Butler University
Digital Commons @ Butler University

Undergraduate Honors Thesis Collection | Undergraduate Scholarship

2019

Nonword Repetition and Word Learning in Children with Specific Language Impairment

Kerianne Schoff
Butler University

Follow this and additional works at: https://digitalcommons.butler.edu/ugtheses

 Part of the Communication Sciences and Disorders Commons

Recommended Citation

Schoff, Kerianne, "Nonword Repetition and Word Learning in Children with Specific Language Impairment" (2019). *Undergraduate Honors Thesis Collection*. 486.
https://digitalcommons.butler.edu/ugtheses/486

This Thesis is brought to you for free and open access by the Undergraduate Scholarship at Digital Commons @ Butler University. It has been accepted for inclusion in Undergraduate Honors Thesis Collection by an authorized administrator of Digital Commons @ Butler University. For more information, please contact digitalscholarship@butler.edu.

BUTLER UNIVERSITY HONORS PROGRAM

Honors Thesis Certification

Please type all information in this section:

Applicant: Kerianne Mackenzie Schoff

(Name as it is to appear on diploma)

Thesis title: Nonword Repetition and Word Learning in Children with Specific Language Impairment

Intended date of commencement: May 11, 2019

Read, approved, and signed by:

Thesis adviser(s): Sofia M. Souto — 05-07-19

Date

Reader(s): [signature] — 5-8-19

Date

Certified by: _____ _____

Director, Honors Program — Date

For Honors Program use:

Level of Honors conferred: University _____

Departmental _____

_____

_____

Nonword Repetition and Word Learning in Children with Specific Language Impairment

A Thesis

Presented to the Department of Communication Sciences and Disorders

College of Communication

and

The Honors Program

of

Butler University

In Partial Fulfillment

of the Requirements for Graduation Honors

Kerianne Schoff

May 8, 2019

Abstract

Children with specific language impairment (SLI) are notorious for inconsistent use of grammatical morphemes, as well as a small vocabulary. This lack of vocabulary is linked to their difficulty in learning new words, which requires a strong phonological memory. Tasks of nonword repetition call upon this same skill. This overlap in skills suggests a strong relationship between the two tasks. The current study explores the relationship between nonword repetition performance and novel word learning abilities in preschool-aged children with SLI as compared to their typically developing (TD) age-matched peers. Nine children with SLI and nine TD children completed a nonword repetition test (NRT) and a novel word learning task. Analysis of the relationship between the two tasks revealed few significant meaningful correlations for TD children and no significant correlations for those with SLI. The findings suggest that tasks of nonword repetition and encoding in word learning may not be tapping into the same mechanism, and that the relationship between the two is not as strong as first assumed.

Introduction

Children with specific language impairment (SLI) have severe impairments in expressive language, which cannot be attributed to hearing loss, low nonverbal intelligence, or neurological damage (Leonard, 2014). Their impairments are marked by inconsistent use of grammatical morphemes, as well as a small vocabulary. Children with poor vocabulary, including children with SLI, are likely to have difficulty learning new words (Alt & Suddarth, 2011). This may be attributable to difficulty forming the phonological representations, or the sound sequences, of lexical items (Lahey & Edwards, 1999). Word learning requires children to hear the sounds correctly, hold those sounds in short-term memory, plan production of those sounds, and then say the new

word correctly. Tests of nonword repetition examine the same phonological representations involved in word learning, requiring skills of perception, encoding, and production (Gathercole, 2006; Jackson, Leitao, & Claessen, 2015). A deficit in any of these areas would result in both repetition and word learning difficulties (Coady & Evans, 2008). The consistently low performance of children with SLI on tests of nonword repetition is well-documented, and is therefore often used in the identification of children with SLI (Leonard, 2014). Although the literature largely agrees that word learning and nonword repetition tasks tap into the same abilities, further research is needed to solidify the relationship between the two tasks and understand the word learning difficulties of children with SLI.

