimal Pairs in Spanish (Test de Pares Minimos, by Carrillo, 2002)

Task description

Participants' ability to discriminate between subtle phonemic differences in syllable pairs was evaluated as part of phonological processing. It could be argued that if participants have difficulty in spelling tasks or even with phonological representations, these deficits could in part be due to failure in accurately discriminating phonemes in their native language. The test of Auditory Discrimination for Minimals Pairs in Spanish (Carrillo, 2002) was evenly administered by playing items recorded on a CD. Participants were required to listen to syllabic word pairs and indicate if the syllables

within each pair were the same or different. The following examples are illustrative of this task:

Examples: "pa – ba"; "kla – gla"; "fa – va"; "ma – na"

Test administration procedures

Each participant was given this set of instructions in Spanish (see actual Spanish text below this translation):

"We will start by listening to two syllabes and will determine if these syllables are the same or different. The syllables sound very close. We must therefore listen carefully. You will raise your hand like this (model raising hand) everytime that the syllables sound different. Let us start with a few examples." (The participant should respond well on the four examples provided. If a mistake is made, the syllable pair should be readministered to elicit a correct response. Only proceed when the examples have been mastered)

Please note the exact instructions that were provided in Spanish:

"Comenzaremos escuchando dos sílabas y debemos determinar si estas sílabas son iguales o diferentes. Las sílabas se parecen bastante, por lo tanto hay que escuchar con mucho cuidado. Debe levantar la mano así (demostración) cada vez que las sílabas sean diferentes. Empecemos con algunos ejemplos."

Word-List Reading Test (Test the Lectura de Palabras by Carrillo, 2002)

Task description

The test of Lectura de Palabras (Reading of Words) by Carrillo (2002) was selected in order to measure visual word recognition and to contrast the efficiency of this strategy with that of decoding. This task consists of a list of familiar words that resemble a list of pseudowords that must also be read aloud in a different task. The list of familiar

words is made up of 12 two-syllable words, 12 three-syllable words and 12 four-syllable words. Each participant read these items aloud and responses were tape-recorded. Response time and number of errors were measured. One point was credited for each word read correctly. The following items are illustrative of the words in this task:

Examples: "libro", "transistor", "lavadora", "libreta"

Test administration procedures

Each participant was given this set of instructions in Spanish (see actual Spanish text below this translation):

"You must read aloud a list of familiar words. These are words that you should know. Read them carefully and correctly. I will tape record your reading as part of this task. I will also measure the time you take in reading these words. We can begin when you are ready."

Please note the exact instructions that were provided in Spanish:

"Usted deberá leer en voz alta una lista de palabras conocidas. Estas son palabras que usted ya conoce. Léalas con cuidado y correctamente. Gravaré su lectura como parte de esta tarea. También mediré el tiempo que tome en leer estas palabras. Podemos comenzar cuando este lista(o)."

Standard Progressive Matrices (Ravens)

Task description

This is a nonverbal task of cognitive ability. Participants are presented with figures or matrices consisting of patterns in a progression and they are asked to select the correct pattern to complete the sequence. There are 5 sets of progressive matrices

(ABCDE) increasing in the order of difficulty and there are 12 items in each section. A total score is calculated by adding responses under each set.

Test administration procedures

Participants were presented with a booklet containing the progressive matrices on each page. They were instructed to carefully look at each figure and to select the one that should follow the pattern. They were first allowed to complete two practice patterns and instructed to continue on to the rest of the test when they were ready. Participants were reminded to work as rapidly as possible through all the figures but were also told that there was no time limit. Each participant's performance was timed.

Questionnaire on Reading and Language History

Task description

This questionnaire consists of 40 questions written in Spanish and arranged under the categories of: 1) Early learning, language and reading history; 2) Current native language ability; 3) Learning English; 4) Reading in English; 5) Reading in Spanish, and 6) Integration into U.S. mainstream society. Responses were scored on a 5 point-scale, with 0 being the "no difficulty" and the other extreme being "severe difficulty" (all were converted to a single scale for the purposes of analysis).

Test administration procedures

The questionnaire was given as part of an untimed personalized interview. Participants were read each of the questions and asked to provide responses on a 0-4 scale. They were also allowed to read over the questions and to review their responses.

Appendix II. Questionnaire on Reading and Language History

(Spanish)

Nombre:_____

Dirección postal:_____

Teléfono:_____

E-mail:_____

Fecha de nacimiento:_____

País de origen:_____

CUESTIONARIO SOBRE HISTORIA DE LENGUAJE Y LECTURA

Este cuestionario contiene preguntas relacionadas a su aprendizaje escolar, uso del lenguaje en su lengua nativa, su forma de aprender y usar el inglés, y también sobre algunas de sus prácticas sociales. Por favor circule el número en la respuesta que mas se aproxime a su experiencia en las siguientes preguntas.

---

1. ¿Cuál de los siguientes describe mejor la actitud que usted tenía hacia la escuela cuando era niño?

Me gustaba		Indiferente		No me gustaba
0	1	2	3	4

---

2. ¿Cómo describiría usted su aprendizaje en la escuela primaria?

Bueno		Promedio		Malo
0	1	2	3	4

---

3. Indique si necesitó ayuda para aprender a leer cuando estaba en la escuela primaria.

Ninguna	Familia	Tutor especial

0 1 2 3 4

---

4. Indique si invertía usted el órden de las letras o de los números cuando era niño(a)

Nunca Ocasionalmente Muchas veces

0 1 2 3 4

---

5. ¿Cómo compararía usted su habilidad en la lectura en relación a sus compañeros de primaria?

Mejor Igual Peor

0 1 2 3 4

---

6. ¿Tenía dificultad en articular correctamente algunas palabras de niño?

Nunca Ocasionalmente Frecuentemente

0 1 2 3 4

---

7. ¿Tiene hoy en día dificultad en recordar como se dicen algunas palabras en su propia lengua?

Nunca Ocasionalmente Frecuentemente

0 1 2 3 4

---

8. ¿Cómo compararía su habilidad lectora en relación a otros con quienes ha estudiado?

Mejor Igual Peor

0 1 2 3 4

---

9. ¿Cuan fácil o dificil diría usted que es aprender a leer inglés?

Fácil Regular Dificil

0 1 2 3 4

---

10. Describa su actitud en cuanto a la lectura en general.

Me gusta Me da igual No me gusta

0 1 2 3 4

---

11. ¿Cuánto tiene usted que leer en relación con su trabajo?

Mucho Un poco Muy poco

0 1 2 3 4

---

12. ¿Qué tal es su habilidad para recordar los nombres de personas en su lengua?

Bueno Promedio Malo

0 1 2 3 4

---

13. ¿Lee cosas en inglés?

Siempre Ocasionalmente Nunca

0 1 2 3 4

---

14. ¿Lee cosas en español?

Siempre Ocasionalmente Nunca

0 1 2 3 4

---

15. ¿Tuvo alguna dificultad en sus clases a nivel de secundaria o en la universidad?

Ninguna Un poco Mucha dificultad

0 1 2 3 4

---

16. Su ortografía en español es:

Excelente Regular Pobre

0 1 2 3 4

---

17. ¿Pensaron alguna vez sus padres que usted podría repetir algún grado escolar?

Nunca Alguna vez Frecuentemente

0 1 2 3 4

---

18. Si usted pudiera describir la calidad de las escuela(s) en las que estudió cuando mas joven, diría usted que eran buenas o malas?

Buenas		Regulares		Malas
0	1	2	3	4

---

19. ¿Se siente usted integrado a la cultura norteamericana?

Completamente		Mas o menos		Poco
0	1	2	3	4

---

20. Indique si se enfermaba usted de los oídos cuando joven.

Nunca		Ocasionalmente		Mucho
0	1	2	3	4

---

21. ¿Cuánta televisión diría usted que mira en español?

Poca		Algunas veces		Mucha
0	1	2	3	4

---

22. ¿Participa usted en muchas actividades que no sean relacionadas a su trabajo? (estudio, trabajo voluntario, organizaciones sociales o religiosas, escuela, etc.)?

Frecuentemente		Ocasionalmente		Muy poco
0	1	2	3	4

---

23. ¿Participa usted en muchas actividades dentro de la comunidad angloparlante (que hablan solo inglés, norteamericanos)?

Frecuentemente		Ocasionalmente		Muy poco
0	1	2	3	4

---

24. Indique si ha tomado alguna vez algún tipo de medicamento para mejorar sus niveles de atención.

Nunca	Alguna vez	Regularmente

0 1 2 3 4

---

25. ¿Qué pensaban sus maestros de usted como estudiante? ¿Dirían que era buen o mal estudiante?

Bueno Regular Malo

0 1 2 3 4

---

26. ¿Diría usted que su pronunciación del inglés es buena o mala?

Buena Regular Mala

0 1 2 3 4

---

27. Su ortografía en inglés es:

Excelente Regular Pobre

0 1 2 3 4

---

28. ¿Cuántas de sus amistades hablan bien inglés?

Mayoría Algunos Ninguno

0 1 2 3 4

---

29. ¿Qué importancia cree usted que tiene el que una persona complete una carrera universitaria?

Importante Mas o menos No es importante

0 1 2 3 4

---

30. Muchas personas leen las palabras letra por letra y otras reconocen las palabras al momento de mirarlas. ¿Cree usted que reconoce la mayoría de las palabras escritas en español con tan solo mirarlas?

Casi siempre Algunas veces Casi nunca

0 1 2 3 4

---

31. Muchas personas leen las palabras letra por letra y otras reconocen las palabras al momento de mirarlas. ¿Cree usted que reconoce la mayoría de las palabras escritas en inglés con tan solo mirarlas?

Casi siempre Algunas veces Casi nunca

0 1 2 3 4

---

32. ¿Qué importancia tiene para usted el aprender inglés?

Importante Mas o menos No es importante

0 1 2 3 4

---

33. ¿Al compararse con otras personas de su mismo nivel educacional, cómo describiría usted su nivel de vocabulario en español?

Bueno Regular Pobre

0 1 2 3 4

---

34. ¿Al compararse con otras personas que llevan igual tiempo que usted aprendiendo inglés, cómo describiría usted su nivel de vocabulario en inglés?

Bueno Regular Pobre

0 1 2 3 4

---

35. ¿Diría usted que lee rápido o despacio en español?

Rápido Regular Despacio

0 1 2 3 4

---

36. ¿Piensa usted regresar a vivir en su país?

No Quizas Sí

0 1 2 3 4

---

37. ¿Le gusta vivir en los Estados Unidos?

Me gusta Mas o menos No me gusta

0 1 2 3 4

---

38. Si compara el esfuerzo que usted ha dedicado a aprender inglés con el esfuerzo que sus compañeros de estudio han dedicado ¿Cómo describiría sus esfuerzos propios?

Mucho esfuerzo Mas o menos Poco esfuerzo

0 1 2 3 4

39. ¿Cómo caracterizaría usted los métodos, maestros, etc. que ha tenido para aprender inglés?

Buenos Regular Malos

0 1 2 3 4

40. ¿Cuán fácil o dificil diría usted que es aprender a hablar inglés?

Fácil Regular Dificil

0 1 2 3 4

Información adicional:

Appendix III. Questionnaire on Reading and Language History

(English)

Name:_____

Address:_____

Telephone:_____

E-mail:_____

Date of birth:_____

Country of origin:_____

READING AND LANGUAGE HISTORY QUESTIONNAIRE

This questionnaire inquires about your school learning, native language use, how you learn and use English and also about some of your social practices. Please encircle the response number that best fits your experience in the following questions.

---

1. Which describes best your attitude toward school when you were a child?

Liked school		Indifferent		Disliked school
0	1	2	3	4

---

2. How would you describe your learning in elementary school?

Good		Average		Poor
0	1	2	3	4

---

3. Indicate if you needed assistance in learning to read when you were in elementary school?

None		Family		Special tutor
0	1	2	3	4

4. Indicate if you inverted or changed the sequence of letters or numbers when you were a child?

Never		Occasionally		Frequently
0	1	2	3	4

5. How would you compare your reading ability in relation to your peers in school when you were young?

Better		Same		Worse
0	1	2	3	4

6. Did you have difficulty articulating correctly certain words when you were a child?

Never		Occasionally		Frequently
0	1	2	3	4

7. Do you currently have difficulty remembering how to say certain words in your native language?

Never		Occasionally		Frequently
0	1	2	3	4

8. How would you compare your reading ability in relation to your study peers?

Better		Same		Worse
0	1	2	3	4

9. How easy or difficult would you say that learning English is?

Easy		Regular		Difficult
0	1	2	3	4

10. Describe your general attitude toward reading.

I like reading		Indifferent		I do not like reading
0	1	2	3	4

11. How much reading do you have to do that is work-related?

A lot		Some		Very little
0	1	2	3	4

12. What is your ability for remembering other people's names in your native language?

Good		Average		Poor
0	1	2	3	4

13. Do you read things in English?

Always		Occassionally		Never
0	1	2	3	4

14. How much reading in general do you do?

Always		Occassionally		Never
0	1	2	3	4

15. Did you have any difficulty in your high school classes or in college?

None		Some		Much difficulty
0	1	2	3	4

16. Your Spanish spelling is:

Excellent		Regular		Poor
0	1	2	3	4

17. Did your parents ever think that you would be held over in a grade?

Never		Sometimes		Frequently
0	1	2	3	4

18. If you could describe the quality of the school(s) that you attended as a child, would you say they were good or poor?

Good		Regular		Poor
0	1	2	3	4

---

19. Do you feel to be "integrated" into the United States' mainstream culture?

Completely		Somewhat		Not much
0	1	2	3	4

---

20. Indicate if you had frequent ear infections when you were younger?

Never		Occasionally		Frequently
0	1	2	3	4

---

21. How much television in Spanish would you say that you watch?

Rarely		Occasionally		Frequently
0	1	2	3	4

---

22. Do you participate in many activities that are not work-related? (e.g. study, volunteer work, social and religious, school, etc.)

Frequently		Occasionally		Very little
0	1	2	3	4

---

23. Do you participate in many activities within the anglo-speaking community?

Frequently		Occasionally		Very little
0	1	2	3	4

---

24. Indicate if you have ever taken medication to improve your attention levels ?

Never		Occasionally		Regularly
0	1	2	3	4

---

25. What did your teachers think about you as a student? Did they think that you were a good or a poor student?

Good		Average		Poor
0	1	2	3	4

---

26. Would you say that your English pronunciation is good or poor?

Good		Average		Poor
0	1	2	3	4

---

27. Your English spelling is:

Excelent		Regular		Poor
0	1	2	3	4

---

28. How many of your friends speak English well?

Most		Some		None
0	1	2	3	4

---

29. How much importance would you ascribe to obtaining a college degree?

Important		Somewhat		Unimportant
0	1	2	3	4

---

30. Many individuals read words letter by letter and others recognize words as soon as they see them. Do you think that you can recognize most words in Spanish just by looking at them?

Frequently		Occasionally		Rarely
0	1	2	3	4

---

31. Many individuals read words letter by letter and others recognize words as soon as they see them. Do you think that you can recognize most words in English just by looking at them?

Frequently		Occasionally		Rarely
0	1	2	3	4

---

32. How important is learning English for you?

Important		Somewhat		Unimportant
0	1	2	3	4

---

33. When you compare yourself with other individuals who have a similar educational level as yours, how would you describe your vocabulary in Spanish?

Good		Average		Poor
0	1	2	3	4

---

34. When you compare yourself with others who have been learning English for as long as you have, how would you describe your vocabulary levels in English?

Good		Average		Poor
0	1	2	3	4

---

35. Would you say that you read fast or slowly in Spanish?

Fast		Average		Slow
0	1	2	3	4

---

36. Do you plan to return to live in your country?

No		Maybe		Yes
0	1	2	3	4

---

37. Do you enjoy living in the United States?

Enjoy		Somewhat		Not enjoy
0	1	2	3	4

---

38. If you compare your efforts in learning English with the efforts that your peers have dedicated, how would you describe your learning efforts?

Great effort		Average		Little effort
0	1	2	3	4

39. How would you describe the methods, teachers, etc. that you have had in learning English?

Good		Average		Poor
0	1	2	3	4

40. How easy or difficult would you say that learning English is?

Easy		Regular		Difficult
0	1	2	3	4

Additional information:

Appendix IV. Participant screening form and general information

Respond briefly to the following questions:

In which language can you express yourself better, in Spanish or in English?

How many years have you been living in the United States?

What was your profession in your native country?

How many years have you been learning English?

Is there anyone who speaks English in your home? (e.g.: children, other relatives, etc.)

What kind of work do you do in the United States?

What is your educational level (number of years in school)?

Were you held over in any grade when you were younger?

Do you use your right hand for writing?

Your parents use their right hand (R) or their left hand (L) for writing:
Your mother: R_L_ (I do not know) __
Your father: R_L_ (I do not know)__

Is there anyone in your family who has learning, reading or language problems?

What languages can you speak?

What languages can you read?

What languages can you write?

Have you ever been diagnosed with learning, reading or language problems?

Have you ever been diagnosed with a neurological condition? (e.g.: epilepsy, stroke, traumatic brain injury, etc.)

Have you ever been diagnosed with an attention deficit disorder?

Have you ever been diagnosed with hearing problems or with vision problems? If you respond yes, indicate if you wear eyeglasses or hearing aids.

Table 1. Population data

Table 1. Population data: N = 60, 43 female and 17 male

	MINIMUM	MAXIMUM	MEAN	STD.DEVIATION
Years of education	6	17	10.00	3.03
Age	19	49	39.00	8.91
Years in US	3	38	8.73	6.24
Years ESL	2	10	3.06	1.78

Table 2. Main groups: Demographics

Table 2. Main groups: Demographics

GROUPS	Years in US Means	Years of Education	Years English Study	Self+teacher rating on English learning	PPVT-III scores Mean	PPVT-III scores S.D.
Good Learners GELL	8.00	12.00	3.33	1-1 (N=1) 2-1 (N=5)	72.50	20.18
Poor Learners PELL	7.57	12.57	3.14	3-3 (N=7)	27.57	19.19
PEER group	9.17	12.94	3.40	Not applicable (N=17)	50.23	20.93

Table 3: Additional groups: Demographics

Table 3. Additional groups: Demographics

Groups	Years in US	Years English Study	Years of Education	Self+teacher ratings	PPVT-III scores	PPVT-III scores
					Mean	S.D.
Average AELL	7.00	3.87	12.75	2+2 (N=8)	45.37	18.38
Average-Poor APAELL	14.66	4.00	12.66	2+3 (N=3)	55.00	23.57
Poor-Average PAELL	9.33	2.83	13.33	3+2 (N=6)	54.33	13.53
PELL-Low ed	8.66	2.55	6.99	3+3 Low.ed. (N=9)	24.77	12.98
PEER Low-ed.	8.64	2.89	9.53	Not applicable (N=21)	38.00	21.61

Table 4. Performance by PELL, PEER and GELL groups

TASKS	PELL Mean, S.D., p values	PEER Mean, S.D. p values	GELL Mean, S.D., p values
Nonwords time	89.00, 28.40 U=4, p<.014*	69.29 sec., 19.02 U=25.50, p<.040 †	54.66 sec., 10.34 U=4, p<.014*
Nonwords accuracy	25.57, 5.31 U=.000,p<.001*	29.17, 4.34 U=35.00, p<.130	35.00, 1.09 U=.000, p<.001*
Dictation	55.42, 6.85 U=25.50;p<.028	61.23, 3.68 U=25.50, p<.028 †	62.00, 4.19 U=9.00, p<.101
Phonological Awareness (TPAS)	24.42, 3.20 U=12; p<.234	24.82, 2.76 U=12.00, p<.234	26.66. 2.73 U=55.00, p<.804
Reading sentences (TEL) time	15.23, 6.11 U=1.00,p<.002*	8.87 min., 3.27 U=13.00, p<.002*	6.82 min., 2.71 U=1.00, p<.002*
Reading sentences (TEL) accuracy	59.28, 2.56 U=1.00,p<.002*	60.76, 3.43 U=36.50, p<.147	63.16, .752 U=1.00, p<.002*
Orthographic Decision time	3.35, .747 U=.000, p<.001*	2.08 min., .809 U=12, p<.001*	1.41 min., .508 U=.000, p<.001*
Orthographic Decision accuracy	62.00, 3.05 U=14, p<.366	63.82, 2.21 U=14, p<.366	63.50, 1.87 U=41.50, p<.260
RAN Colors time	32.57, 4.82 U=.000, p<.001*	26.35 sec., 3.80 U=15.50, p<.003*	22.33 sec., 1.50 U=.000, p<.001*
RAN Colors accuracy	35.00, .816 U=.6.00, p<.035	36.00, .870 U=6.00, p<.350	35.58, .000 U=33.00, p<.099
RAN Objects time	34.57, 6.50 U=5, p<.022	27.41 sec., 5.72 U=24.50,p<.024†	23.83 sec., 1.60 U=5.00, p<.022 †
RAN Objects accuracy	36.00, .000 U=3.00, p<.008*	35.88, .332 U=14.5, p<.003*	36.00, .000 U=.003, p<.008*
RAN Letters time	23.15, 3.67 U=3.50, p<.008*	18.29 sec., 3.13 U=21.50, p<.013*	16.16 sec., 2.16 U=3.50, p<.008*
RAN Letters accuracy	34.15, 1.35 U=3.00, p<.008*	35.47, 1.17 U=22.50, p<.016*	36.00, .000 U=3.00, p<.008*

