

## **Lexical Knowledge and Working Memory in Second-Generation Spanish/English Bilinguals**

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### **Abstract**

*The aim of this study was to analyze the lexical knowledge and working memory of second-generation Spanish-English bilinguals in South Florida. A sample of 59 Spanish-English bilinguals (age: 19-54 years), born from native-Spanish speaking parents, moving to the U.S. before the age of 10 (or born in Miami), and mostly/totally attending school in English were selected. The following instruments were administered: Cross-Linguistic Naming Test, Vocabulary subtest (from WAIS-III), Verbal Fluency, Digits, Sentence repetition (from the Multilingual Aphasia Examination), Letter-Number Sequencing (from the WAIS-IV), and n-back task, plus a bilingual questionnaire. Overall performance was about 25% higher in English than in Spanish. It was concluded that second-generation bilinguals have more lexical knowledge and better working memory ability in their L2 (English) than in their L1 (Spanish).*

**Keywords:** Spanish/English bilingualism; lexicon; working memory; Immigrants second-generation; unbalanced bilingualism

### **Introduction**

Among the many different types of bilingualism that can be distinguished, one of the major types is that of the second-generation immigrants (Ardila, 2007). Worldwide, there are over 200 million people living in a country different from the country in which they were born (United Nations, 2011). In a significant number of these cases, a different language is spoken in the host country. The immigrants usually maintain their native language at home, but their children become bilinguals. The parents' language is spoken at home (L1) but the social and educational language is the language of the new country (L2). This results in a particular type of bilingualism that unfortunately has not been sufficiently analyzed. This type of second-generation bilingualism represents one of the most important and extended forms of bilingualism world-wide. In the US there are over 40 million people born abroad (United States Census Bureau Foreign born, 2012); and close to 50% of them are native Spanish speakers. It is easy to conclude that the number of second generation Spanish/English bilinguals represents a significant percentage of the American population. Spanish/English bilinguals, however, are unevenly distributed in the country; they are particularly concentrated in the south states and in New York. In Miami-Dade county Hispanics represent about 65% of the population (U.S. Census Bureau, 2011), and Spanish is spoken at home by 58.5% of the Miami-Dade families (Solomon, 2008). Cubans represent about 50% of the Spanish speakers, followed by Colombian, Nicaraguans, and other Latin American immigrants (Motel, 2012).

Despite the linguistic importance of this type of bilingualism, information about language profile in L1 and L2 in this second generation of Spanish/English bilinguals is limited. In general, it has been observed that second-generation speakers are bilingual, with a high degree of control in both Spanish and English (Mora, Villa & Dávila, 2006).

Studies suggest that encouragement of L2 positively correlates with L2 development and does not result in degradation of L1 development (Cahill, 1987). Some studies indicate that L1 maintenance may even aid in development of both languages (Schwartz & Leikin, 2012). Additionally, various factors, such as if one or both primary caregivers enter into the L2 workforce and whether or not L1 is spoken at home, influence dominance of language development in the second generation (Harres, 1989). Other factors, which include historical trends in the United States leading to L1 attrition, particularly of Spanish among individuals in South Florida and Southern California, have also been investigated in various studies by Portes (Portes, 1994; Portes & Hao, 1998). Perhaps one of the greatest factors in the United States that leads to L1 attrition is the educational system. Spanish/English bilinguals in the United States are under very specific linguistic conditions and have language needs that are not being met by formal educational institutions (Dicker, 2006). Schwartz & Katzir (2012) indicate that support may need to be provided to second-generation children in order to near their academic vocabulary to that of a monolingual English speaker. At least in the Southwest portions of the United States, studies support evidence toward L1 attrition in the native-born population (Garland, Hudson, & Hernandez Chavez, 2000). Several studies have been carried out in efforts to counter the theory of L1 attrition in second-generation bilinguals. Bae (2007) indicates that L1 can be fostered in an academic immersion program without disadvantaging development of L2. Lawrence et al. (2012) posit that intervention programs can be used to facilitate lexical acquisition of second-generation students who do not use English as their primary home language.