The current study draws data from Leonard et al.'s (2019) study. Leonard and colleagues tested the phenomenon of achieving long-term retention and recall in children with SLI by implementing repeated retrieval as described by Karpicke and Roediger (2008) in studies of college students. Karpicke and Roediger (2008) examined the effects of repeated study versus repeated testing on word learning outcomes in college students. Students studied 40 Swahili-English words in one of four conditions involving a variety of combinations of studying and testing the new words throughout the session. At the end of all sessions, tested pairs were recalled 80% of the time, and non-tested pairs were only recalled 36% and 33% of the time. Overall, repeated retrieval practice increased final recall by 4 standard deviations and led to greater than 150% improvement in long term retention of the word pairs. Leonard et al.'s (2019) results revealed a similar advantage for children with SLI when retrieval of the word and the referent was required during novel word learning. Both TD children and children with SLI showed better learning when they were asked to recall the words in response to a picture than when they simply

heard the word paired with the referent. Interestingly, they found that retention from the 5-minute test to the 1-week test was similar across the groups.

The current study investigates the relationship between performance on a nonword repetition test (NRT) (Dollaghan & Campbell, 1998) and word retrieval during the word learning process in preschool-aged children with SLI as compared to their TD age-matched peers. Given the anticipated superior performance of TD children over those with SLI on the NRT, we expected significantly better accuracy in word retrieval for the TD group as compared to the age-matched peers with SLI. Moreover, significantly better immediate retrieval versus delayed retrieval was expected. A strong relationship between NRT and retrieval during word learning was expected given data suggesting similar mechanisms underlying these processes, and the similarity between the NRT task and retrieval for trials during learning that immediately followed presentation of the new word.

Research Questions

1. How will the TD group and the SLI group differ at each level of nonword repetition performance?
2. What is the relationship between nonword repetition performance and novel word recall during learning for each group?

Research Methods

Participants

Participants in this study were recruited for participation in Leonard et al.'s (2019) study examining the role of repeated retrieval compared to repeated study in word learning in children with SLI. Participants included two groups of nine monolingual English-speaking children, both TD children and children with SLI. The TD group

included four females and five males, with a mean age of 64 months. The SLI group consisted of three females and six males, with a mean age of 61.78 months. There was no significant difference in age between the two groups. To recruit the TD participants, announcements and flyers were posted at local childcare centers inviting families to take part in the project, with prior approval from childcare center directors. Local speech-language pathologists (SLPs) were contacted to review their caseloads for eligible children with SLI and to pass along information to them regarding participation in the project. Participants were also recruited by word of mouth.

Children with SLI had significant delays in expressive language skills despite normal hearing, normal cognitive development, no neurological deficits, and no suspected autism spectrum disorder. Standardized tests of language, speech, and nonverbal intelligence were administered to confirm children's eligibility for participation. Testing included the *Peabody Picture Vocabulary Test, Fourth Edition* (PPVT; Dunn & Dunn, 2007), and the *Primary Test of Nonverbal Intelligence* (PTONI; Ehrler & McGhee, 2008) or the *Kaufman Assessment Battery for Children* (KABC-II; Kaufman & Kaufman, 2004). If there were phonological substitutions or omission errors in the speech of the children with SLI, the *Bankson-Bernthal Test of Phonology* (BBTOP; Bankson & Bernthal, 1990) was administered to record such errors. All TD children performed within normal limits on the *Structured Photographic Expressive Language Test – Primary 2* (SPELT-P2; Dawson, Stout, Eyer, Tattersall, Fonkalsrud, & Croley, 2005), and all children with SLI obtained a standard score below 87. This cutoff reflects good sensitivity and specificity for the identification of SLI in preschool aged children (Greenslade, Plante, & Vance, 2009). All children performed within the normal range for nonverbal intelligence and passed a hearing screening. Eligibility testing took

place within a month of participation in the study and experimental testing took place across six sessions within a three week period.

All participants had no medical concerns that affected their participation in this study. An incentive of $10 per visit was offered as compensation for the participants' time as well as transportation expenses. Parents or caregivers provided informed consent and basic background information regarding the child's language history.