Table 4. Performance by PEER and GELL groups

Key:
1.1 significant (PELL is worse)
† PELL tends to be worse

Table 5. Performance by: PAELL, APELL and AELL groups

TASKS	PAELL Mean, S.D. p values	APELL Mean, S.D. p values	AELL Mean, S.D. p values
Nonwords time	72.16 sec., 19.48 U=12.00, p<.234	77.33 sec., 38.03 U=7.00, p<.517	64.12 sec., 8.82 U=8.50, p<.021 †
Nonwords accuracy	30.16, 3.86 U=10.00, p<.138	27.33, 5.77 U=8.00, p<.667	60.83, 2.85 U=17.00, p<.232
Dictation	60.83, 2.85 U=10.50, p<.138	56.33, 4.72 U=9.50, p<.833	63.37, 1.76 U=3.50, p<.002*
Phonological Awareness (TPAS)	24.83, 2.04 U=18.50, p<.731	26.33, 2.08 U=6.50, .383	24.25, 3.45 U=26.00, p<.867
Reading sentences (TEL) time	8.19 min., 2.31 U=2.00, p<.005*	11.42 min., 4.58 U=6.00, p<.383	8.42 min., 3.34 U=5.00, p<.006*
Reading sentences (TEL) accuracy	62.00, 1.54 U=8.00, p<.073	60.00, 2.64 U=9.50, p<.833	60.12, 4.61 U=10.00, p<.336
Orthographic Decision time	2.04 min., .454 U=2.00, p<.005*	3.21 min., 1.17 U=9.00, p<.833	1.69 min., .486 U=1.00, p<.001*
Orthographic Decision accuracy	64.33, 1.21 U=12.00, p<.138	61.00, 3.46 U=7.00, p<.517	64.50, 1.60 U=15.50, p<.152
RAN Colors time	27.33 sec., 3.66 U=7.00, p<.051†	30.66 sec., .577 U=7.00, p<.517	32.57 sec., 4.82 U=1.50, p<.001*
RAN Colors accuracy	35.83, .408 U=8.50, p<.073	35.66, .577 U=5.50, p<.267	35.57, 1.18 U=19.00, p<.336
RAN Objects time	29.66 sec., 7.63 U=12.50, .234	31.33 sec., 3.51 U=5.50, p<.267	24.25 sec., 2.71 U=6.50, p<.009*
RAN Objects accuracy	36.00, .000 U=3.00, p<.008*	35.66, .577 U=950, p<.833	35.87, .353 U=7.00, p<.014*
RAN Letters time	18.00 sec., 3.34 U=7.00, p<.51†	21.33 sec., 2.30 U=6.50, p<.383	17.37 sec., 2.82 U=8.00, p<.021 †
RAN Letters accuracy	36.00, .000 U=3.00, p<.008*	35.33, .577 U=4.50, p<.183	35.12, 1.64 U=15.00, p<.152

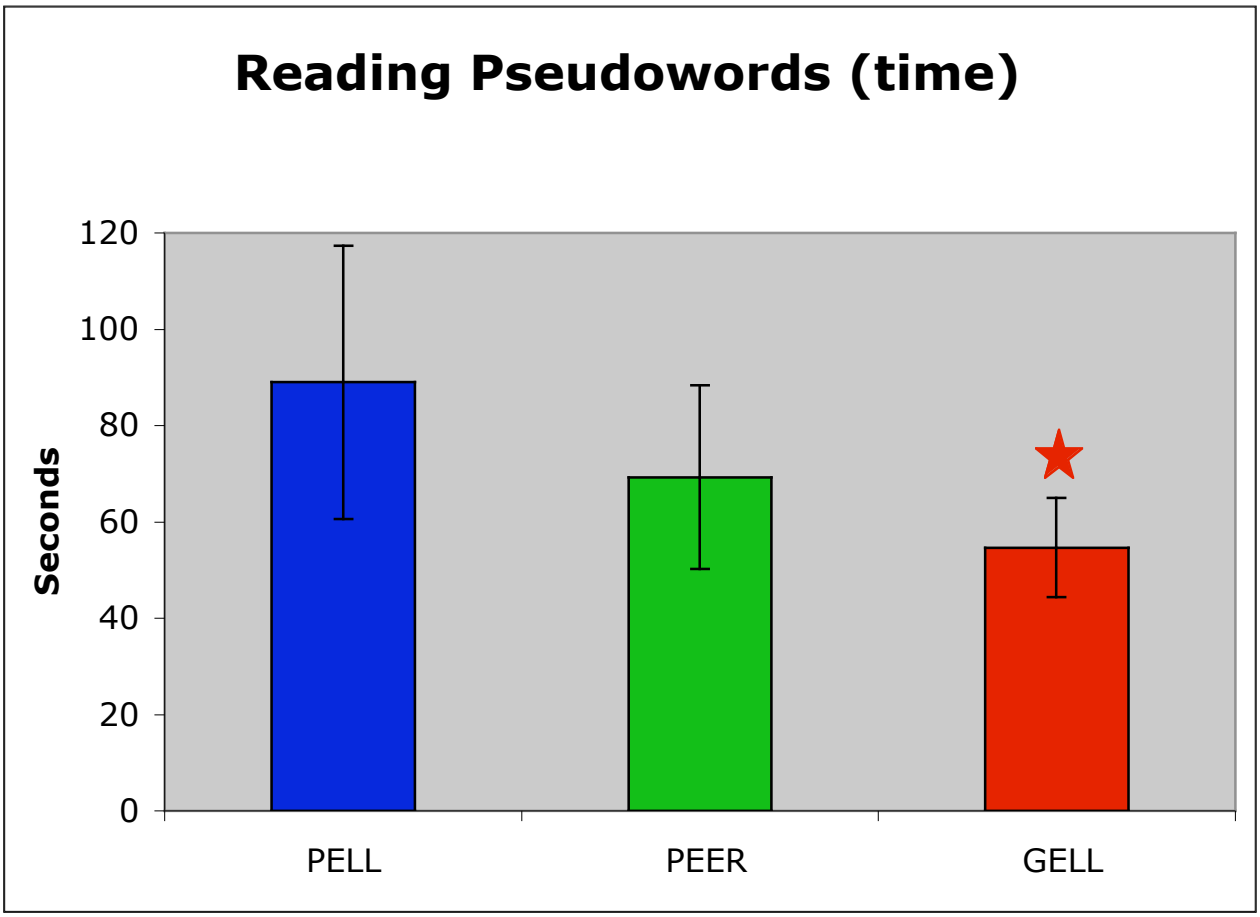
Key:
*significant (PELL is worse)
† PELL tends to be worse

Table 6. Performance by: PEER-Low ed. and PELL-Low ed. groups

TASKS	PEER-LOW ED. Mean and S.D. p values	PELL-LOW ED. Mean and S.D. p values
Nonwords time	72.57 sec., 26.15 U=34.50, p<.036 †	77.11 sec., 15.20 U=23.00, p<.408
Nonwords accuracy	29.42, 4.06 U=41.50, p<.090	26.11, 4.88 U=30.50, p<918
Dictation	56.04, 7.11 U=68.00, p<.796	47.883.51 U=13.50, p<.055 †
Phonological Awareness (TPAS)	24.28, 3.27 U=73.50, p<1.00	20.88, 6.37 U=20, p<.252
Reading sentences (TEL) time	12.84 min., 6.07 U=43.00, p<.113	19.21 min., 6.99 U=17.00, p<.142
Reading sentences (TEL) accuracy	57.19, 8.69 U=71.00, p<917	55.88, 5.18 U=16.50, p<.118
Orthographic Decision time	3.42 min., 1.26 U=73.50, p<1.00	4.37 min., 1.76 U=19.50, p<.210
Orthographic Decision accuracy	60.38, 6.71 U=73.50, p<1.00	51.33, 9.11 U=4.00, p<.002*
RAN Colors time	28.76, 5.72 U=41.00, p<.090	26.11 sec., 2.31 U=5.50, p<.003 ß
RAN Colors accuracy	35.52, .679 U=46.00, p<.115	35.11, .781 U=29.00, p<.837
RAN Objects time	30.52 sec., 7.17 U=43.50, p<.113	32.33, 5.36 U=22.00, p<.351
RAN Objects accuracy	35.52, .746 U=38.00, p<.062	35.44, .527 U=19.50, p<210
RAN Letters time	20.76 sec., 4.03 U=44.00, p<.126	20.66, 1.00 U=18.00, p<.174
RAN Letters accuracy	35.09, .943 U=23.50, p<.408	34/77, .971 U=41.00, p<.090

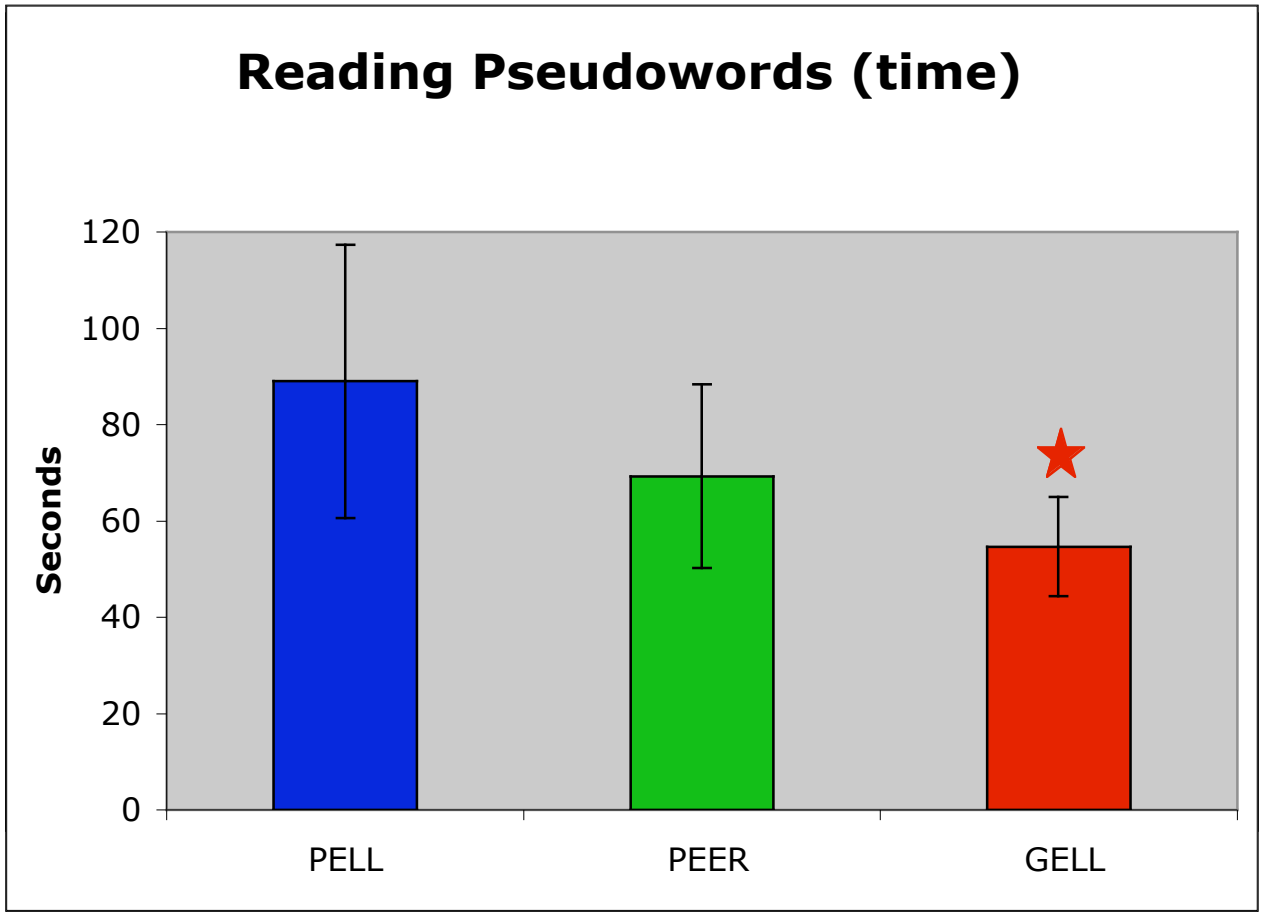
Key:
*significant (PELL is worse)
† PELL tends to be worse
ß PELL is better

Figure 1 . Reading pseudowords by PELL, PEER and GELL (time)



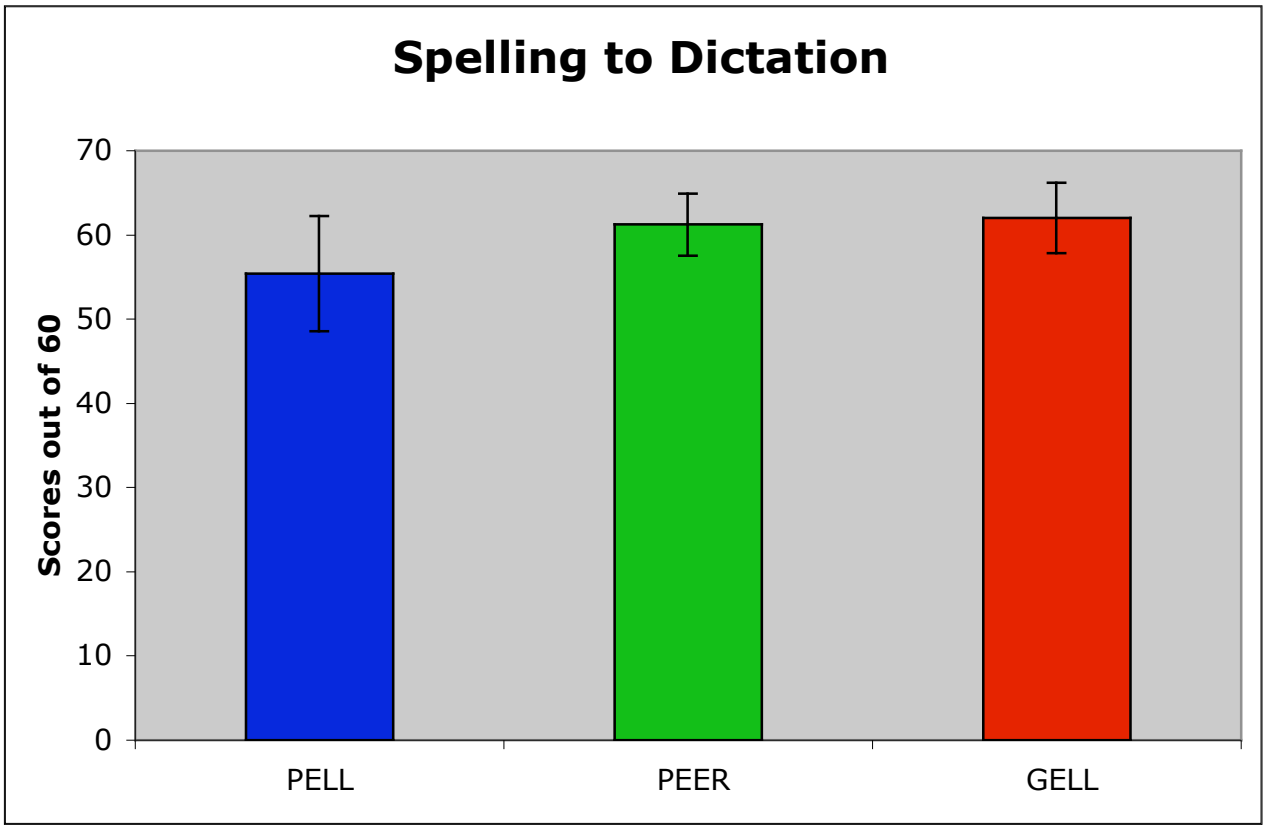
*The PELL group takes longer than the GELL group in reading aloud of pseudowords. The same trend is evident when comparing the PELL with the PEER group:*PELL vs. GELL: 89.00 vs. 54.66 seconds; U=4, p<.014 *
PELL vs. PEER: 89.00 vs. 69.29 seconds; U=27.50, p<.040 (results exceed Bonferroni adjustment p<.016)

Figure 2 . Reading pseudowords by PELL, PEER and GELL (accuracy)



The PELL group is less accurate than the GELL group in the reading aloud of pseudowords.
PELL vs. GELL 25.57 vs. 35.00; U=0, p<.001*

Figure 3. Spelling to dictation in PELL, PEER and GELL

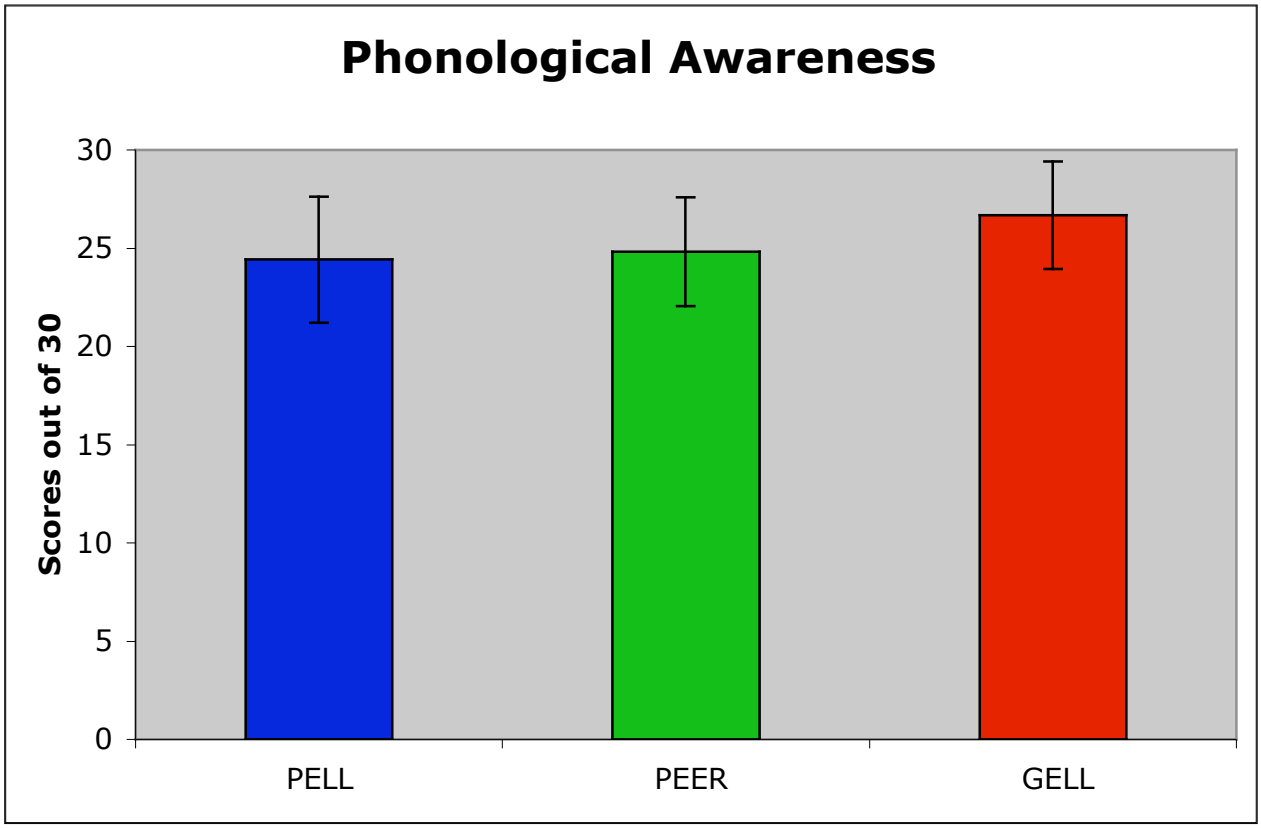


Trend showing the PEER group to be more accurate than the PELL group in spelling words to dictation

1.1.1 PELL vs. PEER: U=25.50, p<.028 (results exceed Bonferroni adjustment p<.016)

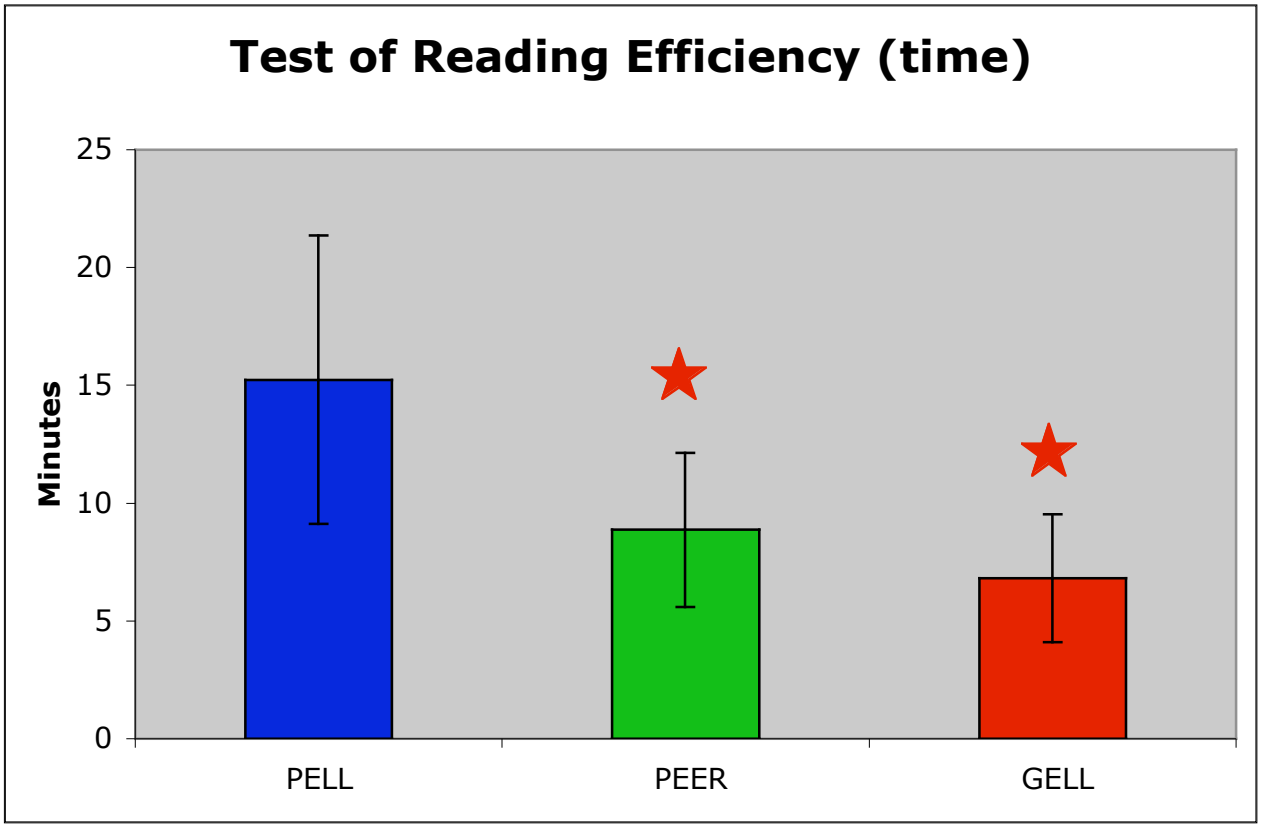
1.2.1 PELL vs. GELL: U=9.00, p<.101

Figure 4. Phonological awareness in PELL, PEER and GELL



There are no significant differences between the PELL group and either of the other groups