Language abilities in lexicon, grammar and reading/writing ability may vary in bilinguals. Kohnert, Hernández and Bates (1998) selected 100 young, educated bilingual adults and administered the Boston Naming Test (BNT) in both Spanish and English (Kaplan, Goodglass, & Weintraub, 1983). Test scores were calculated in three different ways: English only, Spanish only, and a composite score indicating the total number of items correctly named independent of language. As a whole, responses were significantly more accurate in English than in Spanish. For a subset of the larger group ( $n = 25$ ), there were significant differences in composite over single language scores, but no significant differences between Spanish and English. Much greater variability in responses over the Spanish items was found for this Spanish–English bilingual group. Differences in naming ability have been described in individuals that speak more than one language when compared to monolinguals. Some studies have shown, for example, when compared to monolinguals, bilinguals present more “tip of the tongue” retrieval problems (Gollan & Acenas, 2004; Gollan, Bonanni, & Montoya, 2005). Bilinguals also generate fewer words in semantic fluency tasks and name fewer pictures in each language on standardized naming tasks such as the Boston Naming Test (Rosselli et al., 2012; Roberts, Garcia, Desrochers, & Hernandez, 2002). Gollan and Acenas (2004) showed that retrieval problems in bilinguals can be associated with the cognate status of the target word. Fewer retrieval problems were seen when trying to retrieve cognates than when the words had dissimilar names across languages (non-cognates).

More recently, Gollan et al. (2007) selected 29 Spanish–English bilinguals and administered the Boston Naming Test, first in their dominant language and then in their less dominant language. Bilinguals with similar naming scores in each language, or relatively balanced bilinguals, named more pictures correctly when credited for producing a correct name in either language. These participants also named fewer pictures in their dominant language than non-balanced bilinguals, and they named more pictures correctly in both languages if the pictures had cognate names. Non-balanced bilinguals did not benefit from the alternative scoring procedure and showed cognate effects only in their non-dominant language. The authors concluded that the bilinguals’ ability to name pictures reflects their experience with word forms in both languages. Rosselli, Ardila, Jurado, and Salvatierra (2012) analyzed the “cognate facilitation effect,” which refers to the advantage cognate words have over non-cognates in speed of recognition and production of words during the performance of multiple oral and written language tasks. It has been demonstrated that bilinguals produce and recognize cognates faster than non-cognates.

Working memory significantly contributes not only to the learning, but also to the use of a second language (Juffs, 2004). The term working memory refers to a cognitive function that provides temporary storage and manipulation of the information necessary for such complex cognitive tasks as language comprehension, learning, and reasoning (Baddeley, 1992).

Morales, Calvo and Bialystok (2013) compared the performance of monolingual and bilingual children on tasks requiring different levels of working memory. In the first study, 56 5-year-olds performed a Simon-type task that manipulated working memory demands. Bilingual children responded faster than monolinguals on all conditions. In the second study, 125 children 5- or 7-year-olds performed a visuospatial span task that manipulated other executive function components through simultaneous or sequential presentation of items. Bilinguals outperformed monolinguals overall. The authors assume an advantage for bilingual children in working memory that is especially evident when the task contains additional executive function demands.

In a three year longitudinal study, De Abreu and Pascale (2011) investigated whether early childhood bilingualism affects working memory performance in 6- to 8-year-olds. The study tested the hypothesis that bilinguals might exhibit more efficient working memory abilities than monolinguals. The data showed that the monolinguals performed significantly better on the language measures across the years. The study suggested that the need to manage several language systems in the bilingual mind had an impact on children's language skills while having little effects on the development of working memory. Luo, Fergus, Moreno, and Bialystok (2013), tested monolingual or bilingual younger and older adults with verbal and spatial working span tasks. Results indicated that bilingual participants outperformed the monolinguals in spatial working memory. Conversely, monolingual participants achieved higher levels of performance than bilinguals in verbal working memory.