Procedures

The NRT is a test of phonological short-term memory that involves listening to a nonword modelled after one's native language (e.g. *naib* for English) then immediately repeating that word. This test was part of the battery of tests administered prior to the experimental portion of the previous study, but is the focus of the current study. For the NRT, the children were presented with pre-recorded nonwords, ranging from one to four syllables, and asked to immediately repeat that combination of sounds. These responses were audio recorded and later transcribed and scored by an undergraduate honors student. Transcription involved rating the individual phonemes produced as correct or incorrect. Children's regular substitution errors, as determined by a speech production test, were acceptable productions for NRT responses. For example, a child who substitutes /b/ for /v/ was given credit for all NRT productions requiring /v/ that were produced as /b/. If the phonemes produced did not match the nonword presented, or were not acceptable productions, the child was not given credit for the response. This test was scored on percent of phonemes correct for each of one- (PPC1), two- (PPC2), three- (PPC3) and four-syllable (PPC4) nonwords, and the total percent of phonemes correct (TPPC).

The experimental portion involved presentation of four novel words along with a photo of an obscure plant or animal and information regarding what it likes, thereby

presenting a meaning for each nonword. For example, with one photo the child heard, "This is a *doik*. A *doik* likes trees." Learning took place across two learning periods on consecutive days. One learning period was completed per day. During these learning periods, the novel words were retrieved via questions such as, *"What's this one called? What do you call this?"* when shown the picture associated with the novel word. Children were also asked to name what it likes. Recall items were followed by feedback in the form of repetition of the novel word and its meaning by the administrator. The questions were presented at regular intervals: immediately after presentation of the novel word (i.e. 0 trial), and following presentation of three intervening items (i.e. 3 trial). In other words, novel word A was introduced, the child was asked to name it, then three more novel words were presented before the picture of novel word A appeared on the screen. At this presentation the child was immediately asked to name the item (i.e. *"What's this one called? What do you call this?"*) without having heard the name since the last feedback item before the intermittent novel words. Children were tested for retention of word learning immediately following the second learning period on Day 2, and one week following initial learning, but retrieval during the two days of learning is the focus of the current study. All responses were scored as either accurate or inaccurate based on the following set of criteria: the attempt at the target did not resemble a true word, the attempt was judged subjectively as an attempt at the target, and the child's substitution errors were acceptable based on the speech production test (Leonard et al., 2019). Accuracy was calculated for each participant at each retrieval opportunity.

Results

Data analyses of the mean accuracy of performance included performing t-tests for NRT at all syllable levels. Table 1 shows the average NRT scores for both groups

across all syllable levels. The TD group demonstrated greater accuracy than the SLI group in two-, three-, four-syllable, and total percent phonemes correct for NRT performance accuracy.

Table 1: *Means and standard deviations of NRT performance across syllable levels for TD and SLI.*

		PPC1	PPC2	PPC3	PPC4	TPPC
SLI	**Mean**	79.63	80	63.89	51.23	64.47
	SD	15.09	9.35	14.34	11.38	9.64
TD	**Mean**	90.74	92.78*	82.54*	66.98*	79.86*
	SD	6.51	4.41	11.36	12.76	7.33

* $p<0.05$

Retrieval accuracy during novel word learning was compared within and across groups. Tables 2 and 3 show the mean accuracy for word retrieval of the four new words for each groups at each retrieval opportunity during learning on Day 1 and Day 2. A repeated measures ANOVA revealed a significant difference in group performance across learning recall trials ($F(1,16)0=4.55$, $p=0.049$). Pairwise comparisons of least significant difference confirmed no significant differences between the 0-trials (immediate retrieval) as they were near ceiling, but significantly different from nearly all 3-trials. Posthoc comparisons revealed an overall pattern of significant differences between Day 1 3-trials (that involved a delay between exposure and retrieval) and subsequent 3-trials, and Day 2 mean accuracies were comparable to one another. See Appendix A for a summary table of these results. Figure 1 below illustrates these patterns. In summary, both groups experienced improved naming from the first two 3-trials to the last two 3-trials within a day and across days during the learning process, but accuracy levels do not overlap.

