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Error Analysis of Expressive Analogy Task in Spanish-English Bilingual School Age Children With and Without Specific Language Impairment

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Error Analysis of Expressive Analogy Task in Spanish-English Bilingual School Age Children With and Without Specific Language Impairment

by

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Abstract

Error Analysis of Expressive Analogy Task in Spanish-English Bilingual School Age Children With and Without Specific Language Impairment

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Purpose: The relational shift hypothesis (RSH) states that, as children age, the way in which they interpret analogies shifts from a focus on object similarities to relational aspects of objects. This study investigated the validity of the RSH by describing the error patterns of typically developing (TD), low normal (LN), and language impaired (LI) bilingual school-age children when completing an expressive analogy task in A:B::C:D format (e.g. good:bad::happy:____) in English and Spanish.

Method: Participants included a total of 49 Spanish-English bilingual children between the ages of 7;4 and 8; 9 (mean = 8; 1). Ten children were identified as LI, ten scored in the LN range, and 29 were TD. Children were administered English and Spanish versions of the item twice, initially during the second grade and once again approximately one year later. Responses were recorded verbatim and coded as correct (C), thematic/category error (THEM/CAT), wrong object, correct relationship error (WO-CR), unrelated error (UNREL), or repetition/no response (REP/NR).

Results: A repeated measures ANOVA was used to compare children's analogy scores by time, ability, and language. Results demonstrated significant differences for ability. Four chi square tests investigated the error patterns of TD, LN, and LI bilingual children in English and Spanish. We compared responses provided children by response type (C, THEM/CAT, WO-CR, UNREL, or REP/NR). Results from the Spanish analogical reasoning task indicated a decrease in THEM/CAT with age for the LN and TD children. Results from the English analogical reasoning task were inconsistent.

Conclusions: Results provide partial support for the RSH in LN and TD children, but not in children with LI. This difference in error patterns may provide insight into the validity of the RSH in bilingual children with specific language impairment and typically developing second language learners.

Table of Contents

List of Figures

Introduction

WHY DOES BILINGUALISM MATTER?

Though there are varying reports describing the exact total number of bilinguals worldwide, researchers on bilingualism estimate that half of the world's population, if not more so, is bilingual (Grosjean & Li, 2012). However, it is important to note many differing definitions exist for the term bilingualism. One common misconception is that a person can only be considered bilingual if he speaks both languages fluently. This definition of bilingualism assumes that bilinguals are essentially two monolinguals in one person. However, it is often the case that most bilinguals do not have equal fluency in both languages. Typically, bilinguals use each of their languages in different situations and contexts, depending on what they need to accomplish in that language. For this reason, some bilinguals may not have equal fluency across both languages, have an accent in one language, or be unable to read or write in one of their languages. Because bilinguals have varying degrees of proficiency, a definition of bilingualism should instead emphasize the importance of language use. Grosjean and Li define bilingualism and multilingualism as the use of two or more languages (or dialects) in everyday life (2012).

Bilingualism can be observed across all age groups, levels of society, and in most countries. One reason that bilingualism appears to be so widespread is that it is estimated that there are approximately 7000 languages worldwide; however, there are only 196 countries (Lewis, Simons & Fennig, 2015). As a result, many countries have multiple official languages. Interactions between inhabitants of these countries who speak different languages often results in language contact and, eventually, bi- or multilingualism. In some

parts of the world such as Asia or Africa, the percentage of the population that is bilingual is relatively high compared to Europe and North America due to the fact that it is considered normal to know and use several languages on a daily basis. While bilingualism not be as commonplace throughout the world, it is definitely not uncommon. In 2006, a European Commission report reported that 56% of inhabitants across 25 European countries speak a second language well enough to have a conversation in it. In North America, it is estimated that bilinguals make up 35% of the Canadian population and 18-20% of the United States population. Though the percentage of bilinguals in the United States is smaller than what is seen in other countries, this still amounts to approximately 55 million bilinguals. According to the U.S. Census Bureau (2011), approximately 60,577,020 people (21% of the population) reported speaking a language other than English at home. When those who speak another language were asked to describe their English-speaking abilities, approximately 58% reported that they spoke it "very well", 19% reported "well," 15% reported "not well," and only 7% claimed that they spoke it "not at all." This data indicates that approximately 92% of those who do not speak English in the home are functionally bilingual.

Of those who speak another language in the home in the U.S., 37,579,787 people reported speaking Spanish or Spanish Creole at home (U.S. Census Bureau, 2011). Since 1980, the number of Spanish speakers has increased significantly, and it is believed that this number will continue to increase. Between 1980 and 2010, the number of Spanish speakers living in the United States has increased by more than 25.9 million due at least in part to increased immigration. This data demonstrates that in a country of immigrants, such

as the United States, non-English languages and their speakers are an important part of the national culture. Both historic immigration patterns and more recent patterns have increased language diversity over the past few decades and will likely continue to do so in the years to come (Ryan, 2013).