Martin and Eliis (2012), analyzed phonological short-term memory (PSTM) and working memory; and their relationship with vocabulary and grammar learning in an artificial foreign language. The results demonstrated significant independent effects of PSTM and working memory on L2 vocabulary learning and on L2 grammar learning, some of which were mediated by vocabulary and some of which were direct effects. The goal in Gorman's (2012) study was to evaluate the impact of short-term phonological awareness (PA) instruction presented in children's first language (L1; Spanish) on gains in their L1 and second language (L2; English) and to determine whether relationships existed between vocabulary size, verbal working memory, and PA in Spanish-speaking English language learners (ELLs). Results supported the conclusion that PA instruction and strong vocabulary skills in an individual's L1 benefit PA development in both the L1 and L2. Results also indicated that dynamic relationships existed between vocabulary size, storage and processing components of working memory, and PA development in both languages of ELLs.

The purpose of the current study was to describe the lexical knowledge and verbal working memory both in Spanish and English in a sample of second-generation Spanish/English bilinguals in South Florida. It was hypothesized that significant differences in the vocabulary and verbal working memory would be found between Spanish and English.

## **Method**

### **Participants**

A sample of 59 Spanish-English bilinguals born from native Spanish-speaking parents, moving to the U.S. before the age of 10 from a Latin American country (or born in Miami), and totally or mostly attending school in English were selected. Participants came in for one session (about 60 minutes) where lexical knowledge and working memory in both Spanish and English was studied. Before beginning the language testing, a short questionnaire directed to pinpoint the bilingualism history was administered (see Appendix). Participants with neurological, psychological and/or history of medical illness were excluded. Out of these, 39 participants (66%) were female and 20 (34%) were male. Age range was from 19 years of age to 54 years of age (young and middle aged adults) (mean age = 26.7; SD = 7.1). There was a diverse level of education within the participants; 4 earned their high school diploma, 15 earned their associate's degree, 29 earned their bachelor's degree, 10 earned their master's degree, and only 1 received their PhD. Most of the participants (34/59) were born in USA; 1 was born in Colombia, 8 in Cuba, 1 in Costa Rica, 2 in Dominican Republic, 2 in Puerto Rico, 1 in Peru, 2 in Nicaragua, 7 in Venezuela, and 1 in France. For those born abroad (25 participants) the mean age of arrival to U.S. was 6.5 years (SD = 2.9). For all the subjects, parents were Latin American native Spanish. Second language (English; L2) was learned before the age of 10 (mean = 5.3; SD = 2.0) but home language (L1) during childhood was Spanish. Language during primary school was English in 79.7% of the cases; whereas language during middle school was English in 96.6%; and during high school 98.3%. In all the subjects, both Spanish and English were used during the everyday life (average Spanish: 37%; English 63%) but this percentage was highly variable.

27% of participants considered that they speak Spanish excellently, 20% considered that they read Spanish excellently while 76% considered that they speak English excellently and 85% considered that they read English excellently. At home, the participants speak English only 10% of the time, both English and Spanish 30% of the time, and Spanish 60% of the time. The majority of the participants speak Spanish primarily at home. Table 1 summarizes the general characteristics of the sample

**Table 1: General Characteristics of the Sample**

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<b>Age:</b> Mean = 26.7; SD =7.1; Range = 19-54
<b>Gender</b> (ratio F/M) = 39/20
<b>Level of education:</b> HS = 4; Associate degree=15; Bachelor=29; Master = 10; PhD=1
<b>Place of birth:</b> USA=34; Latin America=25
<b>Age of arrival to USA</b> (when born in Latin America): Mean=6.5; SD=2.9
<b>Age of learning L2</b> (English): mean=5.3; SD=2.0
<b>English at school:</b> Primary=79.7%; Middle=96.6%; High=98.3%
<b>Average use of L1 and L2 daily:</b> Spanish=37%; English=63%
<b>Language at home:</b> Spanish=60%; English=10%; both=30%

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### **Instruments**

The following lexical knowledge and verbal working memory instruments were individually administered both in Spanish and English:

#### *Lexical knowledge:*

- Cross-linguistic Naming Test (CLNT) (Ardila, 2007)
- Vocabulary subtest from the WAIS-III (Wechsler, 1997, 1999)
- Verbal Fluency: Letter (F, A, S) and semantic (animals) conditions (Lezak, 1995).