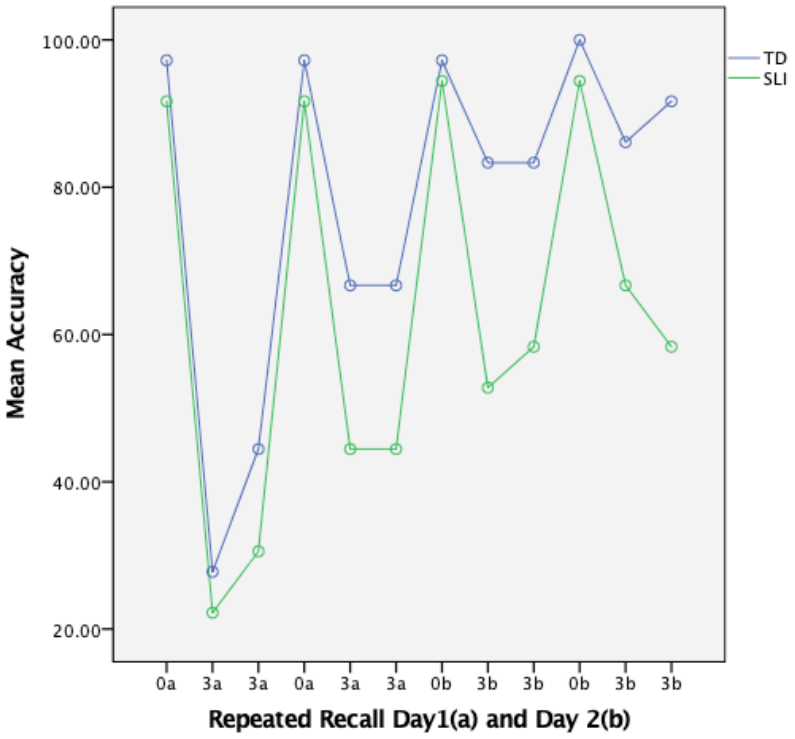
Table 2: *Standard deviations and average word retrieval accuracy of the four words immediately after the presentation of the word (0) and following three intervening items (3) during Day 1 of learning.*

		0	3	3	0	3	3
SLI	**Mean**	91.67	22.22	30.56	91.67	44.44	44.44
	SD	17.68	23.2	24.3	12.5	27.32	34.86
TD	**Mean**	97.22	27.78	44.44	97.22	66.67	66.67
	SD	8.33	31.73	30.05	8.33	30.62	27.95

Table 3: *Standard deviations and average word retrieval accuracy of the four words immediately after the presentation of the word (0) and following three intervening items (3) during Day 2 of learning.*

		0	3	3	0	3	3
SLI	**Mean**	94.44	47.78	58.33	94.44	66.67	58.33
	SD	11.02	35.54	37.5	11.02	35.36	37.5
TD	**Mean**	97.22	83.33	83.33	100	86.11	91.67
	SD	8.33	21.65	17.68	0	13.18	12.5

Figure 1:*Mean accuracy at each recall point across learning days.*



Correlations between NRT and recall performance for novel word learning were expected since these are considered to be more like NRT given immediate retrieval. NRT performance scores at all syllable levels of production and TPPC were included in the analyses. For TD, there was a positive correlation between PPC4 accuracy and the first immediate (0-trial) novel word retrieval opportunity ($r=.744$, $n=9$, $p<0.05$). There was also a positive correlation between TPPC and the first immediate novel word retrieval opportunity ($r=.737$, $n=9$, $p<0.05$). No significant correlations were found between NRT and novel word learning for the SLI group. Scatterplots in Figures 1 and 2 show correlations between the 4-syllable NRT accuracy and the first immediate retrieval opportunity for both groups.

Figure 2: *Correlation between 4-syllable NRT accuracy and the first immediate novel word retrieval opportunity for the TD group.*