Given the aforementioned data, there are a large number of children who grow up learning Spanish and English. It is important to understand the language learning trajectories of Spanish-English bilinguals in order to better differentiate between errors indicative of a language disorder and those indicative of typical development associated with second language acquisition.

HOW DOES ANALOGICAL REASONING AFFECT LANGUAGE DEVELOPMENT?

Children's expressive language abilities tend to lag behind their receptive abilities. This is important because these differences define the ways in which analogical reasoning abilities affect language development. As they begin to acquire language, children's productions largely consist of imitated words or phrases that they have heard from their environment. Rather than independently create original utterances, young children with more immature expressive language abilities merely memorize and imitate based on their linguistic input. This remains the case until they are able to construct more abstract construction schemas through the use of analogical reasoning. Over time, as children hear hundreds and thousands of utterances, they begin to notice similarities and differences between the utterances; they begin to draw analogies (Bybee & Slobin, 1982). For example, on any given day, a child may hear the following utterances: *[I eat a cookie]*, *[I eat a cake]*,

and *[I eat a banana]*. Based on the similar grammatical forms of these utterances, the child may create a construction schema in the form of *[I eat a x]*. In this schema, x can be filled by food item. By constructing this single schema, children can create hundreds of novel utterances through the use of analogical reasoning (Gentner & Markman, 1997; Gentner & Medina, 1998; Tomasello, 2003). In this way, the use of analogical reasoning can create this grammatical schema with a blank slot that can be filled by a noun that represents an edible object. Because children cannot possibly hear all of the exact utterances that they need in life, the creation of schemas provides them with an outline form into which they can organize their message when they wish to construct a novel utterance (Goldberg, 1995).

Analogical reasoning also affects syntactic, phonetic, and semantic aspects of language as well. Syntactically, overgeneralization of the *–ed* bound morpheme to indicate past tense is an example of analogical reasoning being used to develop linguistic abilities. Phonologically, the use of analogy allows us to deduce the way in which words are pronounced based on the pronunciation of other words with similar spellings. When we read an unknown word, we can often make assumptions about pronunciation based on words whose pronunciation we do know. If the word litter, for example, were our unfamiliar word, our analogical reasoning abilities might note that litter and familiar word bitter are spelled similarly. We might draw the analogy that they are likely pronounced similarly as well (Leroy, Parisse & Maillart, 2012). Semantically, the use of analogy has been shown to aid in categorization and in the learning of object names, properties, parts, and novel adjectives (Gentner & Namy, 2006; Graham, Namy, Gentner & Meagher, 2010; Waxman & Klibanoff, 2000). These examples provide support for the usage-based

hypothesis. This theory states that cognitive processes, which include analogical reasoning abilities, underlie language learning.

HOW DOES SLI AFFECT ANALOGICAL REASONING?

Specific language impairment (SLI) has been described as "an impairment of language comprehension, language production, or both in the absence of hearing impairment, the absence of a general developmental delay, the absence of any neurological impairment, and no diagnosis of autism" (Schwartz, 2010, p. 3). Research indicates that children who have language-impairment have difficulty completing both verbal and perceptual analogical reasoning tasks (Masterson & Perrey, 1994).

One important aspect of determining the relationship between analogical reasoning and language impairment (LI) is determining whether the mode of presentation of the analogy task affects the outcome. Because children with LI have linguistic deficits, it can logically be assumed that tasks presented verbally might be more difficult for them. Therefore, an inability to succeed in tasks presented verbally may be more indicative of these known linguistic deficits rather than difficulties associated with analogical reasoning processes. A study by Kamhi, Gentry, Mauer, and Gholston (1990) aimed to determine if the mode of presentation of an analogical reasoning task affected accuracy levels in monolingual English, school-age TD children and those with LI. The children involved were separated into groups based on ability (LI vs TD) and then randomly assigned to either a verbal only presentation of the task or a combined verbal and physical demonstration of the task. During the task, the children were presented with a hypothetical

problem, a solution to the aforementioned problem, and then a new problem that was analogous to the original problem. Results indicate that children with LI who received only verbal presentation of the task took significant longer to learn the solution than any of the other groups. After they learned the solution, though, they were able to accurately transfer that solution to the analogous problem presented (Kamhi, Gentry, Mauer & Gholston, 1990). These findings suggest that there is indeed a relationship between analogical reasoning and specific language impairment. Results indicate that children with LI have difficulties with analogical tasks presented exclusively verbally. Further research is necessary to determine the underlying causes of these results.