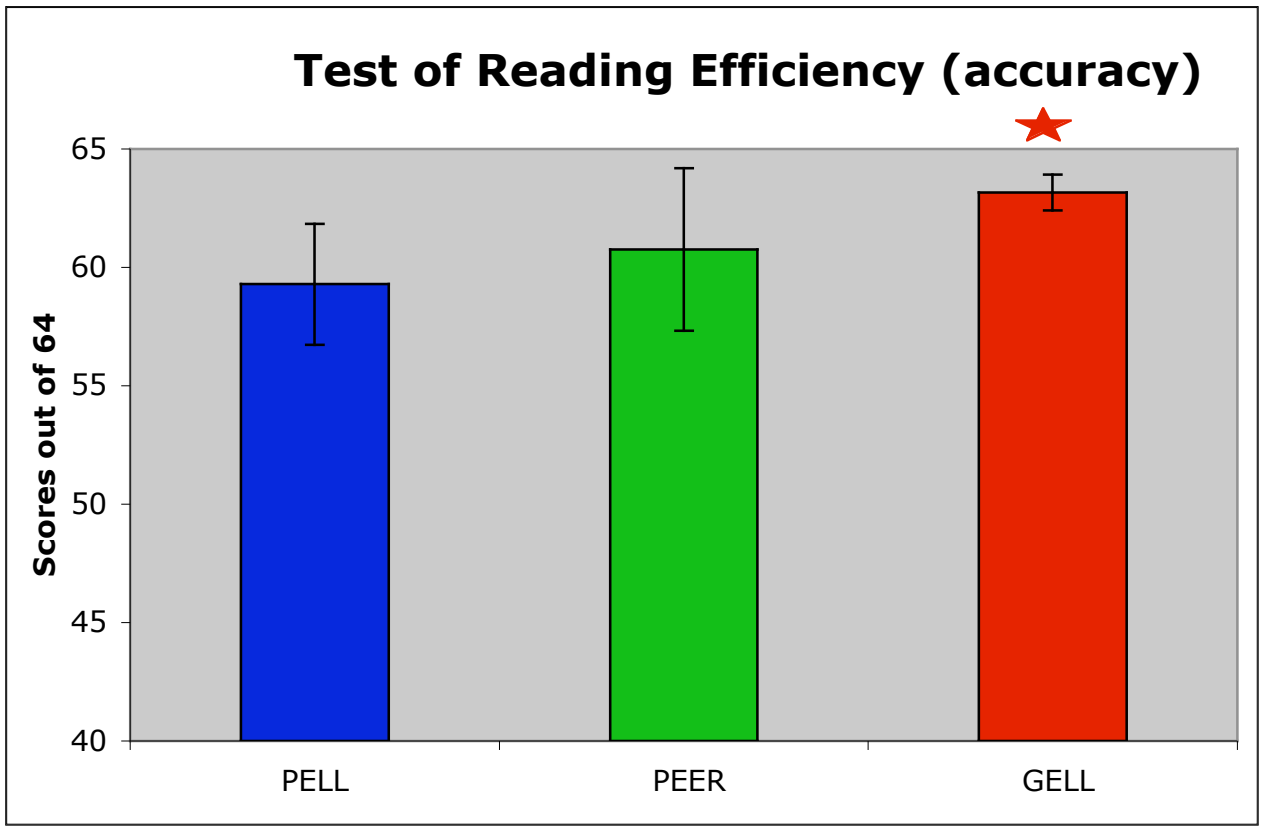
Figure 5. Test of Reading efficiency in PELL, PEER and GELL (time)



The PELL group takes longer than the PELL and PEER groups in the time to silently read and complete sentences in Spanish

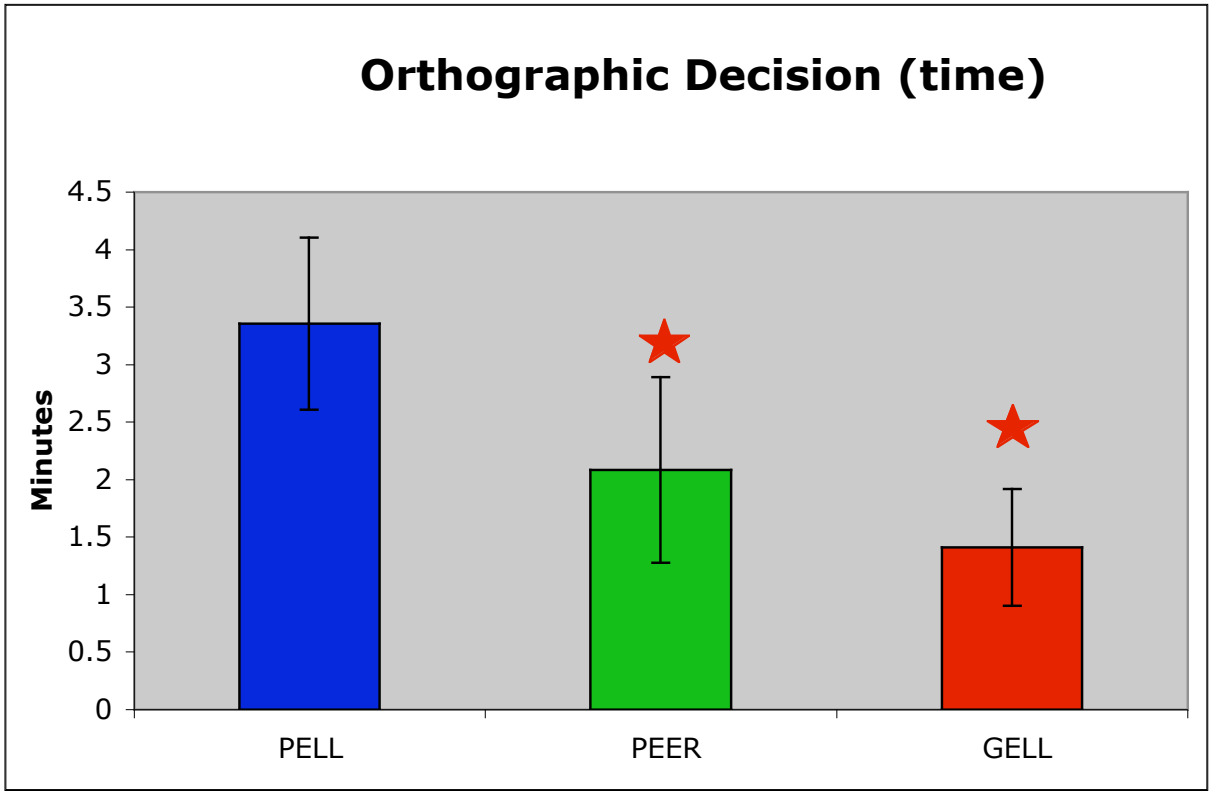
1.1.1 PELL vs. GELL: 15.23 vs. 6.82 min; U=1.00; p <. 002*
PELL vs. PEER: 15.23 vs. 8.87 min.; U=13; p<. 002*

Figure 6. Test of reading efficiency in PELL, PEER and GELL (accuracy)



The PELL group is less accurate than the GELL group in completing sentences in Spanish
PELL vs. GELL: 59.28 vs. 63.16; U=1.00; p <. 002*

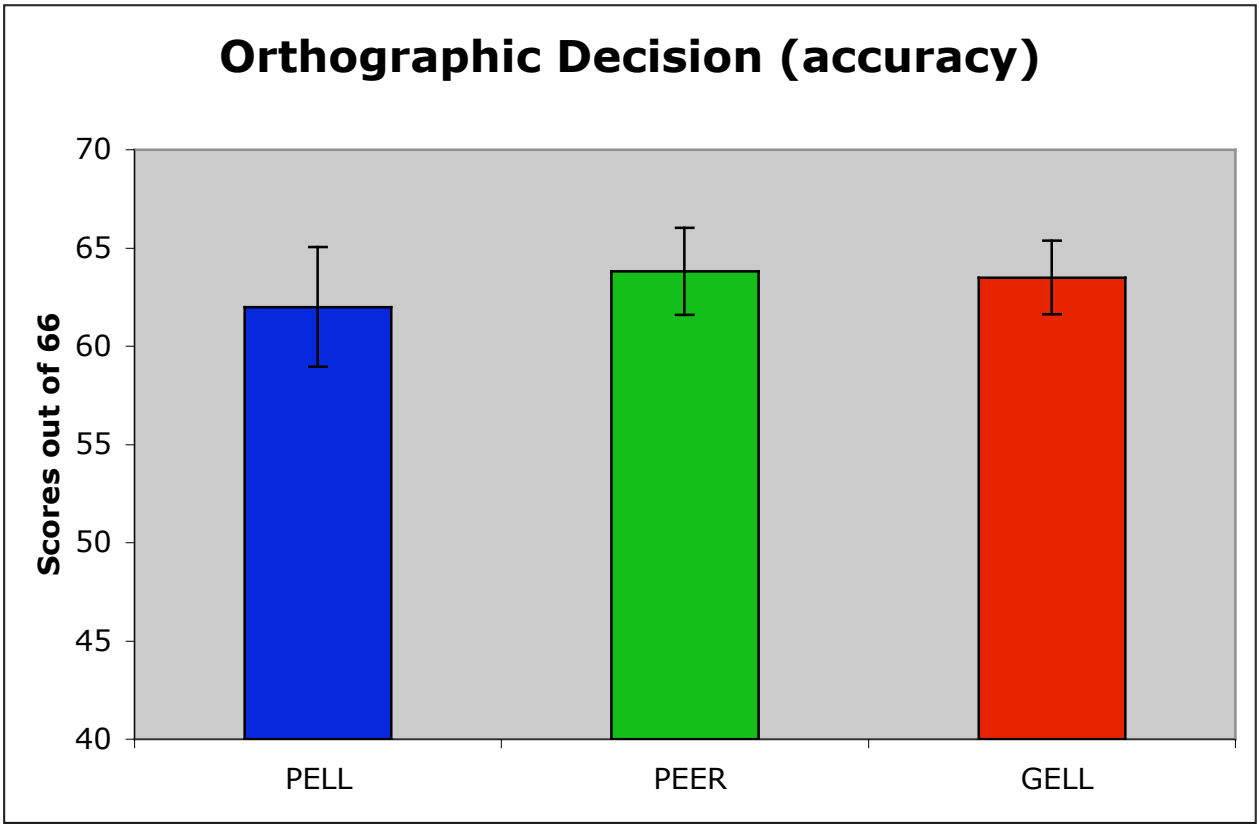
Figure 7. Orthographic decision in PELL, PEER and GELL (time)



The PELL group takes longer than the GELL and PEER groups in identifying correct word spellings in Spanish

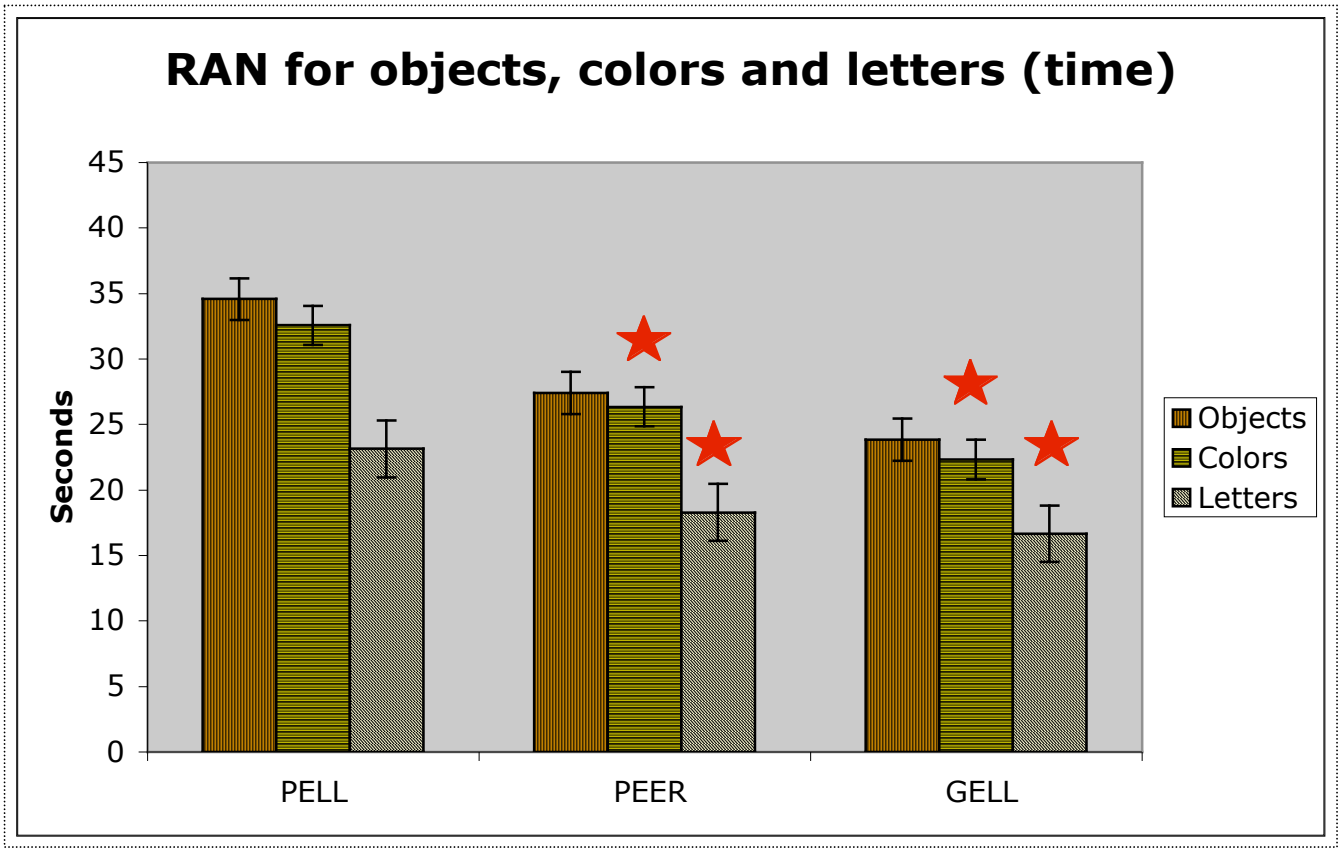
1.1.1 PELL vs. GELL: 3.35 vs. 1.41 min.; U = .000; p <.001*
PELL vs. PEER: 3.35 vs. 2.08 min.; U = 12; p <.001*

Figure 8. Orthographic decision in PELL, PEER and GELL (accuracy)



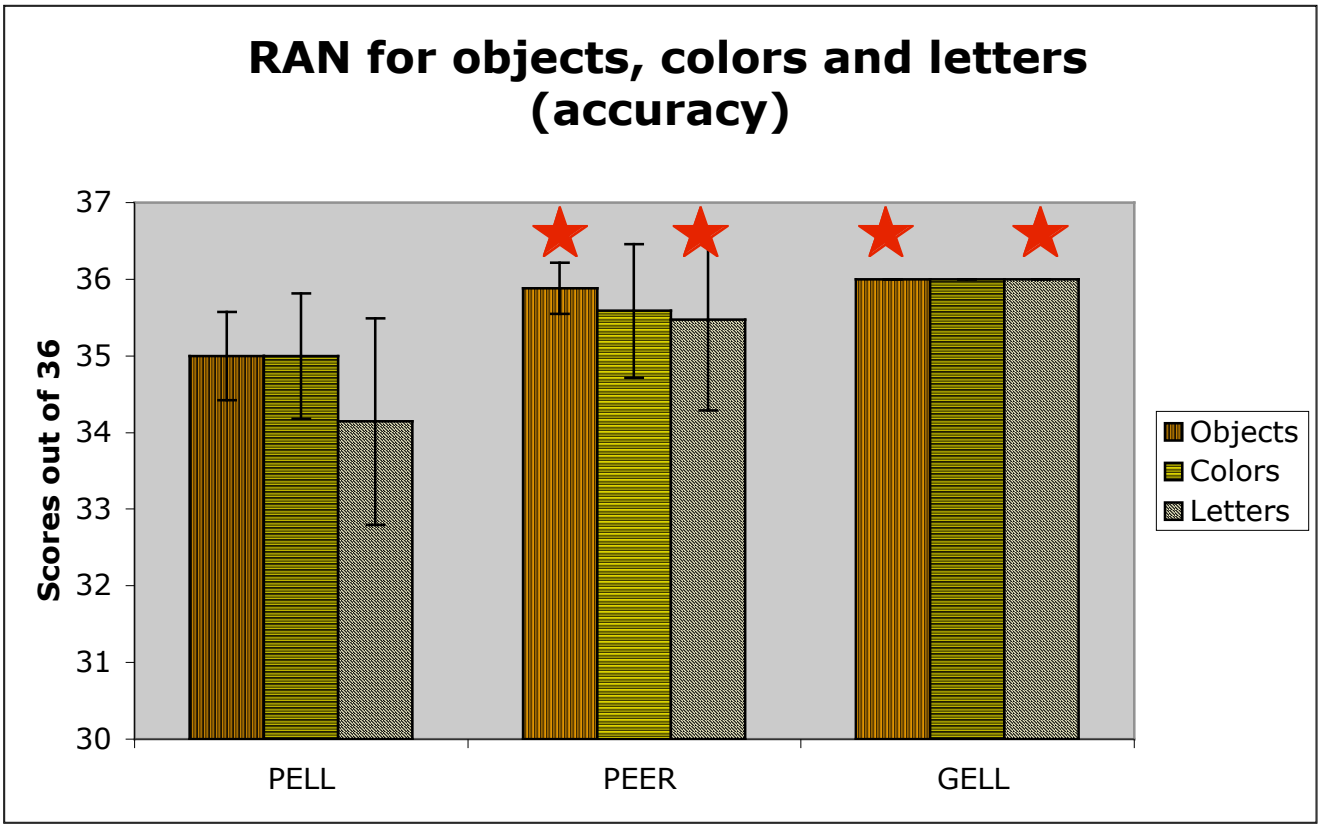
There are no significant differences between the PELL group and any of the other groups

Figure 9. RAN for objects, colors and letters for PELL, PEER and GELL groups (time)



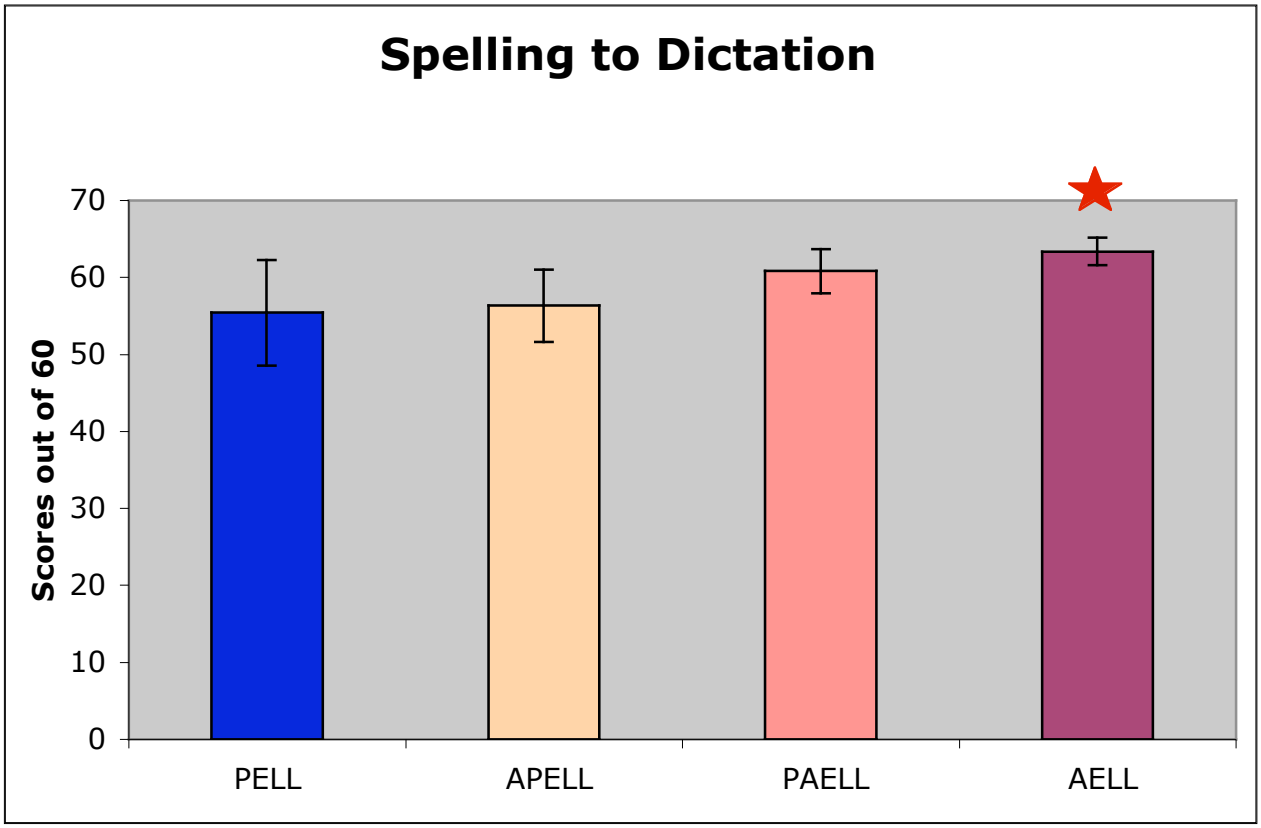
PELL vs. GELL: (Objects) 34.57 seconds vs. 23.83; U = 5.00; p < .022
PELL vs. GELL: (Colors) 32.57 seconds vs. 22.33; U = .000; p < .001*
PELL vs. GELL: (Letters) 23.15 seconds vs. 16.66; U = 3.50; p < .008*
PELL vs. PEER: (Colors) 34.57 vs. 27.41 seconds; U = 15.50; p < .003*
PELL vs. PEER: (Letters) 23.15 seconds vs. 18.29; U = 21.5; p < .013*

Figure 10. RAN for objects, colors and letters for PELL, PEER and GELL groups (accuracy)