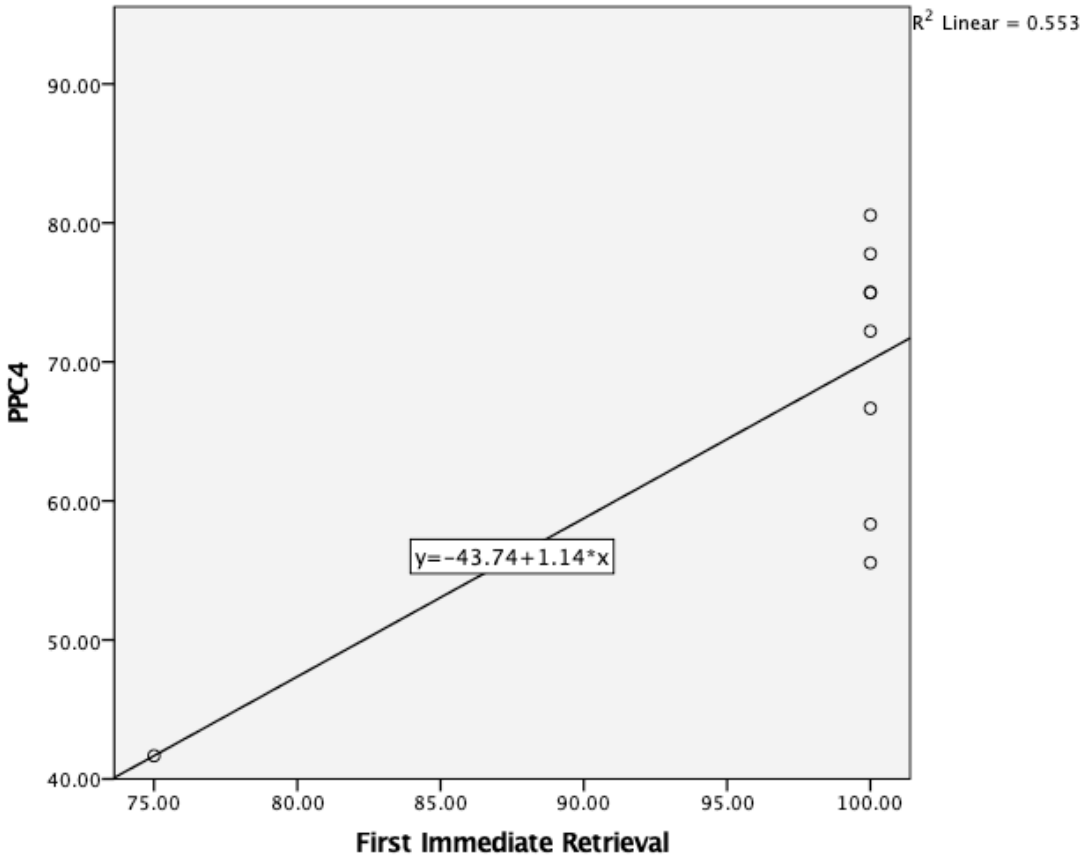
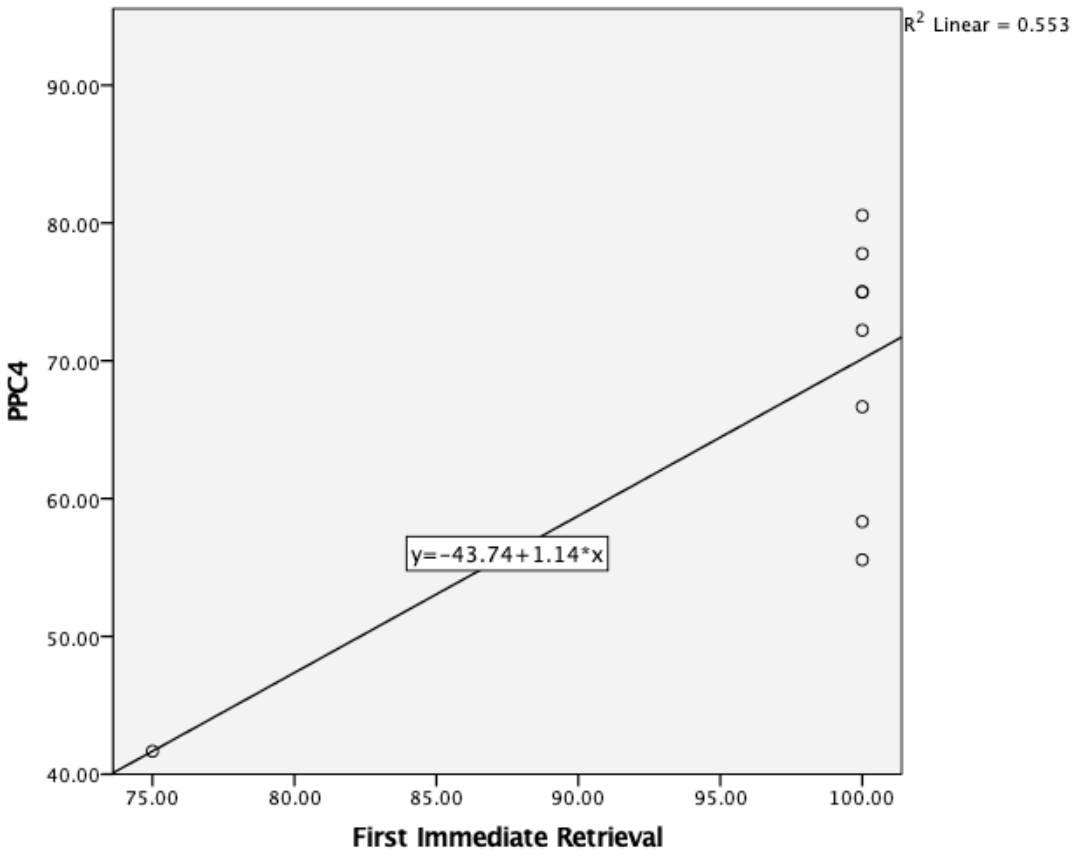