#### *Verbal working memory:*

- Digits (forwards and backwards) (Wechsler, 1997)
- Sentence repetition subtest from the Multilingual Aphasia Examination (Benton & Hamsher, 1983; Rey, Sivan, & Benton, 1991). Sentences progressively longer are presented to be repeated. Sentence 1 has 3 words, sentence 2 has 4 words, sentence 3 has 5 words, etc. The score indicates the longest sentence that the subject can repeat which contains the order number of the sentence plus two words.
- Letter-Number Sequencing from the WAIS-III (Wechsler, 1997). Letters and numbers are randomly presented to the participant. Initially the numbers (in ascending order) and later the letters (also in ascending order) should be repeated. Sequences are progressively longer.
- N-Back Task (auditory) (Kirchner, 1958). The subject is presented with a sequence of letters, and the task consists of indicating when the current stimulus matches the one from  $n$  steps (from 2 to 5) earlier in the sequence. Maximum score was 27.

A Bilingual Questionnaire adapted from Paradis (1987) was also administered to pinpoint the demographic and bilingual characteristics of the participants (see Appendix).

### **Procedure**

Participants were mostly Florida International University students from Miami or relatives of university students. The testing was carried out throughout the FIU campus, but mostly in the Department of Communication Sciences and Disorders. First, the participants filled out a form of consent. Then the examiner completed the bilingual questionnaire by asking the participants various questions about their bilingual background. Half of the subjects were initially tested in English and later in Spanish; in the rest the inverse order was used; order of testing was randomly decided. Two types of comparisons were done: (1) performance in Spanish in the different tests versus performance in English; (2) subjects were divided into two groups: born in USA and born in Latin America; these two groups were compared with regard to the performance both in Spanish and in English; it was assumed that the level of exposure during early childhood to Spanish and English was different in these two groups; t-tests were used to find the significance of differences between groups. A statistical level of significance was set at a .01 level.

## Results

The mean scores and standard deviation (SD) values were calculated for each test administered in Spanish (L1) and English (L2), along with a t-value and p-value comparing participant's performance in L1 to performance on the same test administered in L2 for any statistically significant difference. Table 2 presents the general results. Performance was higher in English than in Spanish in the following measures: CLNT, Letter Fluency (A and S), Semantic Fluency, Digits Forward, and Sentence Repetition. No significant differences were found in Letter Fluency (A), Digits Backward, Letter-Number Sequencing, and N-back Task.

**Table 2: General Results in the Different Tests**

	English		Spanish		t	p
	Mean	SD	Mean	SD		
<b>CLNT*</b>	39.93	0.25	39.03	1.93	3.55	0.001
<b>WAIS Vocabulary*</b>	42.46	7.45	33.15	10.40	5.59	0.001
<b>Letter Fluency:</b>						
- <b>F*</b>	13.59	3.77	9.22	3.30	6.70	0.001
- <b>A</b>	9.85	3.88	9.30	3.93	0.75	0.451
- <b>S*</b>	12.97	4.31	9.41	3.88	4.71	0.001
<b>Semantic fluency*</b>	19.83	4.18	14.27	4.33	7.08	0.001
<b>Digits forward *</b>	7.20	1.70	6.37	1.71	2.64	0.009
<b>Digits Backward</b>	5.15	1.44	4.96	1.54	0.67	0.499
<b>Letter-Number</b>	10.00	3.17	9.13	2.77	1.57	0.120
<b>N-Back Task</b>	17.13	9.10	18.18	8.97	0.63	0.520
<b>Sentence repetition*</b>	9.32	2.80	6.36	3.59	4.99	0.001

Note: \*indicates that differences are significant at the .01 level.