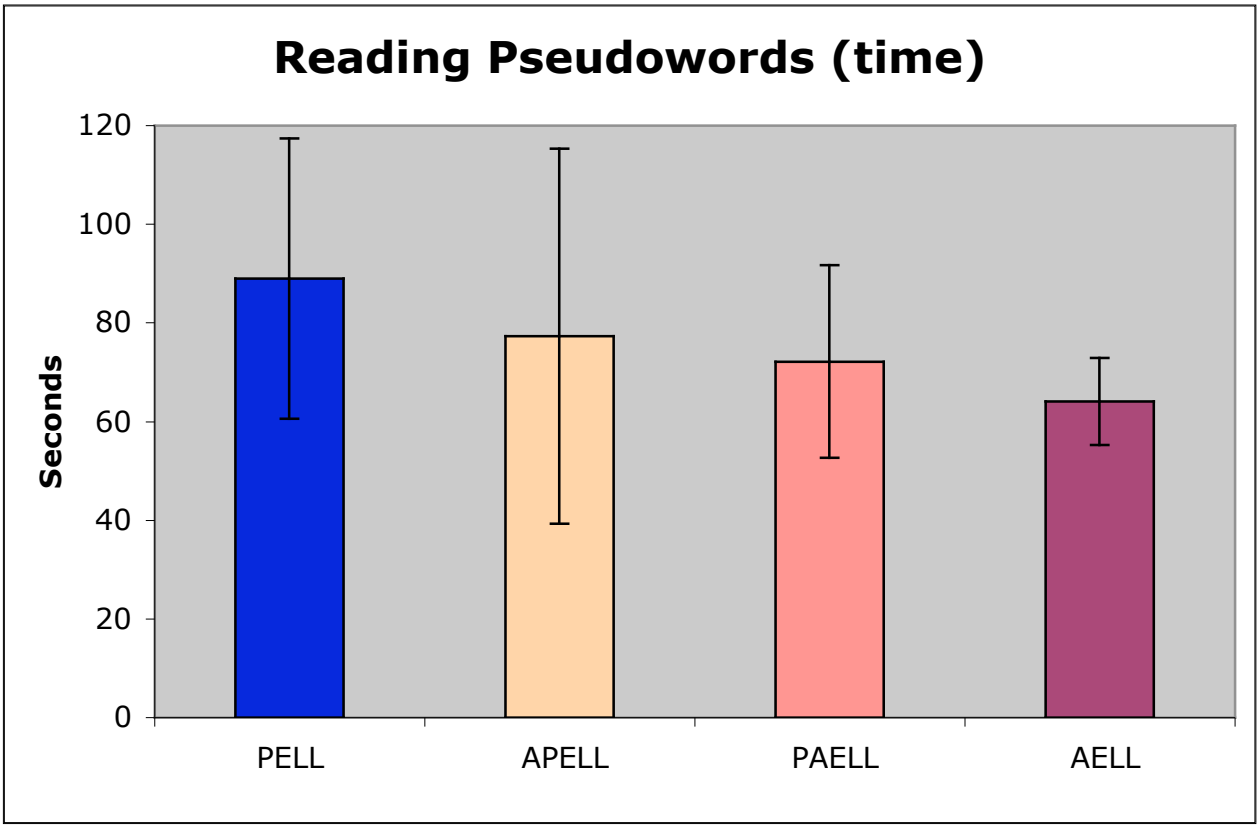
1.1.1 PELL vs. GELL: (Objects) 35 vs. 36; U = 3.00; p <.008*
1.2.1 PELL vs. GELL: (Colors) 35 vs. 36; U = 6.00; p <.035 (trend)
1.3.1 PELL vs. GELL: (Letters) 34.14 vs. 36; U = 3.00; p <.008*
1.4.1 PELL vs. PEER: (Objects) 35 vs. 36; U = 14.5; p <.003*
1.5.1 PELL vs. PEER: (Letters) 35.00 vs. 35.58; U = 22.5; p <.016*

Figure 11. Spelling to dictation for PELL, APELL, PAELL and AELL groups



The PELL group is less accurate than the AELL group in spelling familiar words to dictation
PELL vs. AELL: 55.43 vs. 63.37; U=3.5, p<.002)*

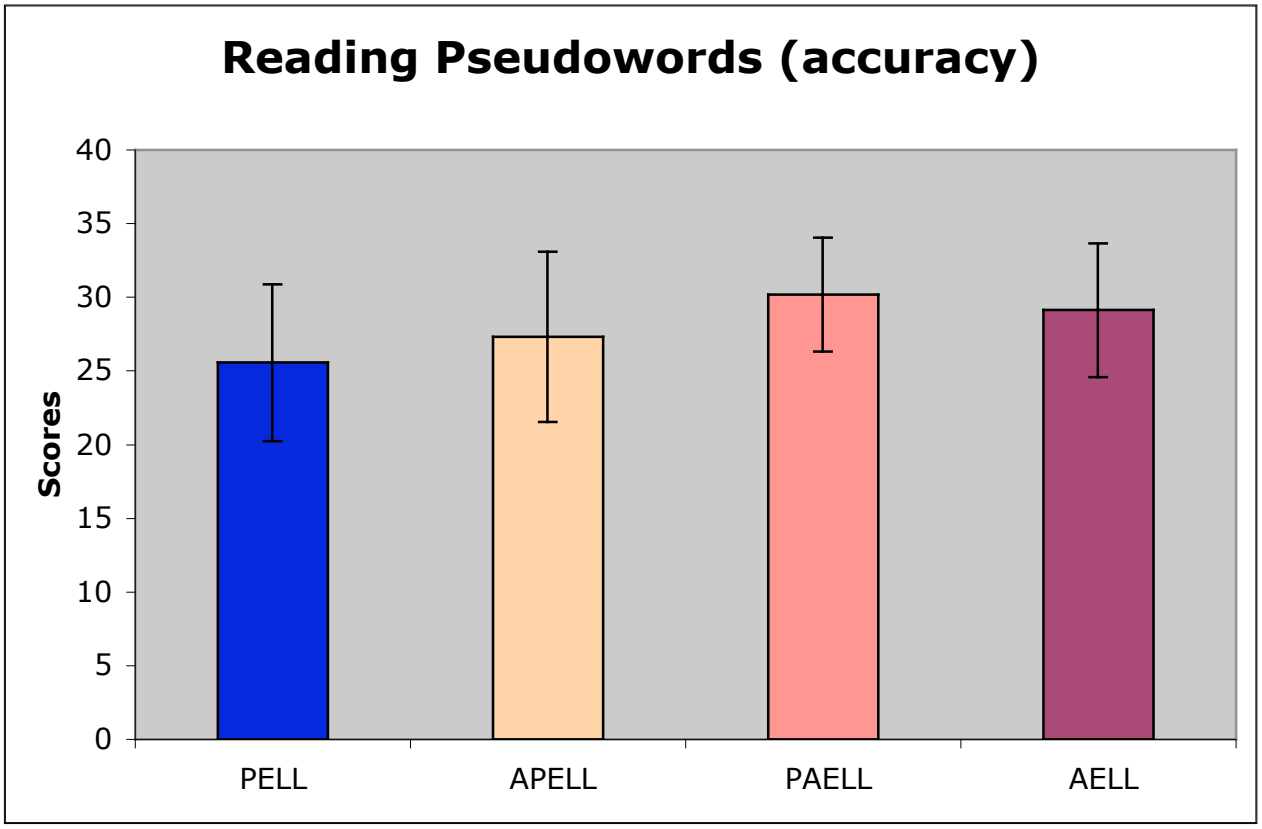
Figure 12. Reading pseudowords for PELL, APELL, PAELL and AELL groups (time)



Trend showing the PELL group takes longer reading aloud pseudowords than the AELL group

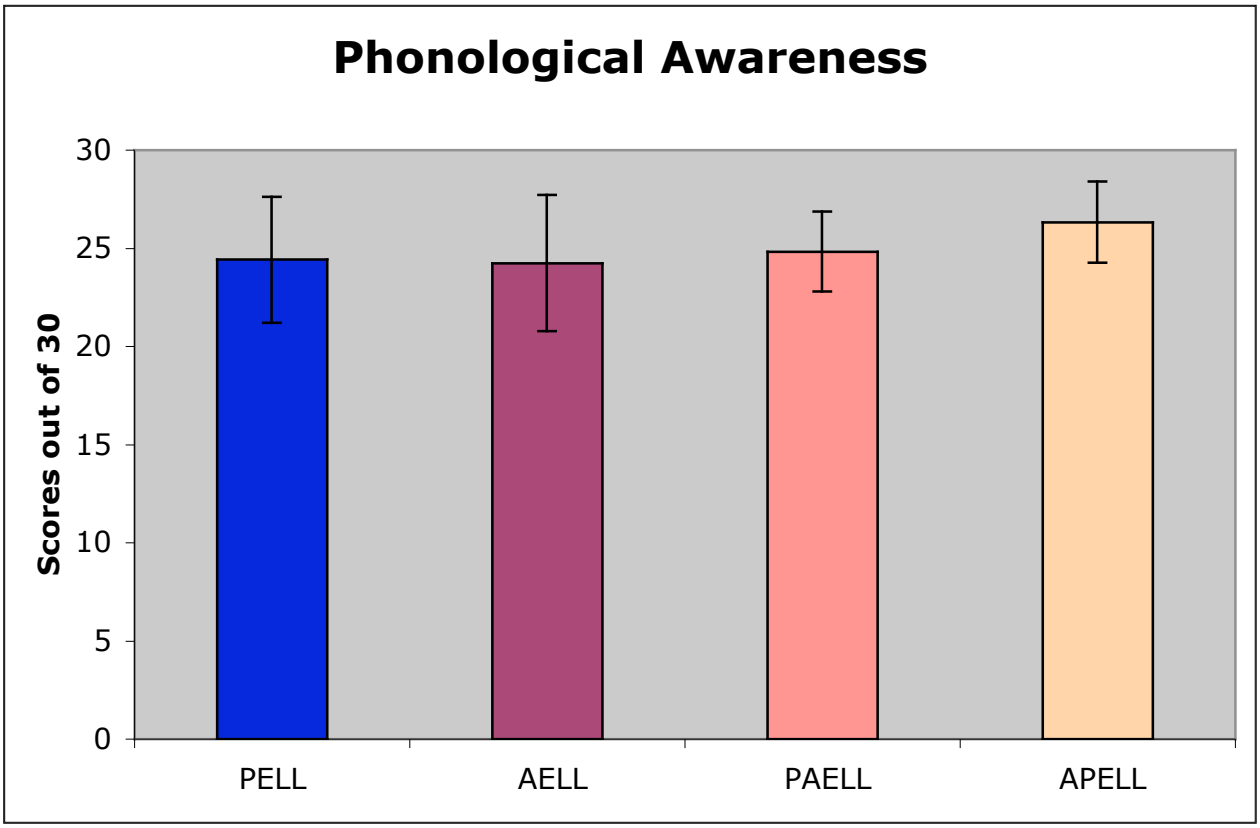
1.1.1 PELL vs. AELL: 89 vs. 64.12 seconds; U=8.5, p<.021 (results exceed Bonferroni adjustment p<.016)

Figure 13. Reading pseudowords for PELL, APELL, PAELL and AELL groups (accuracy)



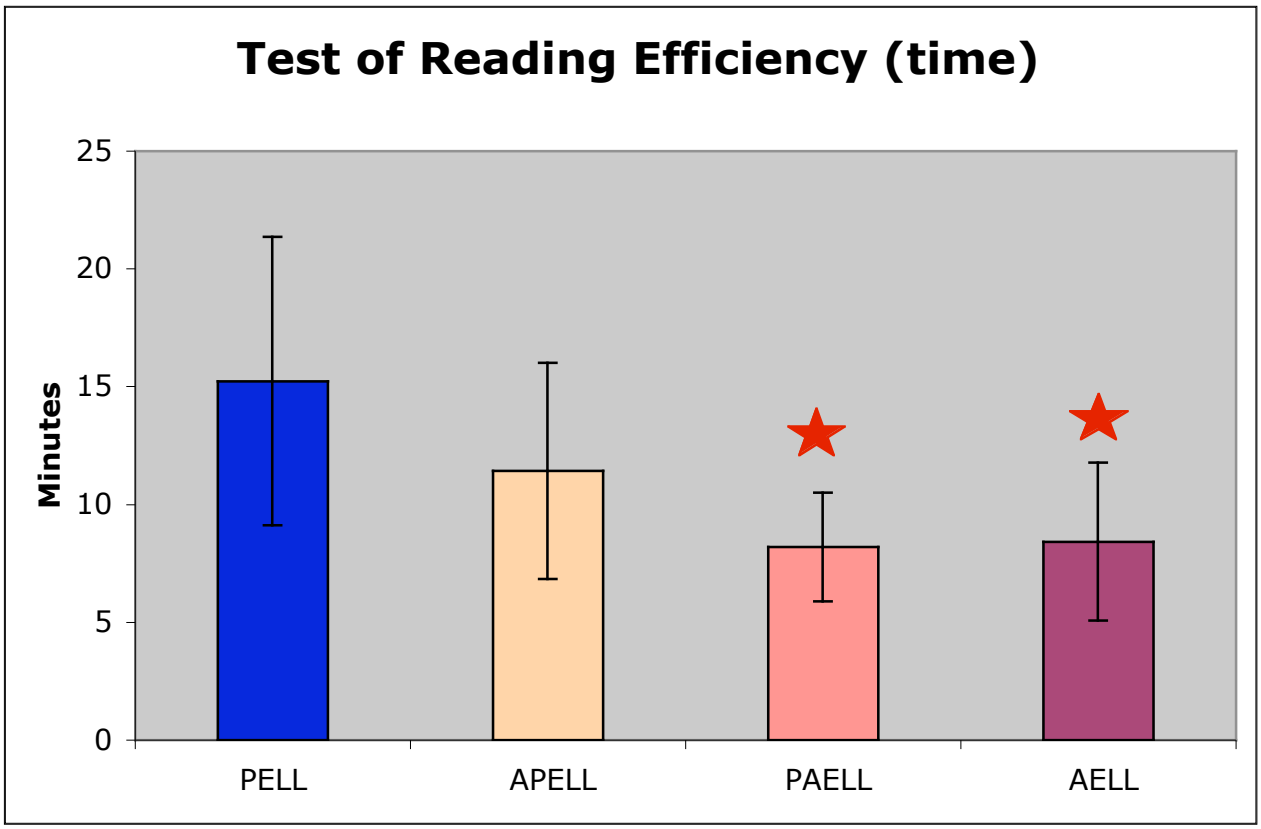
There are no significant differences between the PELL group and any of the other groups

Figure 14. Phonological awareness in PELL, AELL, PAELL and APELL



There are no significant differences between the PELL group and any of the other groups

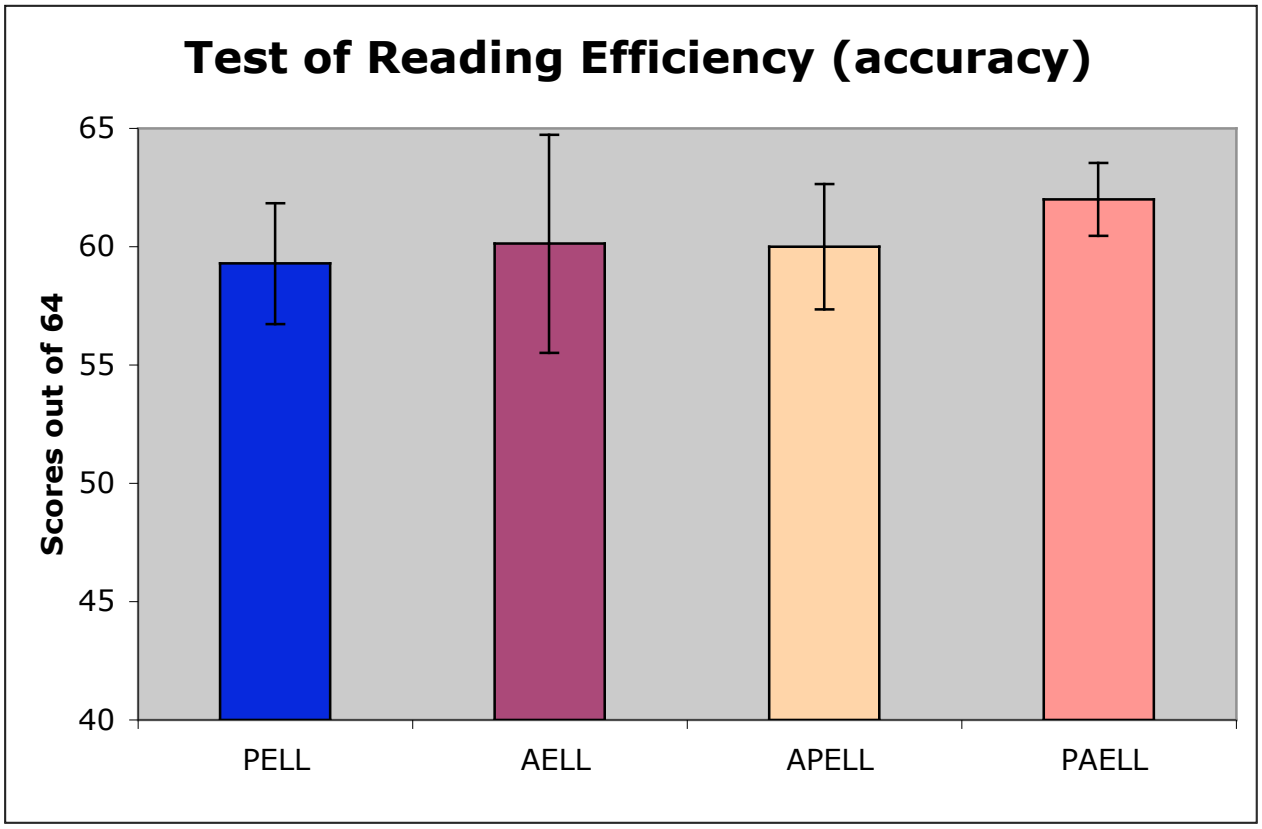
Figure 15. Test of reading efficiency for PELL, APELL, PAELL and AELL (time)



The PELL group takes longer than the AELL and PAELL groups in the time to silently read and complete sentences in Spanish

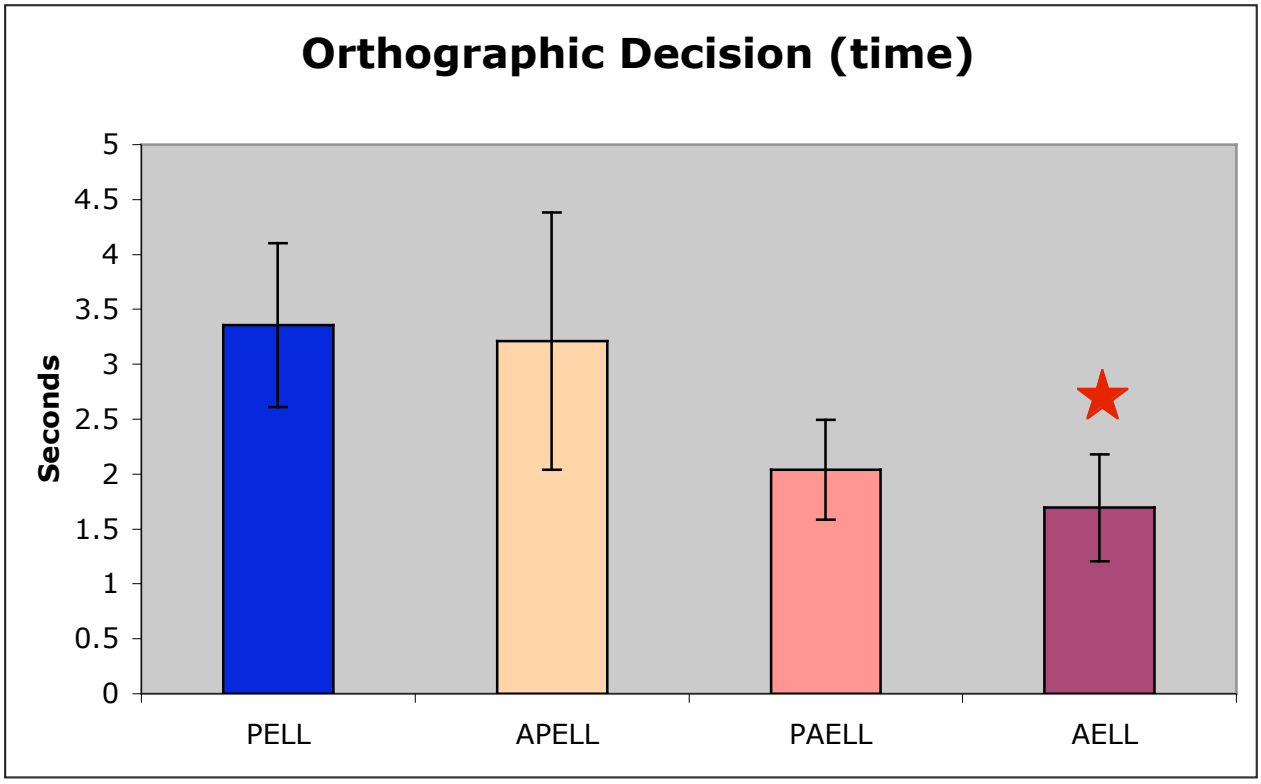
1.1.1 PELL vs. AELL: 15.23 min. vs. 8.42 minutes; U=5, p<.006*
PELL vs. PAELL: 15.23 min. vs. 8.19 min., U=2, p<.005*

Figure 16. Test of reading efficiency for PELL, APELL, PAELL and AELL (accuracy)



There are no significant differences between the PELL group and any of the other groups

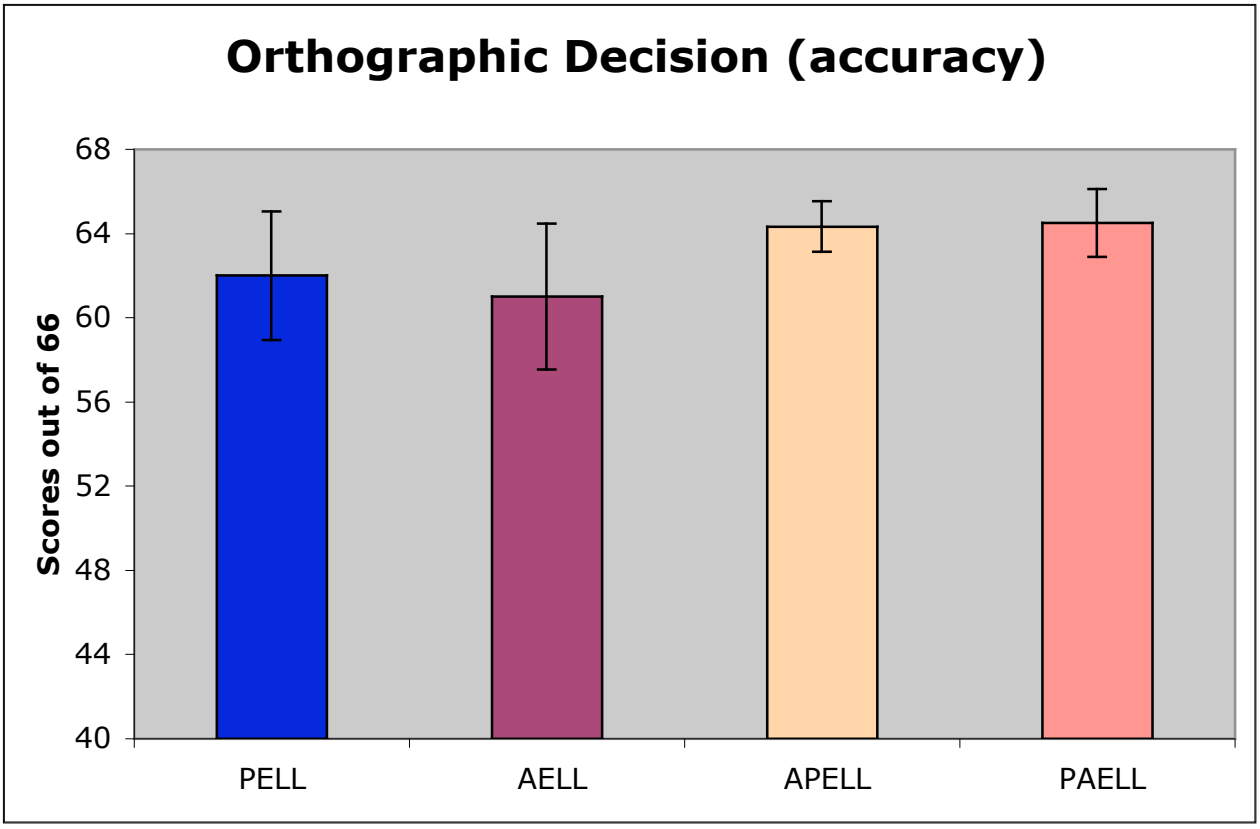
Figure 17. Orthographic decision for PELL, APELL, PAELL and AELL (time)