Figure 3: *Correlation between 4-syllable NRT accuracy and the first immediate novel word retrieval opportunity for the SLI group.*



Discussion

Each group performed as expected on the separate tasks. Although the two groups differed on both NRT and in their ability to encode and associate meaning during the learning period, a lack of meaningful correlations between these for both the TD group and the SLI group suggest that the two processes do not appear to be tapping into the same mechanism. Both skills, NRT and encoding, are weak for SLI; however, the limited evidence of a relationship between the two tasks suggests that the relationship of NRT to word learning is not as profound as first assumed. Given previous findings regarding overlapping skills between the two tasks, the results of the current study were surprising.

The findings here instead support previous studies that challenge the proposal that NRT taps into the same mechanism as the process or task of word learning.

Although nonword repetition and word learning may call upon similar skills, word learning requires a set of skills that are not necessary for nonword repetition. Even in the earliest stages, word learning involves applying a phonological form to a referent (i.e. linking the novel word to a picture and a characteristic), learning a word's meaning, consolidation, and even long-term retention. Nonword repetition does not involve any connection between a phonological form and a referent, but only the short-term ability to hold onto the phonological form and produce it. Once the nonword is repeated by the child, there is no further recall of that sequence of sounds; therefore, there is no need for the child to hang onto the phonological form any longer. Gathercole (2006) suggests that, in addition to phonological memory needed for nonword repetition, there may be another unidentified skill that is *exclusive* to nonword repetition tasks. Gathercole further argues that children with SLI show impairments specific to tasks of nonword repetition, on top of their phonological storage deficits; therefore, this exclusive skill would not be called upon in a child's effort to learn new words.

The findings of the current study are in line with longitudinal data showing no evidence of an influence of nonword repetition abilities on vocabulary and vocabulary growth (Melby-Lervåg et al., 2012). Additionally, Gray (2006) found that poor nonword repetition of children with SLI did not predict fast mapping performance. Fast mapping occurs at the initial stages of word learning when a child encounters a word for the first time, creates a phonological representation of that word, proposes a meaning, and then creates a link between the phonological form and the new referent (Carey & Bartlett, 1978). Gray's findings suggest that phonological short-term memory, while contributing to the formation of strong phonological and semantic depictions of words, does not affect

a child's fast mapping abilities. The findings of the current study support the idea that a child's NRT performance may not accurately predict or be related to their novel word learning abilities, and vice versa.

Considering the importance of phonological memory in vocabulary development and its influence on success in tasks of nonword repetition, these results were unexpected. Small sample sizes for both the TD group and the SLI group may have contributed to these results. Looking forward, an increase in sample size may better showcase the relationship between nonword repetition and a child's word learning abilities. More clarity on this relationship will give insight into the phonological underpinnings of both nonword repetition and vocabulary development, as well as how to best approach intervention involving word learning.

References

Alt, M., & Suddarth, R. (2011). Learning novel words: detail and vulnerability of initial representations for children with specific language impairment and typically developing peers. *Journal of Communication Disorders, 45*, 84-97.

Bankson, N.W., & Bernthal, J.E. (1990). *Bankson-Bernthal Test of Phonology.* Chicago, IL: Riverside Publishing Company.

Botting, N., & Conti-Ramsden, G. (2001). Non-word repetition and language development in children with specific language impairment. *International Journal of Language & Communication Disorders, 36*, 421-432.

Carey, S., & Bartlett, E. (1978). Acquiring a single new word. Papers and Reports on Child Language Development (Stanford University), 15, 17–29.