**Table 3: Comparison of the Tests Scores between those Subjects Born in US and in a Foreign Country (English)**

	USA-Born		Foreign-Born		t	p
	Mean	SD	Mean	SD		
<b>CLNT</b>	39.91	0.29	39.96	0.20	0.69	0.492
<b>WAIS Vocabulary</b>	41.76	8.42	43.14	5.88	0.69	0.480
<b>Letter Fluency:</b>						
- <b>F</b>	13.82	3.73	13.25	3.96	0.57	0.571
- <b>A</b>	10.53	3.97	9.17	3.47	1.37	0.175
- <b>S</b>	13.09	4.29	12.92	4.48	0.15	0.882
<b>Semantic fluency</b>	20.32	4.73	19.08	3.33	1.12	0.266
<b>Digits Forward</b>	7.36	1.76	7.00	1.66	1.14	0.260
<b>Digits Backward</b>	5.09	1.56	5.24	1.30	0.57	0.570
<b>Letter-Numb Seq.</b>	10.15	3.06	9.80	3.38	0.59	0.560
<b>N-back Task*</b>	19.53	7.41	13.88	10.07	3.47	0.001
<b>Sentence repetition</b>	9.41	2.68	9.20	3.03	0.39	0.690

Note: \*indicates that differences are significant at the .01 level.

An additional analysis was conducted to compare linguistic performance both in Spanish and English of participants who were born in the U.S. versus those who were born elsewhere. The rationale for this comparison was the assumption that those participants who were born and initially grew up in a completely Spanish-speaking environment may have a more solid knowledge of Spanish language. Table 3 presents the results for English. It is observed that only in the N-Back Task statistically significant differences between both groups are observed, with a better performance in those subjects born in US. The rest of the scores are similar in both groups.

Table 4 presents the results for Spanish. Statistically significant differences were found in three test scores: Digits forward, N-Back Task and Sentence Repetition. Excepting for the N-Back Task and Vocabulary the performance was higher in those Latin America born subjects.

**Table 4: Comparison of the Tests Scores between those Subjects Born in US and in a Foreign Country (Spanish)**

	USA-Born		Foreign-Born		t	p
	Mean	SD	Mean	SD		
<b>CLNT</b>	38.73	2.29	39.42	1.25	1.35	0.183
<b>WAIS Vocabulary</b>	40.53	10.96	36.77	9.06	2.32	0.023
<b>Letter Fluency:</b>						
- <b>F</b>	9.03	3.46	9.71	2.97	0.79	0.430
- <b>A</b>	8.82	3.54	10.25	4.22	1.41	0.164
- <b>S</b>	8.94	3.75	10.29	3.93	1.34	0.185
<b>Semantic Fluency</b>	13.35	4.22	15.66	4.27	2.07	0.042
<b>Digits forward*</b>	5.91	1.54	7.00	1.76	3.58	0.001
<b>Digits Backward</b>	4.85	1.52	5.12	1.59	0.94	0.350
<b>Letter-Number</b>	8.88	2.69	9.48	2.89	1.17	0.250
<b>N-back Task*</b>	19.94	7.25	15.80	10.59	2.48	0.010
<b>Sentence repetition*</b>	5.59	3.39	7.40	3.66	2.79	0.006

Note: \*indicates that differences are significant at the .01 level.

### Discussion

This study analyzed the lexical knowledge and verbal working memory of 59 English/Spanish bilinguals residing in South Florida who were born from native Spanish speaking parents, moved to the U.S. before the age of 10 from a Latin American country (or born in South Florida), and attended school mostly/totally in English. When comparing the lexical knowledge of all 59 participants, statistically significant differences were observed in all the administered tests except for the Verbal Fluency with the letter A, which did not demonstrate statistical significance. It is evident that their lexical knowledge was higher in English (L2) than in Spanish (L1). In the verbal working memory section, two measures were statistically different: Digits forward and Sentence repetition, with a significantly better performance in English, suggesting a better verbal working memory capacity in English. This better performance in English probably is associated with a diversity of factors, including school language (mostly/totally in English), and daily use of Spanish and English, as they considered that the use of the English was about twice of the Spanish (63% vs 37%).