The PELL group takes longer than the AELL group in identifying correct word spellings in Spanish

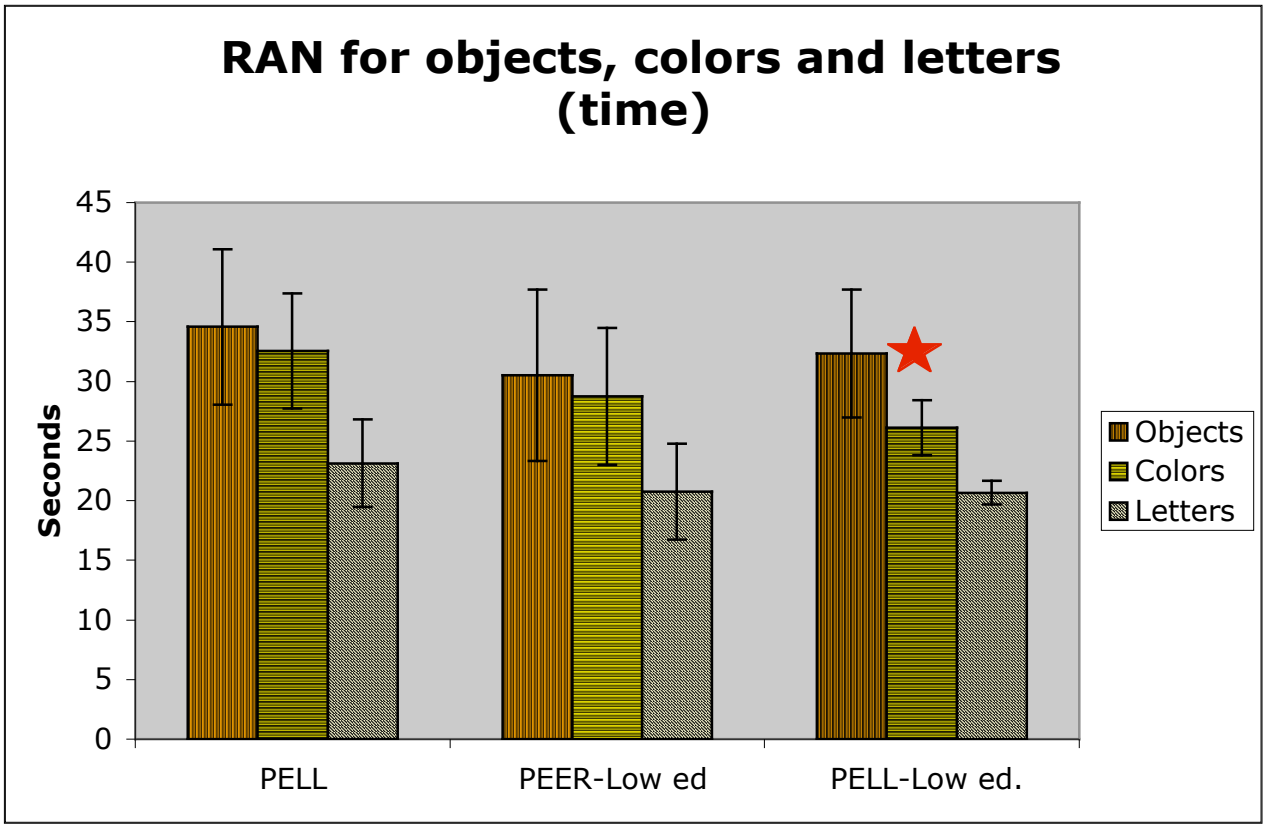
1.1.1 PELL vs. AELL: 3.35 vs. 1.69 minutes; U=1, p<.001*

Figure 18. Orthographic decision for PELL, APELL, PAELL and AELL (accuracy)



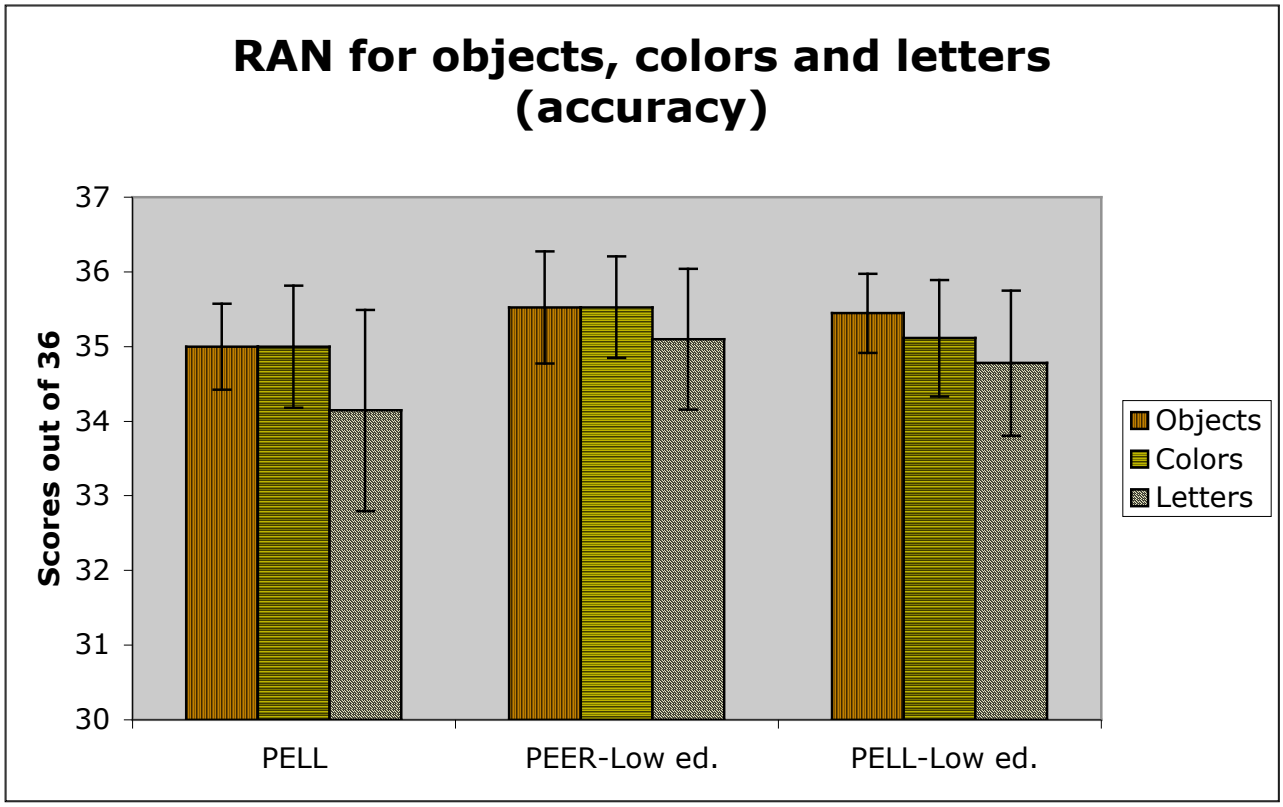
There are no significant differences between the PELL group and any of the other groups

Figure 19. RAN for objects, colors and letters for PELL, PEER-Low ed. and PELL-Low ed. (time)



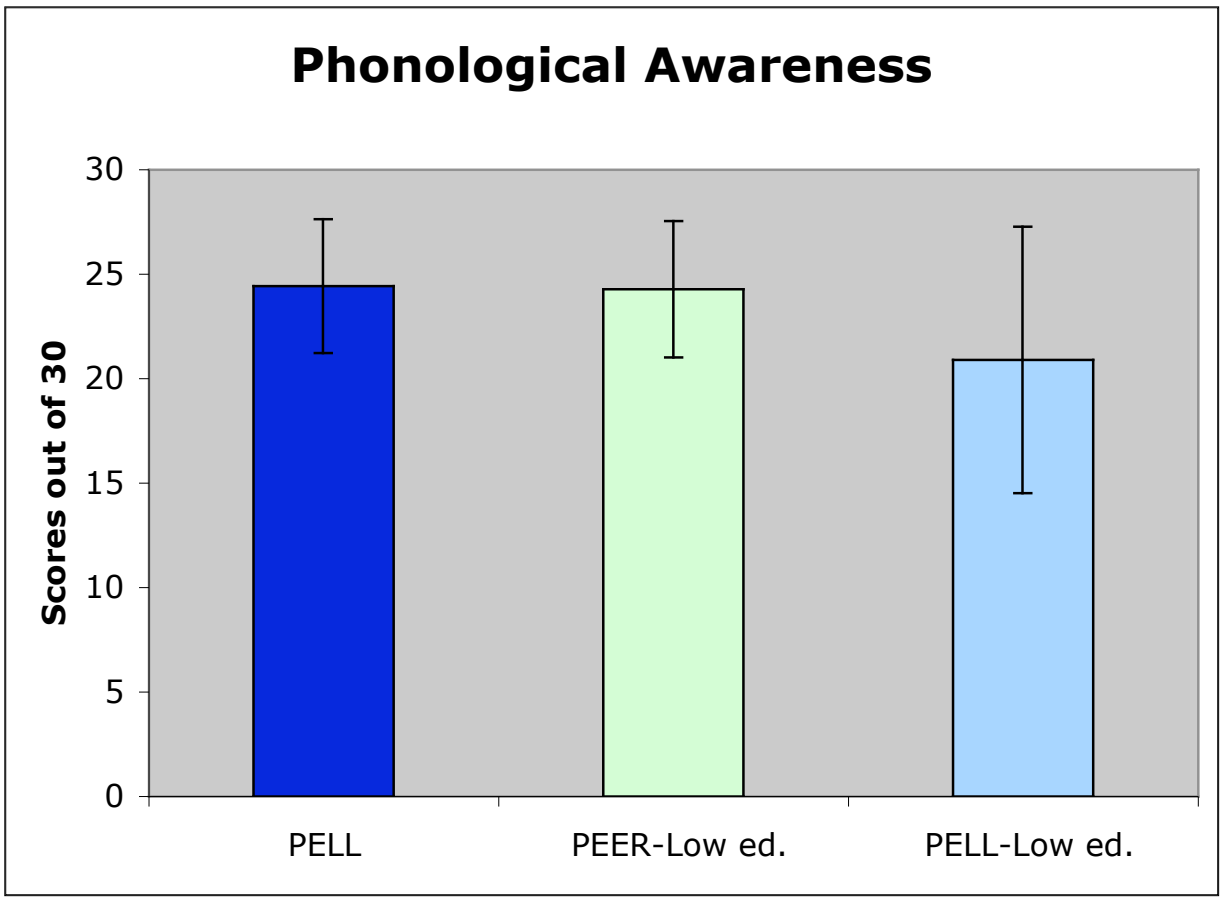
The PELL group takes longer than the PELL-Low ed. group on the rapid naming of colors. This is an unexpected finding:
PELL vs. PELL-Low ed.: (Colors) 32.57 vs. 26.11 seconds, U=5.5, p<.003*

Figure 20. RAN for objects, colors and letters for PELL, PEER-Low ed. and PELL-Low ed. (accuracy)



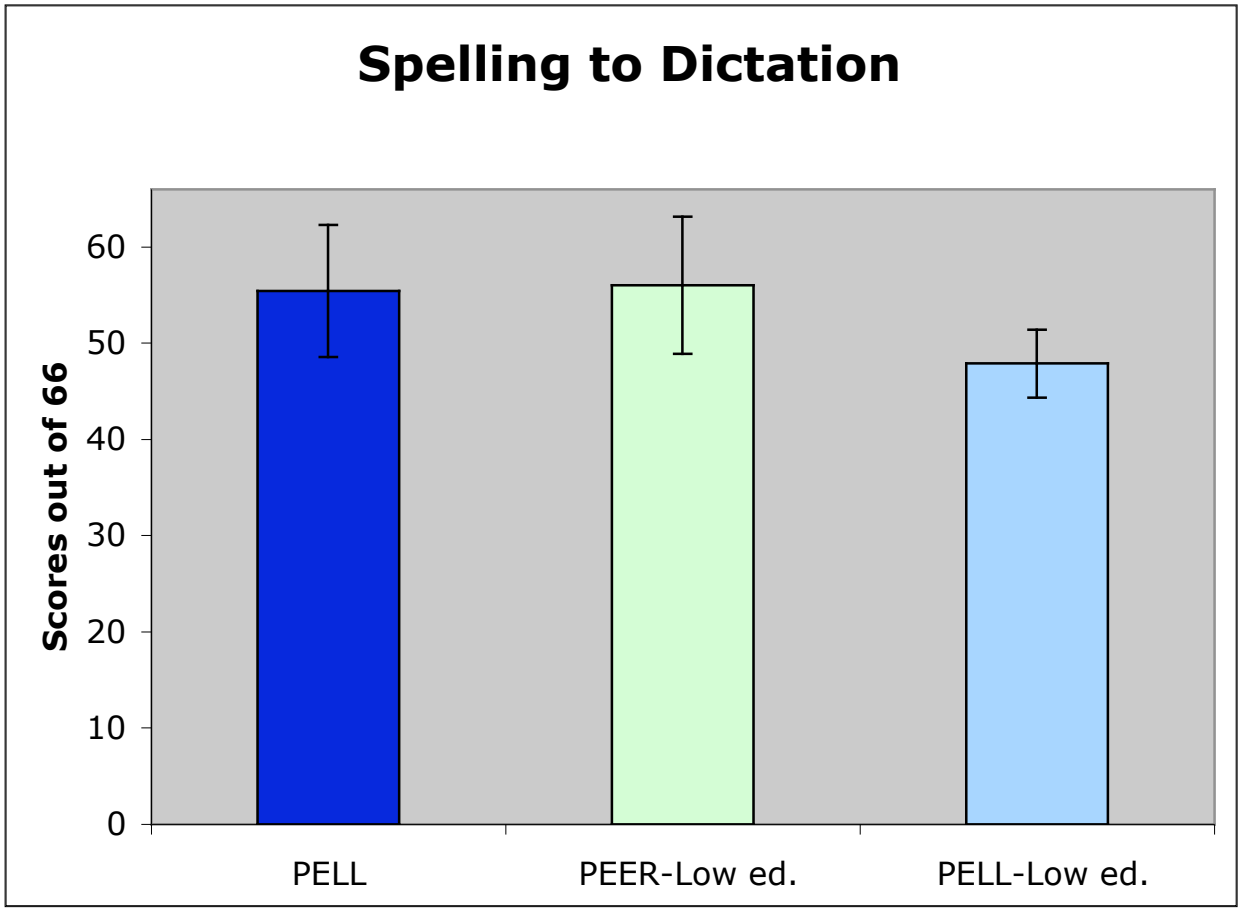
There are no significant differences between the PELL group and any of the other groups

Figure 21. Phonological awareness for PELL, PEER-Low ed. and PELL-Low ed.



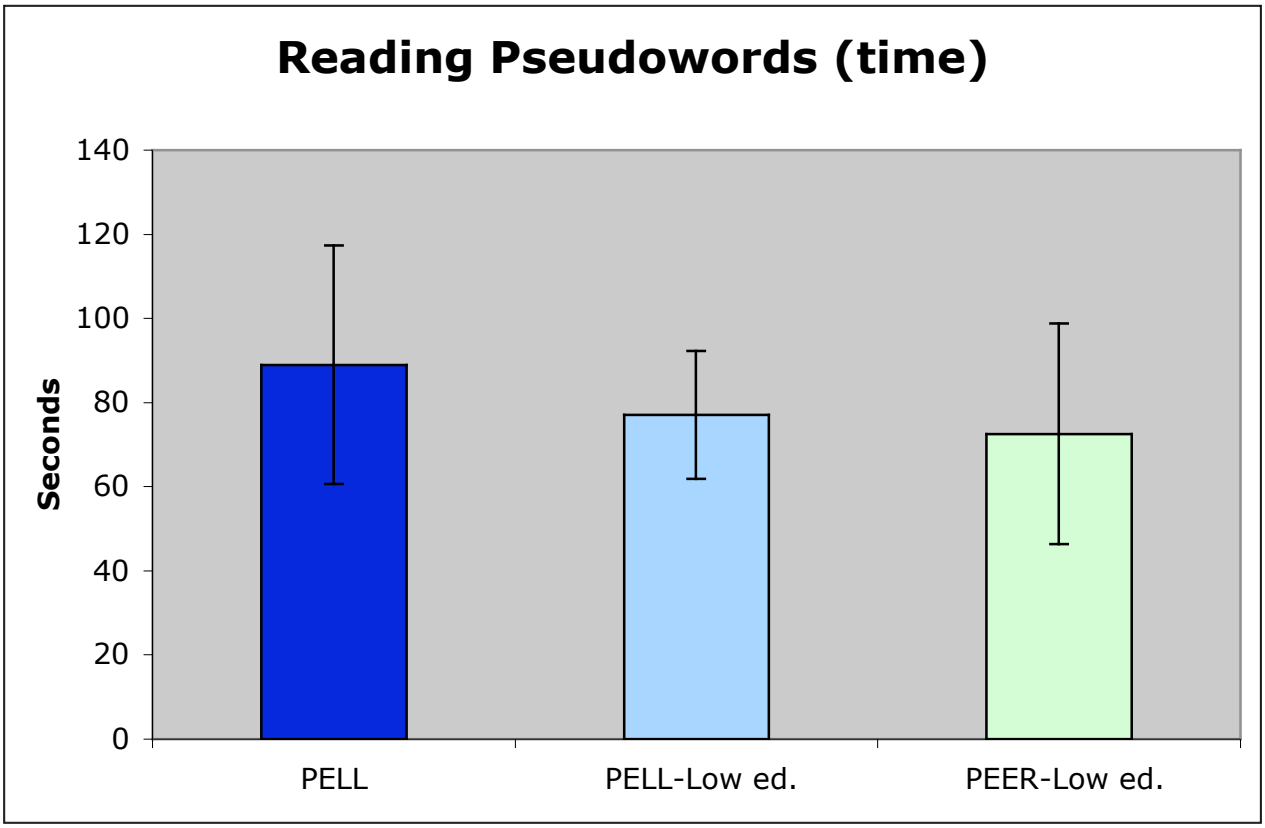
There are no significant differences between the PELL group and any of the other groups

Figure 22. Spelling to dictation for PELL, PEER-Low ed. and PELL-Low ed.



Trend showing the PELL-Lowed group to be less accurate than the PELL group in spelling familiar words to dictation
55.42 vs. 47.88 (U=13.5, p<.055

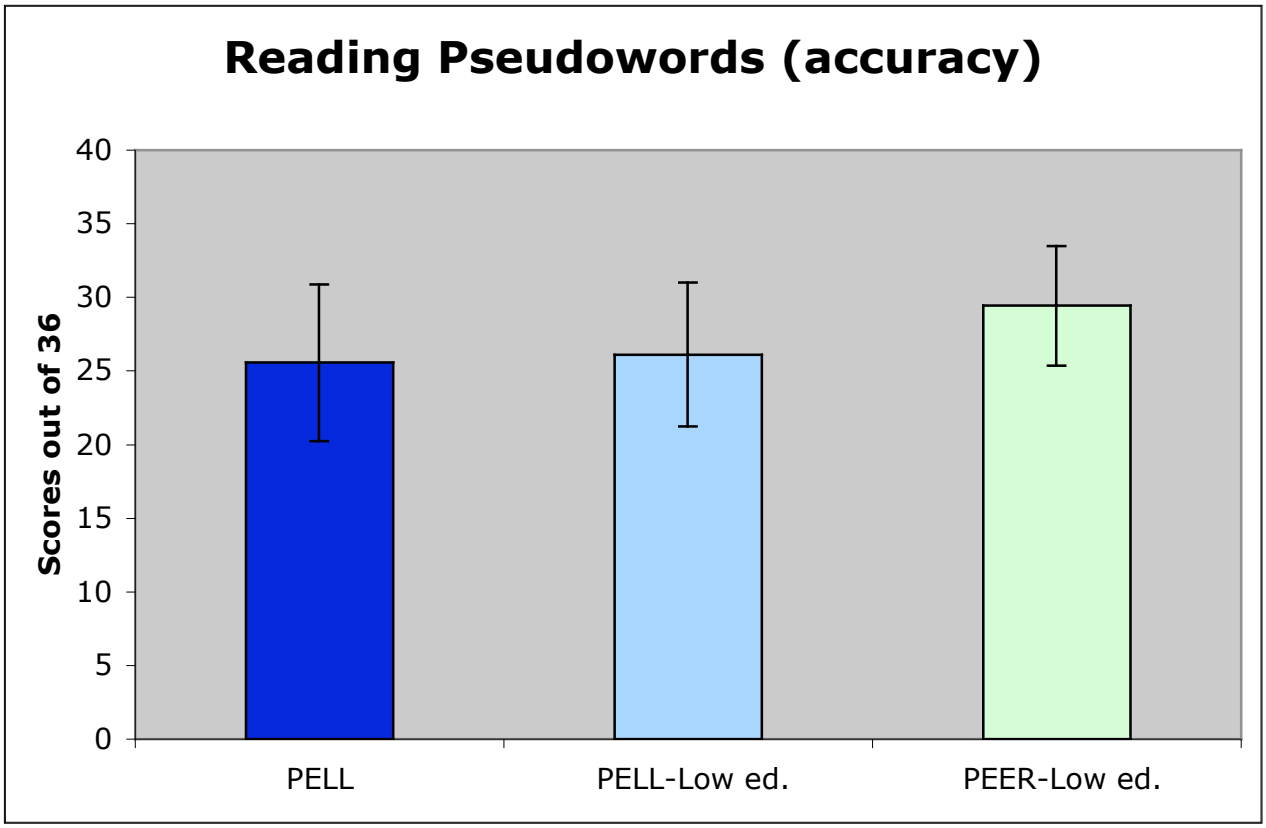
Figure 23. Reading pseudowords for PELL, PEER-Low ed. and PELL-Low ed. (time)