Coady, J.A., & Evans, J.L. (2008). Uses and interpretations of non-word repetition tasks in children with and without specific language impairment (SLI). *International Journal of Language & Communication Disorders, 43*, 1-40.

Dawson, J., Stout, C., Eyer, J., Tattersall, P., Fonkalsrud, J., & Croley, K. (2005). *Structured Photographic Expressive Language Test – Preschool 2*. DeKalb, IL: Janelle Publications.

Dollaghan, C., & Campbell, T. F. (1998). Nonword repetition and child language impairment. *Journal of Speech, Language, and Hearing Research*, *41*(5), 1136-1146.

Dunn, L, & Dunn, D. (2007). *Peabody Picture Vocabulary Test – Fourth Edition*. Minneapolis, MN: AGS/Pearson.

Ehrler, D., & McGhee, R. (2008). *Primary Test of Nonverbal Intelligence*. Austin, TX: Pro-Ed.

Gathercole, S. (2006). Nonword repetition and word learning: the nature of the relationship. *Applied Psycholinguistics, 27*, 513-543.

Gray, S. (2006). The relationship between phonological memory, receptive vocabulary, and fast mapping in young children with specific language impairment. *Journal of Speech, Language, and Hearing Research, 49,* 955-969.

Greenslade, K., Plante, E., & Vance, R. (2009). The diagnostic accuracy and construct validity of the Structured Photographic Expressive Language Test – Preschool: Second Edition. *Language, Speech, and Hearing Services in Schools*, *40*, 150-160.

Jackson, E., Leitao, S., & Claessen, M. (2015). The relationship between phonological short-term memory, receptive vocabulary, and fast mapping in children with specific language impairment. *International Journal of Language & Communication Disorders, 51*, 61-73.

Karpicke, J.D., & Roediger, H.L. (2008). The critical importance of retrieval for learning. *Science, 319*, 966-968.

Kaufman, A., & Kaufman, N. (2004). *Kaufman Assessment Battery for Children: Second Edition*. Circle Pines, MN: American Guidance Service.

Lahey, M., & Edwards, J. (1999). Naming errors in children with specific language impairment. *Journal of Speech, Language, and Hearing Research, 42*, 195-205.

Leonard, L. B. (2014). *Children with specific language impairment*. Cambridge, MA: The MIT Press.

Leonard, L.B., Karpicke, J., Weber, C., Deevy, P., Christ, S., Haebig, E., ... Krok, W. (2019). Retrieval-based word learning in typically developing children and

children with developmental language disorder I: The benefits of repeated retrieval. *Journal of Speech, Language, and Hearing Research, 62,* 932-943.

Melby-Lervåg, M., Lervåg, A., Lyster, S.-A. H., Klem, M., Hagtvet, B., & Hulme, C. (2012). Nonword repetition ability does not appear to be a causal influence on children's vocabulary development. *Psychological Science, 23*, 1092-1098.

Appendix A. *Posthoc comparisons using least significant difference (LSD). Mean difference shown.*

		Day 1						Day 2				
	Trial	**0**	**3**	**3**	**0**	**3**	**3**	**0**	**3**	**3**	**0**	**3**
Day 1	**0**											
	3	69.444*										
	3	56.944*	-12.500*									
	0	0.000	-69.444*	-56.944*								
	3	38.889*	-30.556*	-18.056*	38.889*							
	3	38.889*	-30.556*	-18.056*	38.889*	0.000						
Day 2	**0**	-1.389	-70.833*	-58.333*	-1.389	-40.278*	-40.278*					
	3	26.389*	-43.056*	-30.556*	26.389*	-12.500*	-12.500*	27.778*				
	3	23.611*	-45.833*	-33.333*	23.611*	-15.278*	-15.278*	25.000*	-2.778			
	0	-2.778	-72.222*	-59.722*	-2.778	-41.667*	-41.667*	-1.389	-29.167*	0.003		
	3	18.056*	-51.389*	-38.889*	18.056*	-20.833*	-20.833*	19.444*	-8.333*	0.170	20.833*	
	3	19.444*	-50.000*	-37.500*	19.444*	-19.444*	-19.444*	20.833*	-6.944	0.176	22.222*	1.389

**p<0.05*