When comparing U.S. born to foreign-born in the English testing scores, excepting in the N-back Task, a similar performance was found in both subsamples. However, some differences were found in Spanish testing: Digits forward and Sentence repetition scores were higher in Latin American born subjects, but scores in the N-back task were higher for the USA-born subjects. So, only the N-Back Task differentiates both subsamples; but verbal working memory measured with Digits forward and Sentence Repetition subtests was superior in foreign-born participants.

Our results support Mora et al.'s (2006) findings that second generation speakers are bilingual,--albeit not completely balanced-- with a high degree of control in both Spanish and English. It may also support Schwartz and Leikin (2012) findings that indicate that some studies show that L1 maintenance may even aid in development of both languages, but further research is needed. In the study conducted by Kohnert et al. (1998), the Boston Naming test was given to young, educated bilingual adults. The results showed that responses were significantly more accurate in English than in Spanish. In our study, the CLNT showed slightly more accurate responses in English than in Spanish. Similar findings were observed in the Kohnert et al. (1998) study. Due to time constraints and convenience of sampling, most of our participants were bilingual students from Florida International University.

Ideally, the population sampled would have included second-generation bilinguals from all around South Florida. Using participants mostly from Miami, also brings up the issue that Miami has a different Spanish culture than other parts of the country, making our results difficult to generalize to other parts of the U.S.

Also, due to the large Cuban population in Miami, most of our participants are of Cuban descent. Ideally, our population would have involved more variety from other Spanish speaking countries. Another important limitation refers to the relatively large age range (19-54 years-old), and wide range of schooling experience in a small sample (59 participants). Furthermore, due to time restrictions, testing was limited.

Future research should involve asking questions about family thoughts/encouragement towards L2 (English) in the questionnaire since other studies show that encouragement of L2 positively correlates with L2 development and does not result in an underdeveloped L1 (Cahill, 1987). Future research should also involve testing second-generation bilinguals used in this study with monolinguals to further investigate the research conducted by Rosselli et al. (2012), which states that bilinguals generate fewer words in semantic fluency tasks and name fewer pictures in each language on standardized naming tasks such as the Boston Naming Test than monolinguals.

In summary, the results of this study indicated that participants who are second generation bilinguals residing in South Florida who were born from native-Spanish speaking parents, moved to the US before the age of 10 from a Latin American country (or born in South Florida), and attended school mostly/totally in English, have more lexical knowledge and better verbal working memory ability in their L2 (English) than in their L1 (Spanish).

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**Appendix:**

**Bilingualism Questionnaire**

Number: \_\_\_\_\_ Date \_\_\_\_\_

1. Age (in years): \_\_\_\_\_

2. Sex (circle one): Male/Female

3. Education (degree obtained): \_\_\_\_\_

4. Country of origin \_\_\_\_\_

5. Age of arrival to USA \_\_\_\_\_

6. Please specify the age at which you started to learn your second language (English) \_\_\_\_\_

7. Where are your parents/caregivers from?

Mother: \_\_\_\_\_

Father: \_\_\_\_\_

8. What languages do your parents/caregivers speak?

Mother: \_\_\_\_\_

Father: \_\_\_\_\_

9. What language is spoken at home?

10. What language/s do you use when speaking to your siblings? (If not applicable for any reason, write N/A) \_\_\_\_\_

11. Write down the name of the language in which you received instruction in school, for each schooling level:

Primary/Elementary School \_\_\_\_\_

Secondary/Middle School \_\_\_\_\_

High School \_\_\_\_\_

College/University \_\_\_\_\_

12. Estimate, in terms of percentages, how often you use Spanish and English per day (in all daily activities combined):

Spanish language \_\_\_\_\_%

English language \_\_\_\_\_%

Other languages \_\_\_\_\_% (specify: \_\_\_\_\_)

13. How well do you consider that you speak/read Spanish and English? (write the corresponding number)

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<b>Excellent</b>	<b>Almost nothing</b>
7	1
6	2
5	3
4	4
3	5
2	6
1	7
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Spanish speaking

Spanish reading

English speaking

English reading

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Thank you for your participation!