Trend showing the PELL group takes longer in reading aloud pseudowords than the PEER-Low ed. group

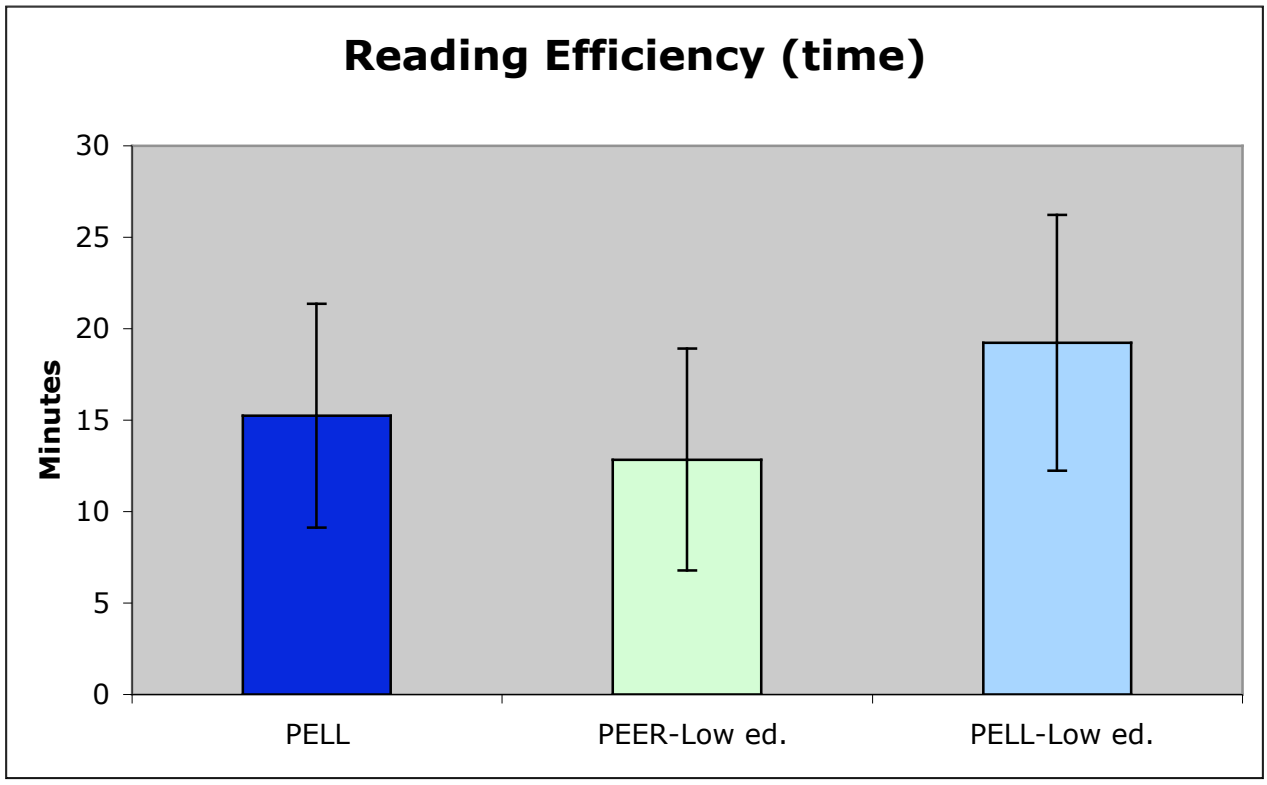
1.1.1 PELL vs. PEER-Low ed.: 89.00 vs. 72.57; U=34.50, p<.036 (results exceed Bonferroni adjustment p<.016)

Figure 24. Reading pseudowords for PELL, PEER-Low ed. and PELL-Low ed. (accuracy)



There are no significant differences between the PELL group and any of the other groups

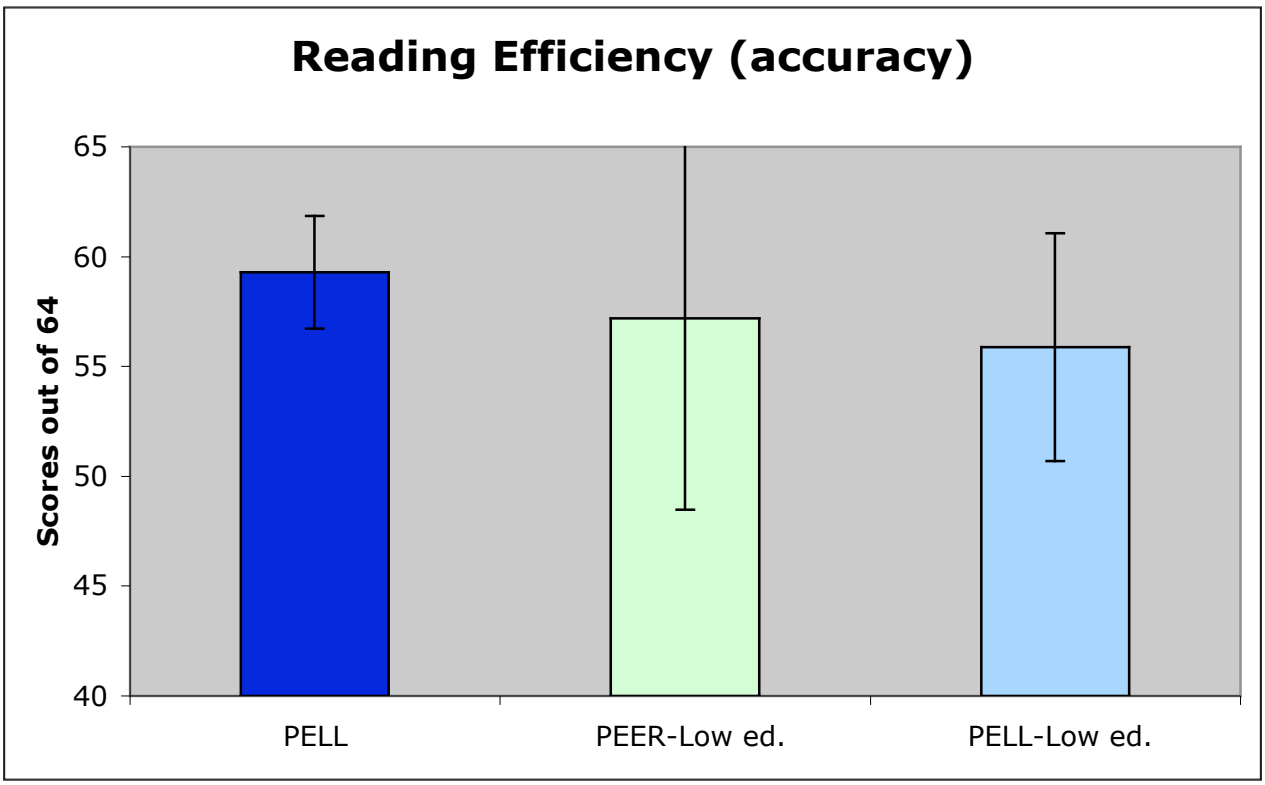
Figure 25. Reading efficiency for PELL, PEER-Low ed. and PELL-Low ed. (time)



There are no significant differences between the PELL group and any of the other groups

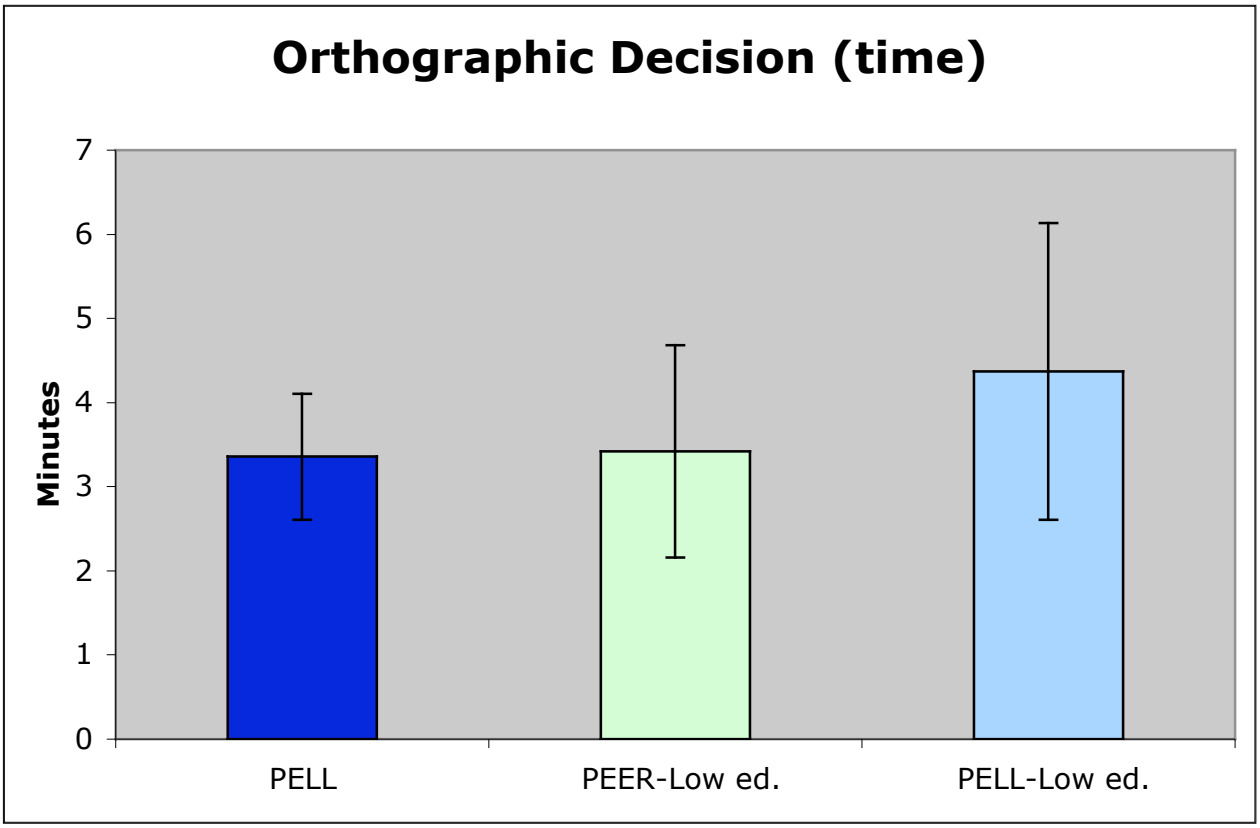
Figure 26. Reading efficiency for PELL, PEER-Low ed. and PELL-Low ed.

(accuracy)



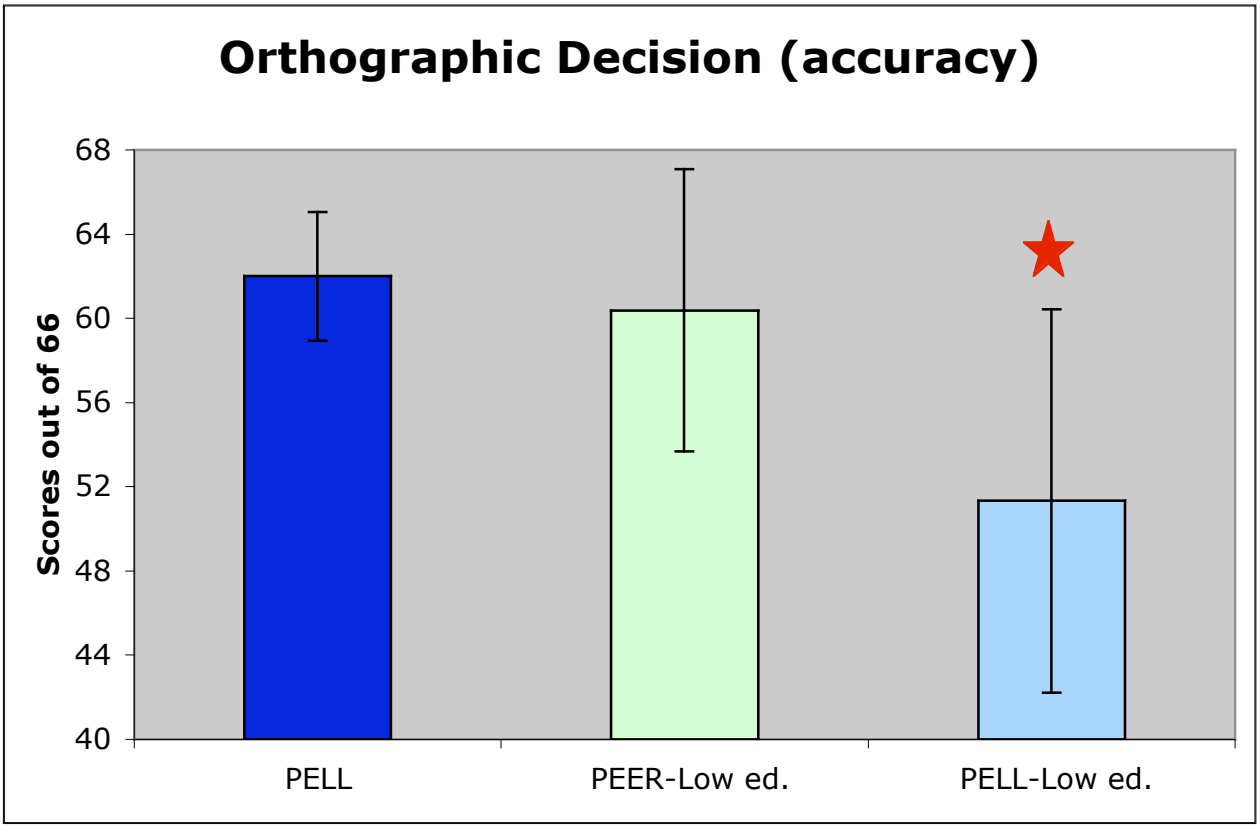
There are no significant differences between the PELL group and any of the other groups

Figure 27. Orthographic decision for PELL, PEER-Low ed. and PELL-Low ed. (time)



There are no significant differences between the PELL group and any of the other groups

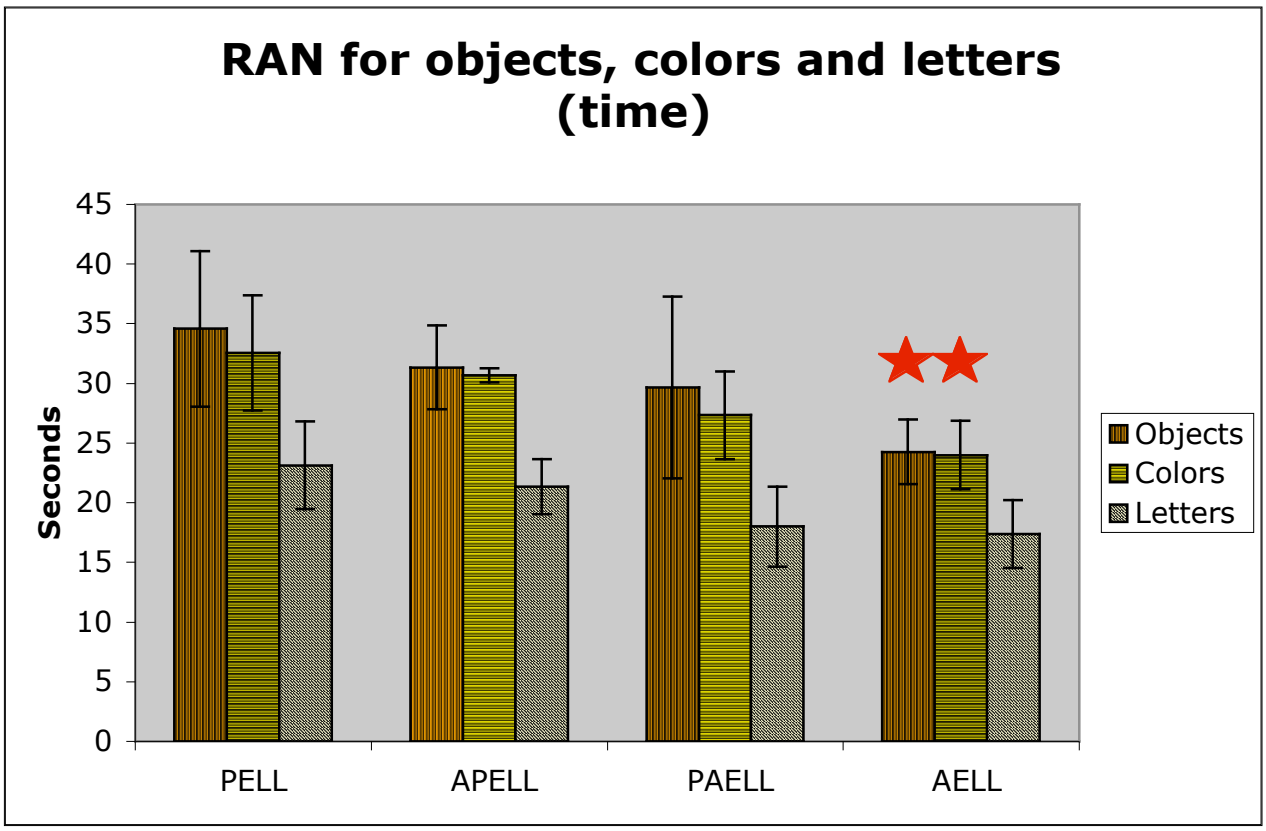
Figure 28. Orthographic decision for PELL, PEER-Low ed. and PELL-Low ed. (accuracy)



The PELL is more accurate than the PELL-Low ed. group in identifying correct word spellings in Spanish

1.1.1 PELL vs. PELL-Low ed.: Mean 62 vs. 51.33; U=4, p<.002*

Figure 29. RAN for objects colors and letters for PELL, APELL, PAELL and AELL (time)

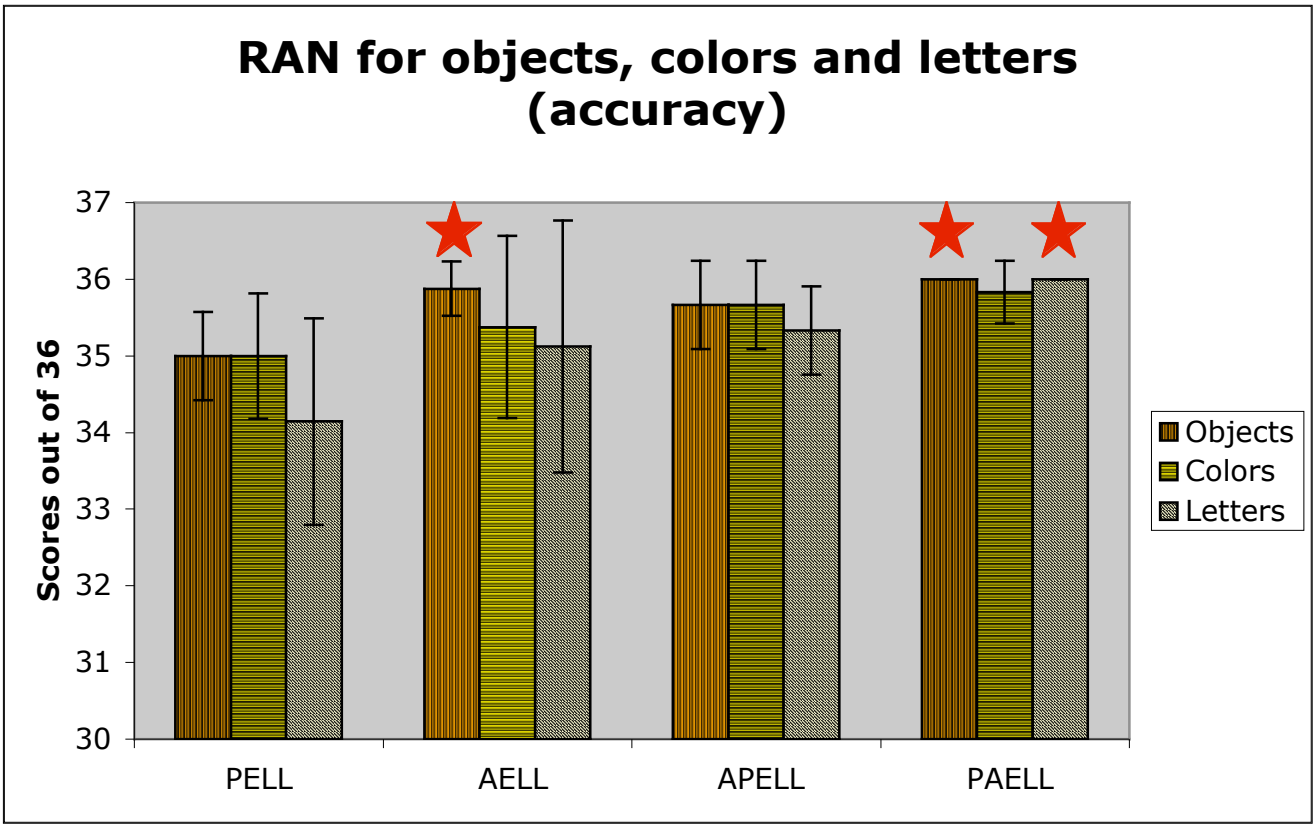


The PELL group takes longer than the AELL group on the rapid naming of objects and colors

PELL vs. AELL: (Objects) 34.57 vs. 24.25 seconds; U=6.5, p<.009*

PELL vs. AELL: (Colors) 32.57 vs. 24 seconds (U=1.5, p<.001*

Figure 30. RAN for objects colors and letters for PELL, APELL, PAELL and AELL (accuracy)



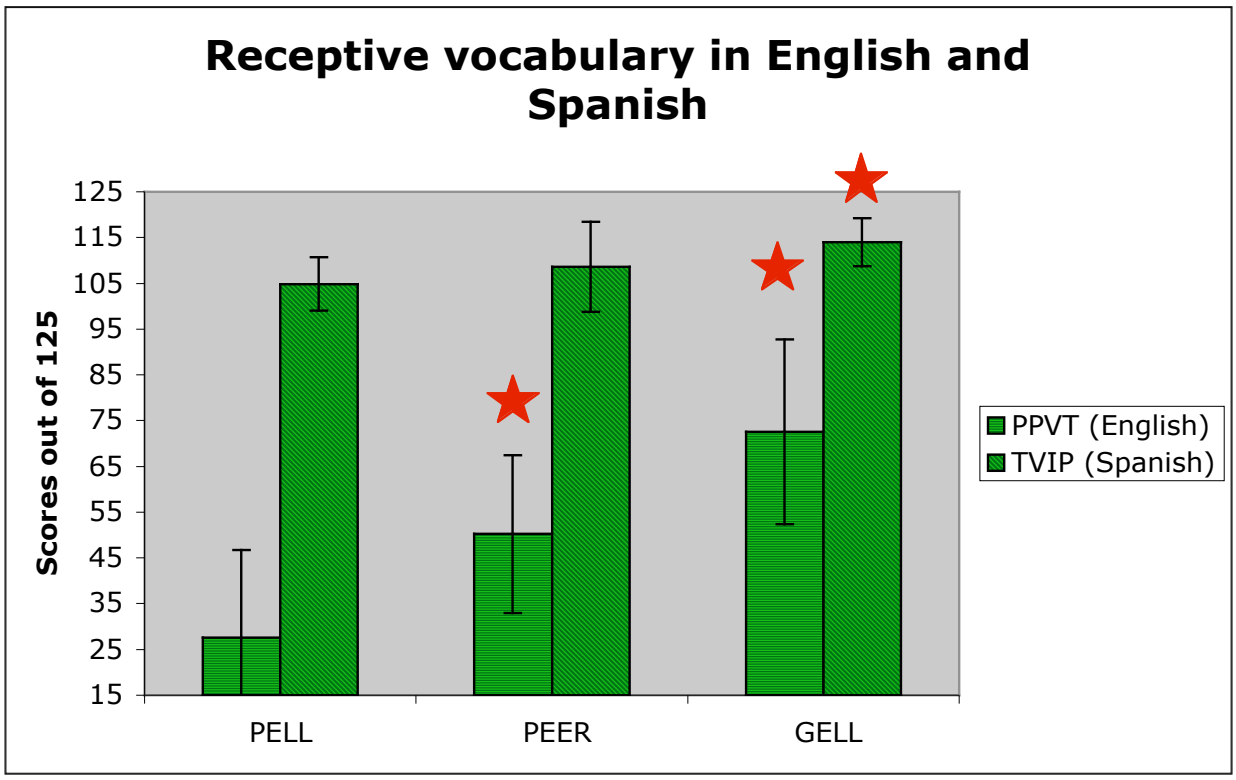
The PELL group is less accurate than the AELL and PAELL groups on the rapid naming of objects and letters

1.1.1 PELL vs. AELL: (Objects) Mean: 35 vs. 36.87; U=7, p<.014*

1.2.1 PELL vs. PAELL: (Objects) Mean: 35 vs. 36; U=3, p<.008*

1.3.1 PELL vs. PAELL: (Letters) Mean: 34.14 vs. 36; U=3, p<.008*

Figure 31. Receptive vocabulary in English and Spanish for PELL, PEER and GELL groups



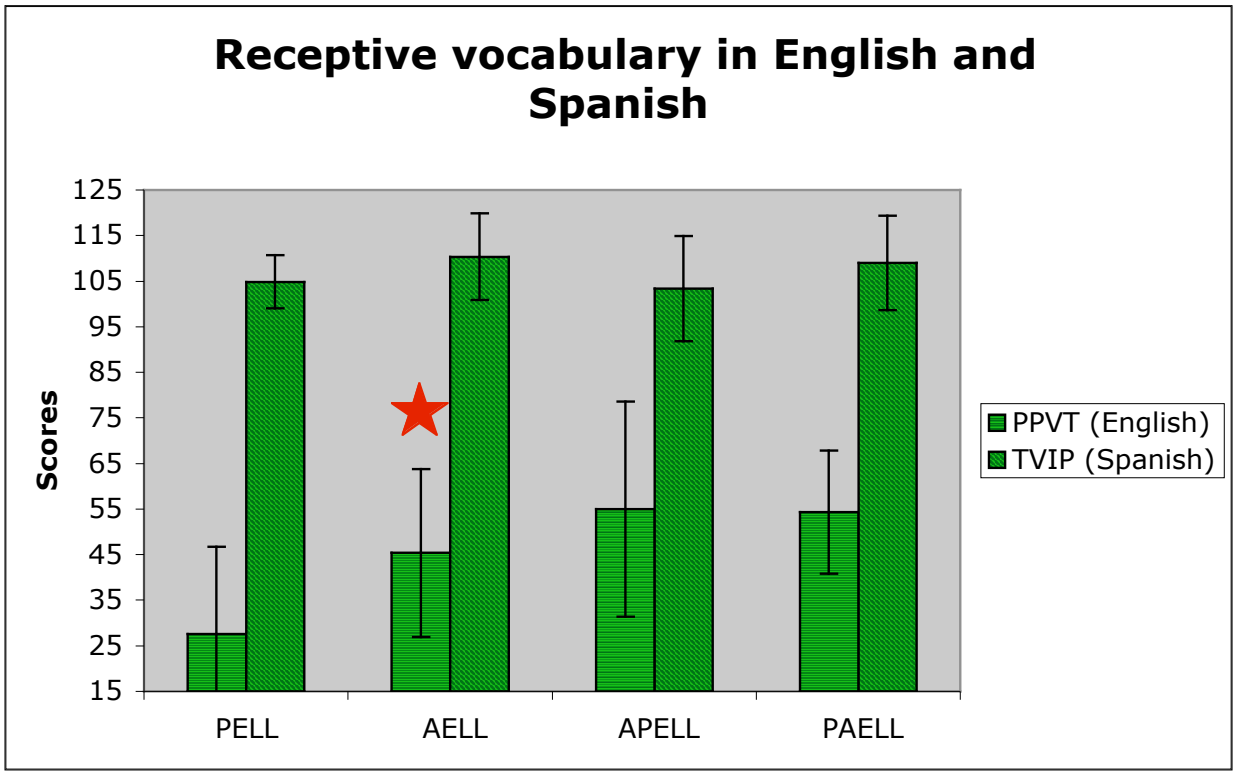
The PELL group has lower receptive vocabulary scores in English and Spanish when compared with the GELL group. Lower receptive vocabulary scores in English are also found when compared with the PEER group

1.1.1 PELL vs. GELL: (PPVT) Mean 27.57 vs. 72.50; U=5, p<.001*

1.2.1 PELL vs. PEER: (PPVT) Mean 27.57 vs. 50.23; U=19.00, p<.009*

1.3.1 PELL vs. GELL: (TVIP) Mean 104.85 vs. 114; U=3; p<.008*

Figure 32. Receptive vocabulary in English and Spanish for PELL, AELL, APELL and PAELL groups

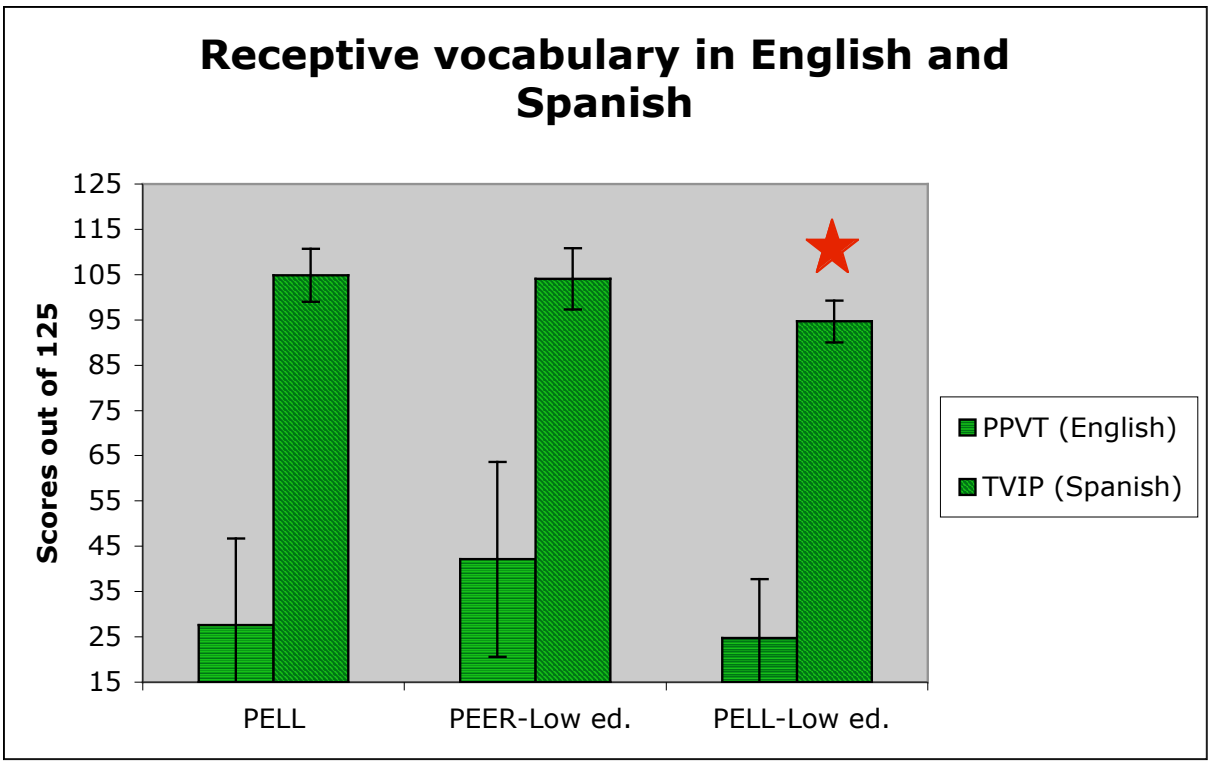


The PELL group has lower English receptive vocabulary scores than the AELL group. A trend in the same direction is shown when compared with the PAELL group

1.1.1 PELL vs. AELL: (PPVT) Mean 27.57 vs. 45.37; U=8.5; p<.021*

1.2.1 PELL vs. PAELL: (PPVT) Mean 27.57 vs. 57.28; U=7.5; p<.051 (Trend)

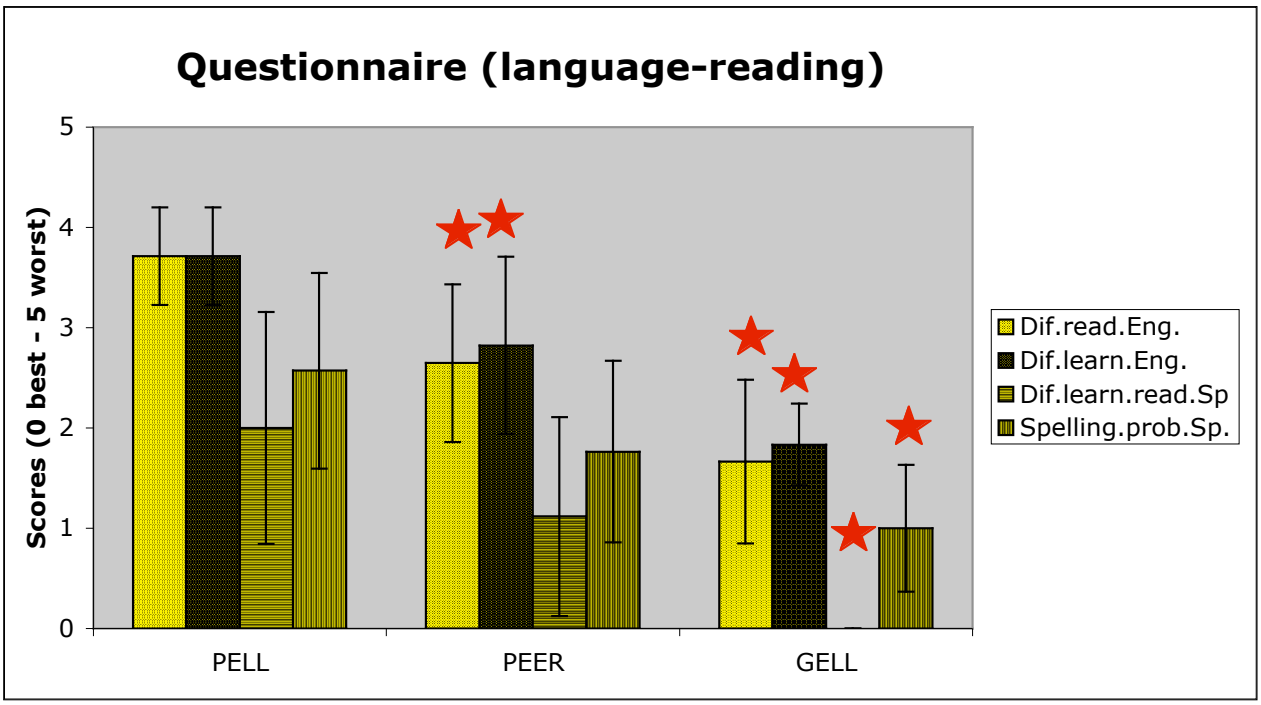
Figure 33. Receptive vocabulary in English and Spanish for PELL, PEER-Low ed. and PELL-Low ed. groups



The PELL group has lower receptive vocabulary scores in Spanish when compared with the PELL-Low ed. group

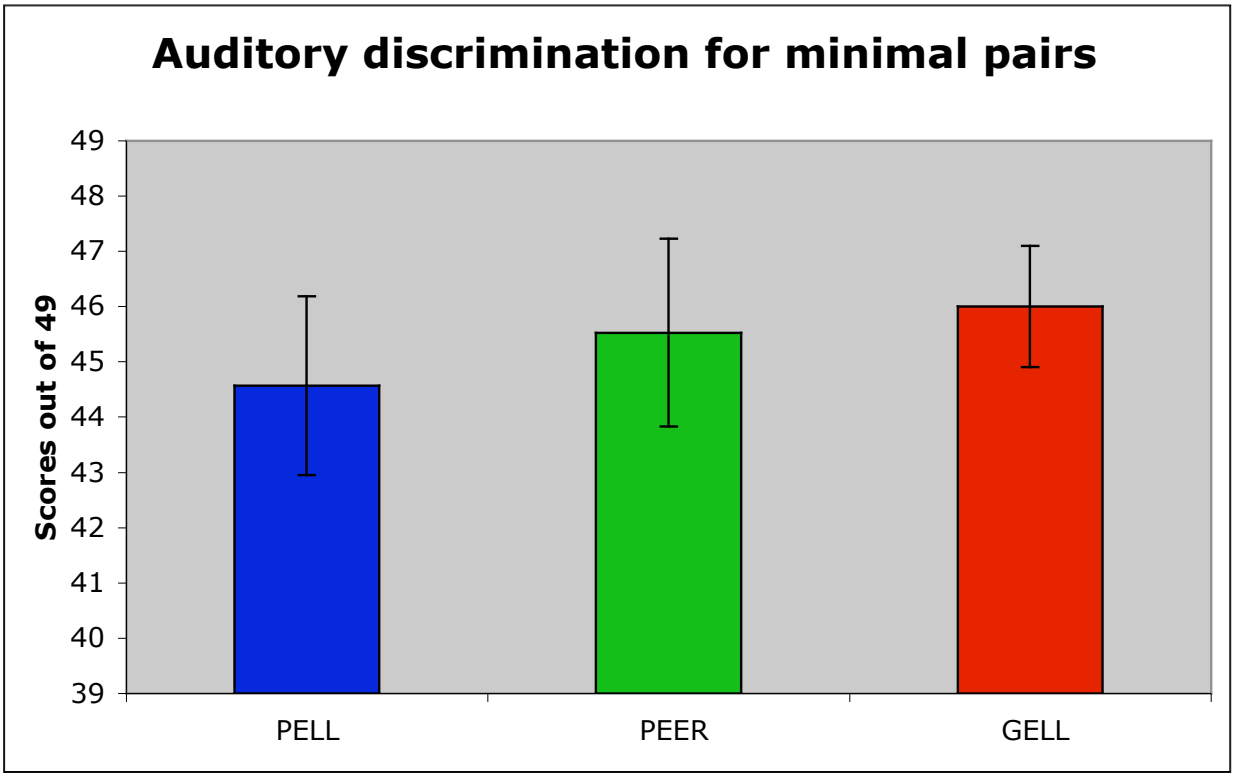
1.1.1 PELL vs. PEER-Low ed: Mean 94.66 vs. 104.85; U=.50, p<.000*

Figure 34. Questionnaire on language and reading history for PELL, PEER and GELL groups.



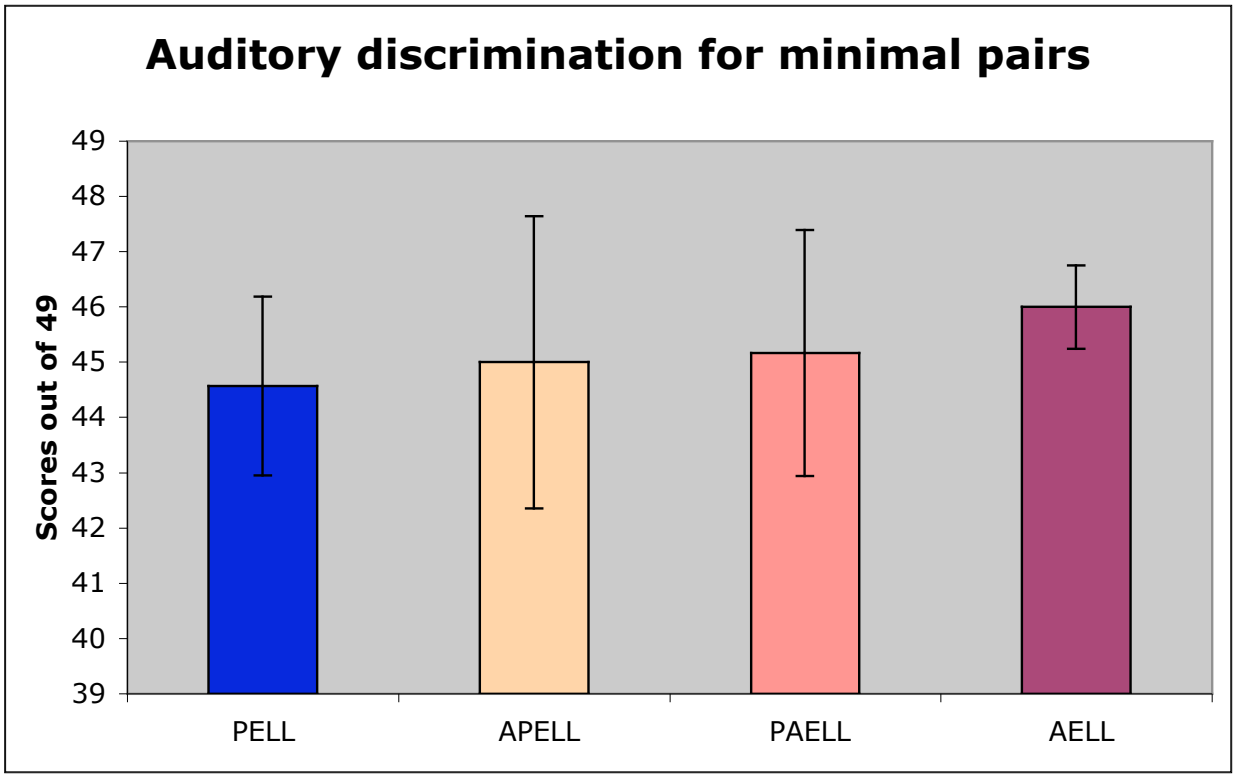
Q9. How easy or difficult is to read English? PELL vs. PEER (p.<.007); PELL vs. GELL (p<.001)*
Q40. How easy of difficult is to learn English? PELL vs. PEER (p.<.034); PELL vs. GELL (p<.001)*
Q2. How much difficulty did you have learning to read during elementary school? PELL vs. GELL (p<.008)*
Q16. Do you have many spelling problems in Spanish? PELL vs. GELL (p<.008)*

Figure 35. Auditory discrimination for minimal pairs for PELL, PEER and GELL groups



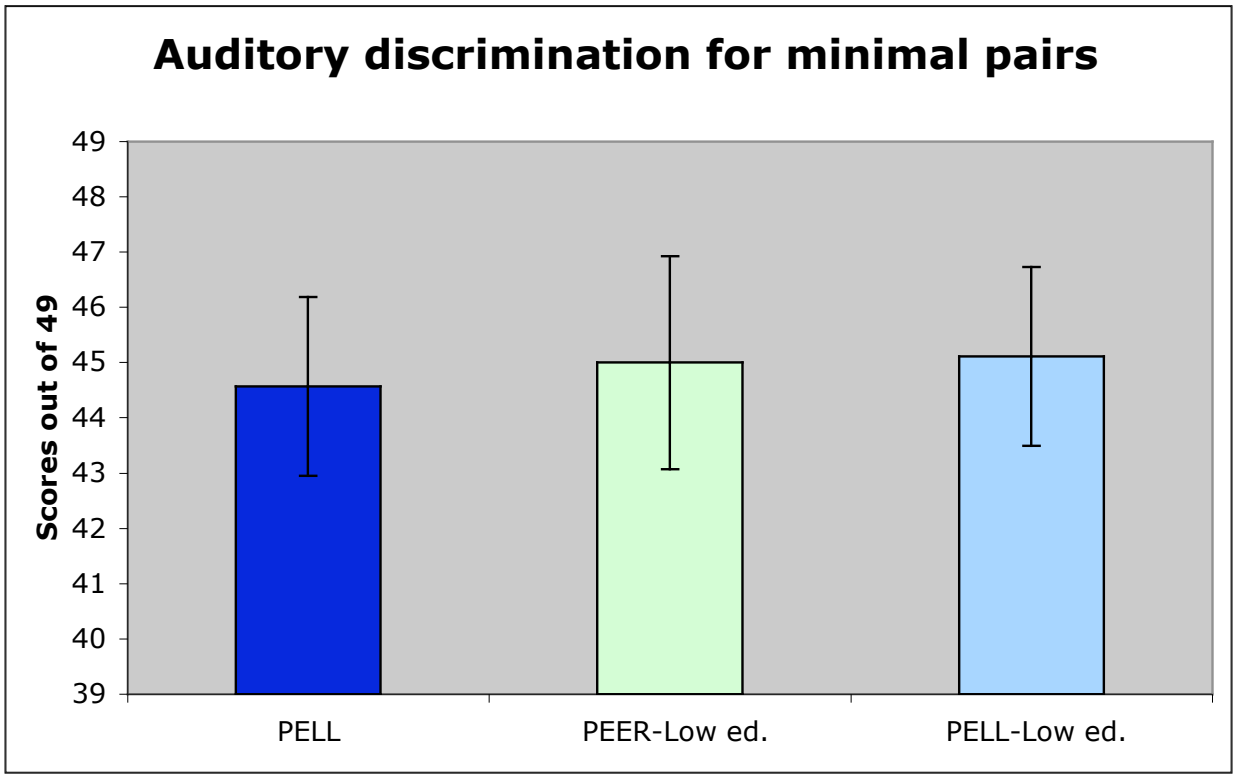
There are no significant differences between the PELL group and any of the other groups

Figure 36. Auditory discrimination for minimal pairs for PELL, APELL, PAELL and AELL groups



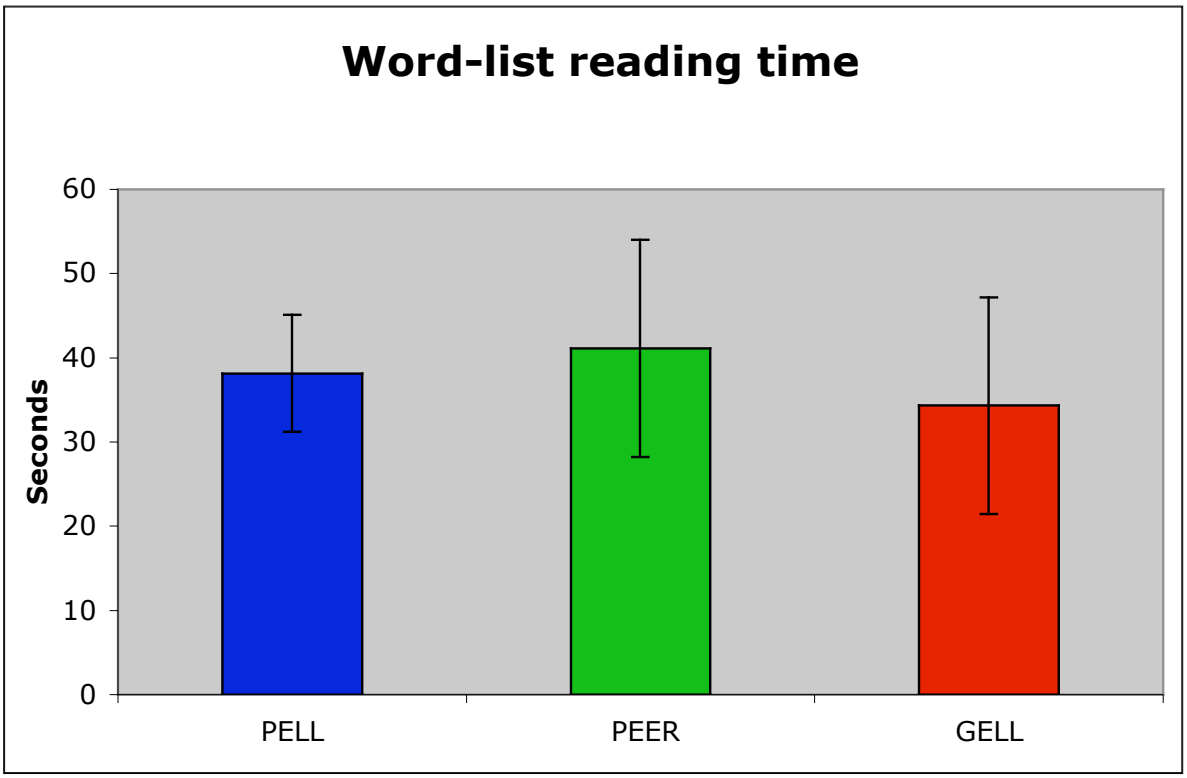
There are no significant differences between the PELL group and any of the other groups

Figure 37. Auditory discrimination for minimal pairs for PELL, PEER-Low ed. and PELL-Low ed. groups



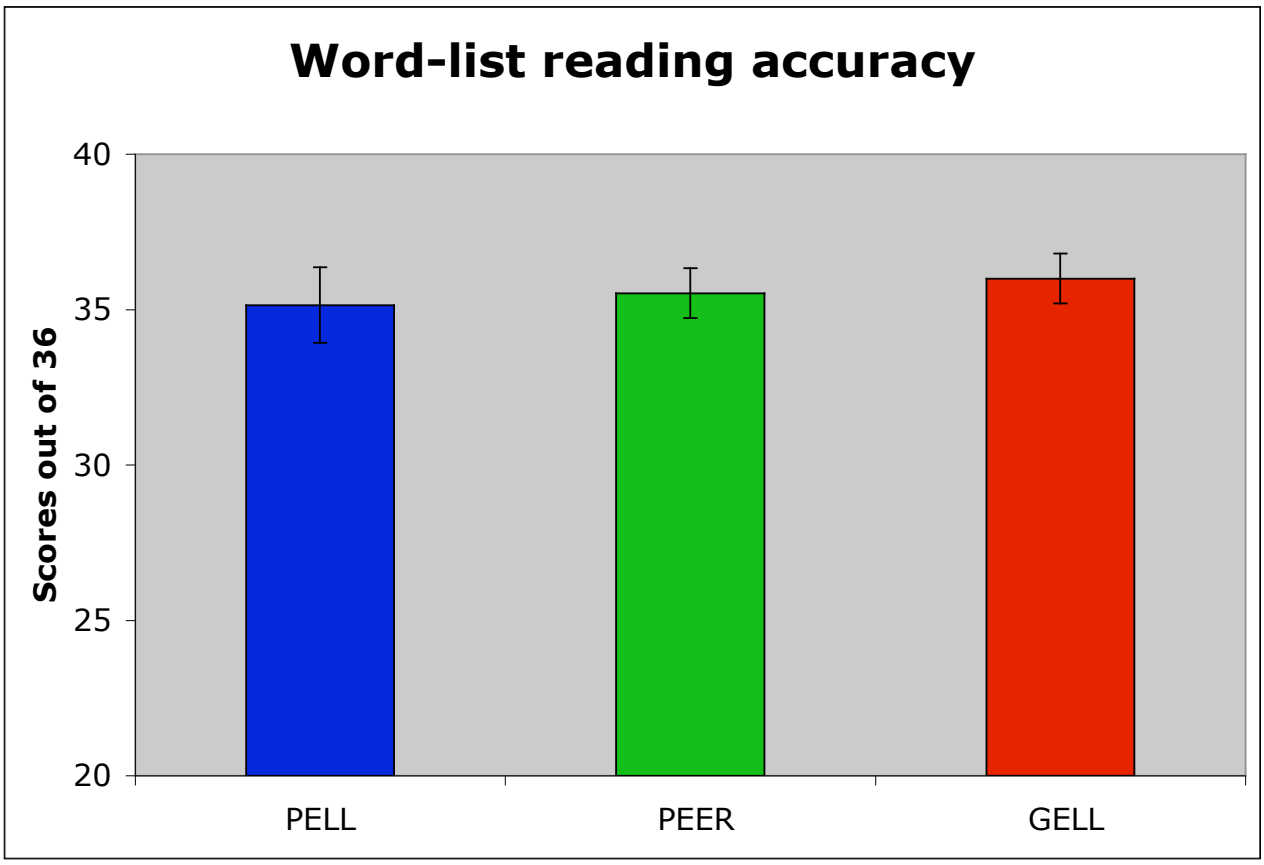
There are no significant differences between the PELL group and any of the other groups

Figure 38. Word-list reading time for PELL, PEER and GELL groups



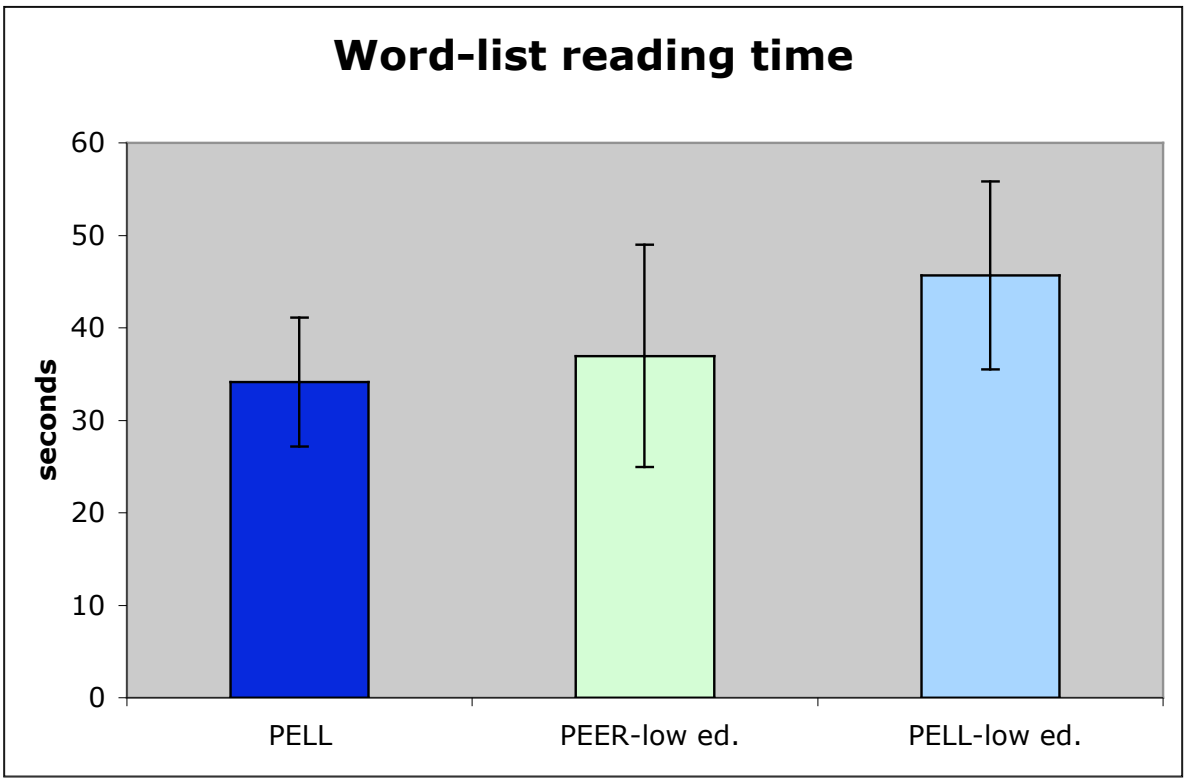
There are no significant differences between the PELL group and any of the other groups

Figure 39. Word-list reading accuracy for PELL, PEER and GELL groups



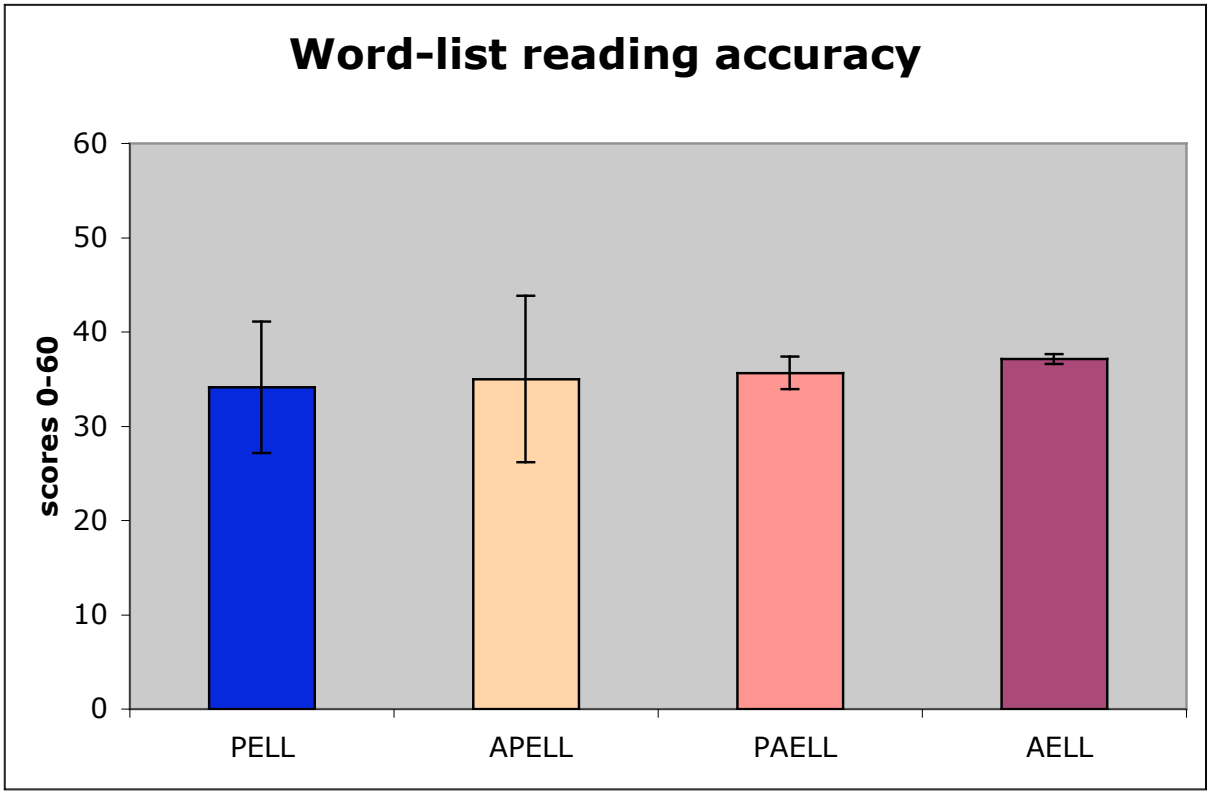
There are no significant differences between the PELL group and any of the other groups

Figure 40. Word-list reading time for PELL, PEER-Low ed. and PELL-Low ed. groups



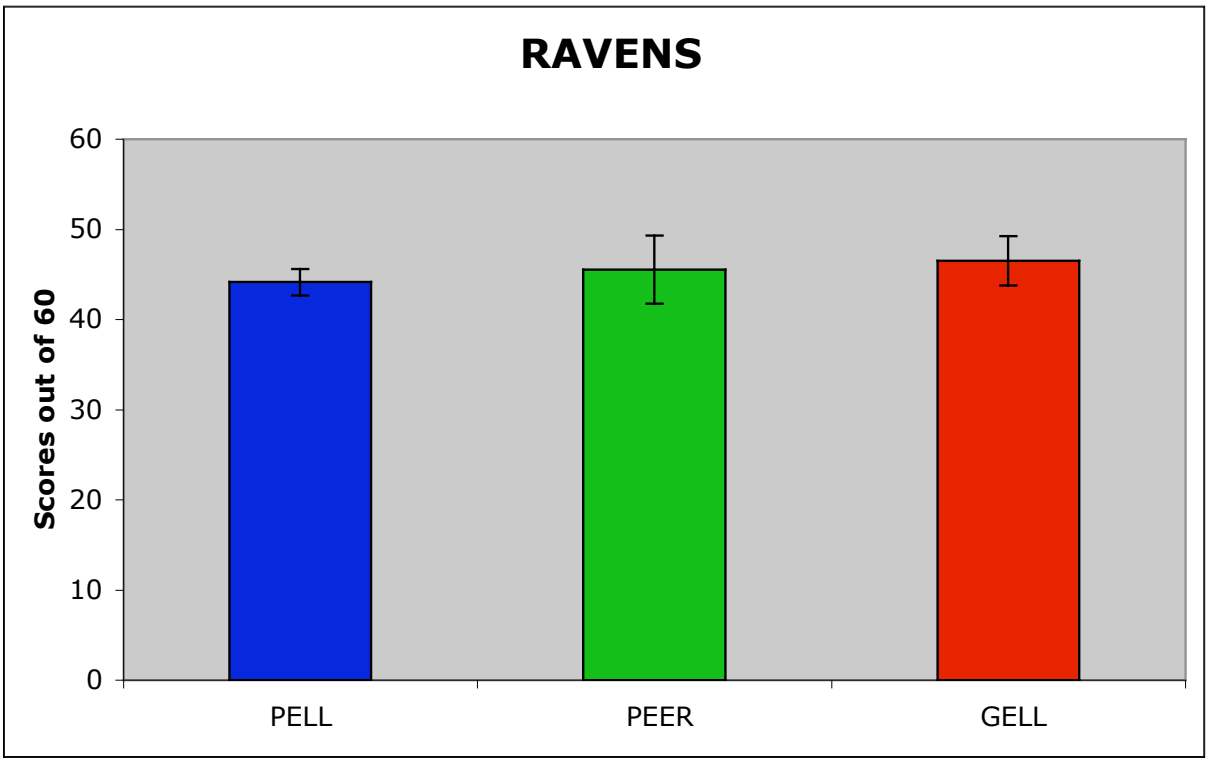
There are no significant differences between the PELL group and any of the other groups

Figure 41. Word-list reading accuracy for PELL, APELL, PAELL and AELL groups



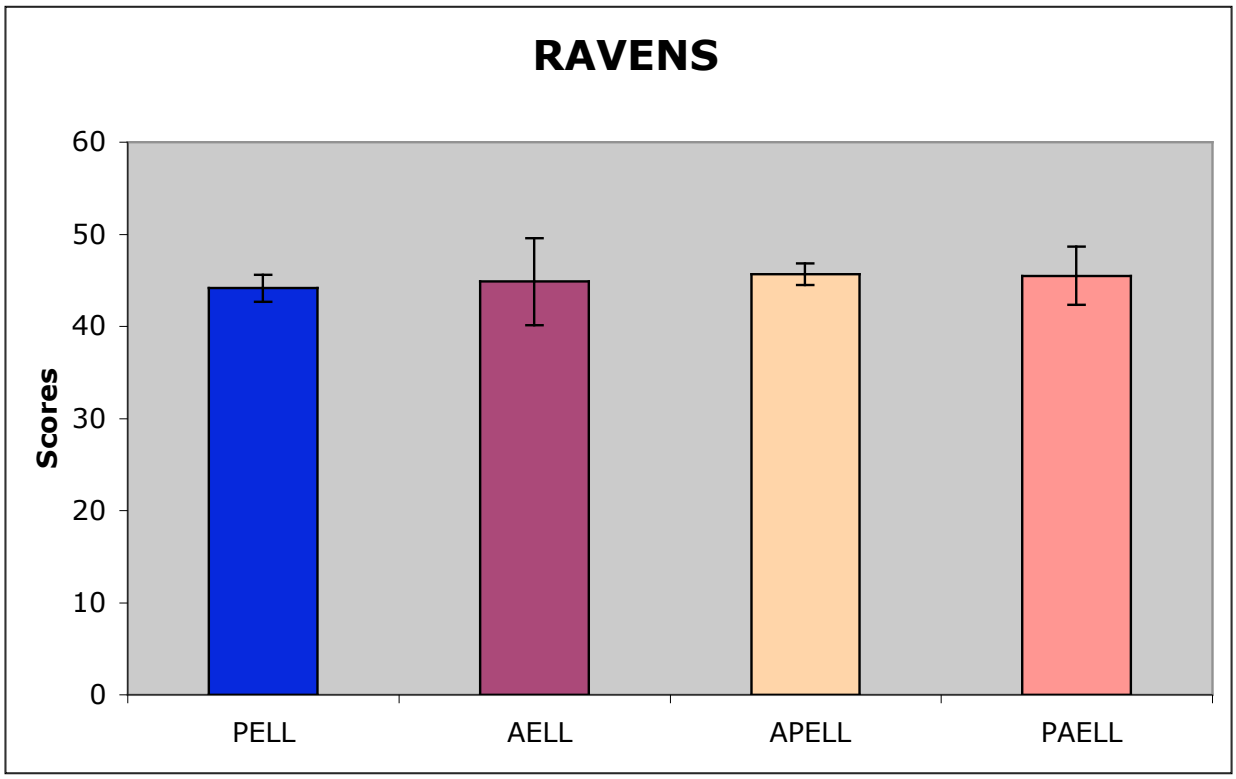
There are no significant differences between the PELL group and any of the other groups

Figure 42. RAVENS performance for PELL, PEER and GELL groups



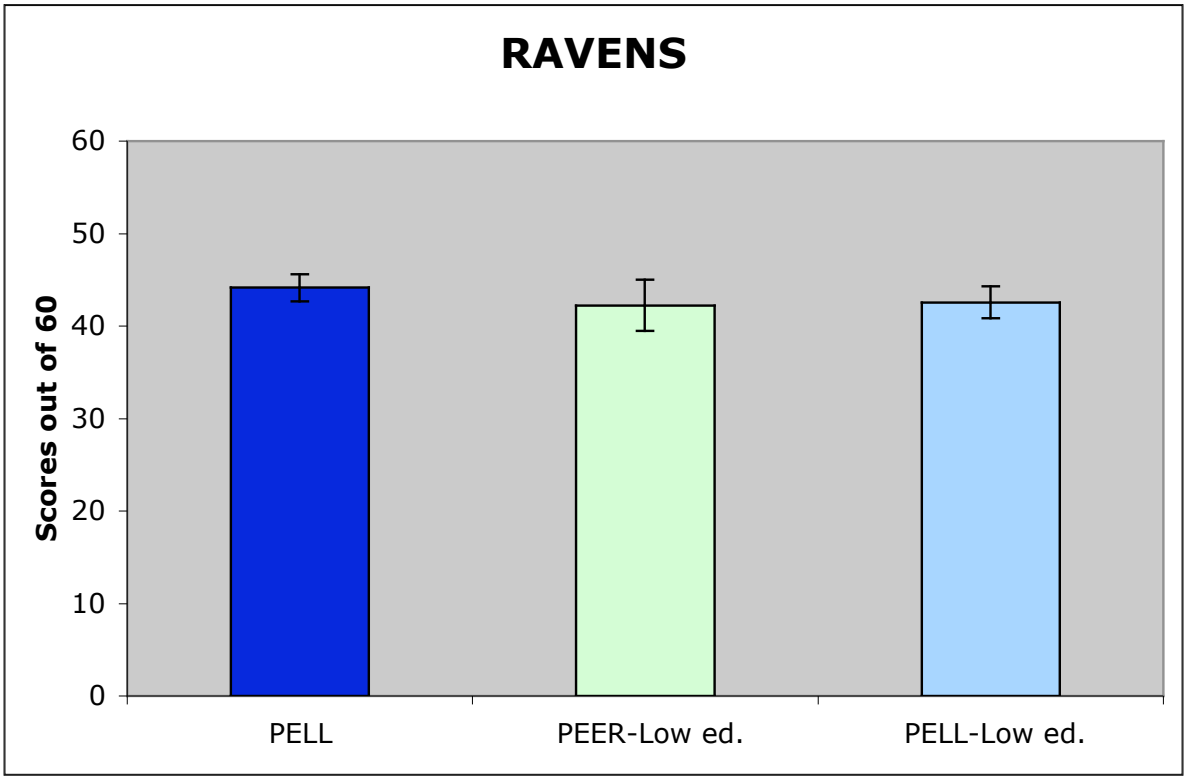
There are no significant differences between the PELL group and any of the other groups

Figure 43. RAVENS performance for PELL, AELL, APELL and PAELL groups



There are no significant differences between the PELL group and any of the other groups

Figure 44. RAVENS performance for for PELL, PEER-Low ed. and PELL-Low ed. groups



There are no significant differences between the PELL group and any of the other groups

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