Some studies suggest that the differences between children with and without language learning disabilities are largely due to the influence of cognitive abilities (Nippold, Erskine & Freed, 1988). Because solving verbal analogical reasoning tasks likely incorporates both cognitive and linguistic processes, it is often difficult to determine which of the two processes is more important. Is the ability to accurately complete analogies more dependent upon cognitive or linguistic abilities? Are they equally important or can a task be achieved despite deficits in one area, such as in children with LI? A study by Masterson, Evans, and Aloia provided evidence for the conclusion that linguistic abilities are a more accurate predictor of performance on an analogical reasoning task than cognitive abilities (1993). The study aimed to answer these questions by comparing children with language learning disabilities to typically developing (TD) children with either comparable cognitive abilities or comparable linguistic abilities. One group of TD children with comparable cognitive abilities were chosen based on nonverbal IQ scores on the Test of Nonverbal

Intelligence (TONI) (Brown, Sherbenou, & Johnsen, 1982). Scores were matched such that the children with language learning disabilities and these TD children were the same mental age. Another group of TD children with comparable linguistic abilities were chosen based on vocabulary scores on the Peabody Picture Vocabulary Test-Revised (Form L) (Dunn & Dunn, 1981). Again, scores were matched such that the children with language learning disabilities and these TD children were the same language age. The examiners aimed to determine which group of TD children performed most similarly to the children with language learning disabilities. These findings would provide valuable insight on the underlying processes necessary to complete analogies. If the children matched for mental age performed similarly, cognitive processes are likely the more important underlying process associated with analogical reasoning. If the children matched for language performed similarly, language processes are likely the more important underlying process associated with analogical reasoning. The tasks administered consisted of five analogy tasks. TD children matched for language age scored similar to the children with language learning disabilities. Furthermore, the TD children with comparable cognitive abilities performed better than both of the other two groups on all analogy tasks. Based on this data, they concluded that linguistic abilities significantly affect analogical reasoning abilities (Masterson, Evans & Aloia, 1993).

Unraveling the differences between linguistic and analogical reasoning abilities is particularly difficult when the tool used to measure analogical reasoning abilities is a verbal analogy task. In an attempt to correct this issue, Leroy, Parisse, and Maillart conducted a study using nonverbal analogical tasks to provide support for the usage-based theory

(2012). The usage-based theory states that cognitive processes serve as the foundation for the development of linguistic abilities. Based on this theory, deficits in cognitive abilities are indicative of linguistic deficits as well. For this reason, tasks that address cognitive abilities, such as analogical reasoning tasks, can provide insight into whether a child has a LI. This study found that overall, monolingual French, school-age TD children performed better on a nonverbal analogical task than did children with LI; this provides support for the usage-based theory. The task presented was a nonverbal analogy completion task that involved sequences of three shapes of various colors. The participants were shown two sequences (references) and then asked to choose a third sequence associated with the reference sequences. Figure 1 provides an example of reference and test sequences.

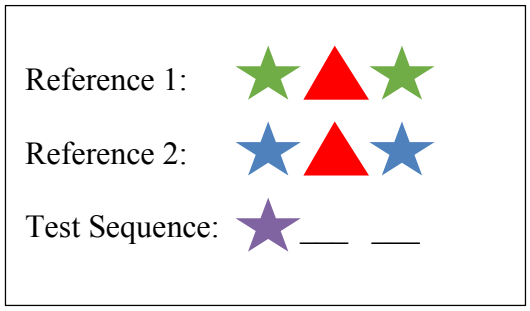

Figure 1: Examples of reference and test sequences

Throughout the task, the sequences had varying degrees of similarity within the sequences and between the sequences. A sequence that contained three blue triangles, for example, was highly visually similar within the sequence. The degree of visual similarities between the two reference sequences (both in terms of shape and color) determined the level of similarities between the sequences. Figure 2 provides examples of sequences with varying degrees of visual similarities.

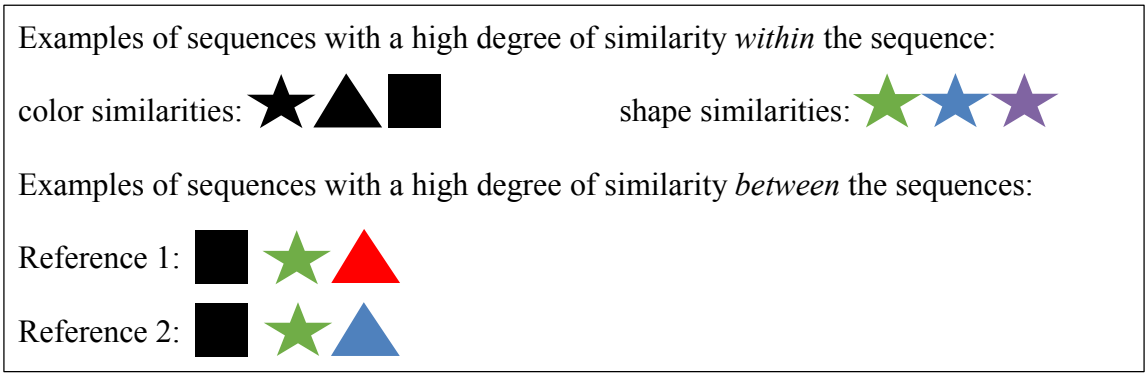

Figure 2: Examples of sequences with a high degree of similarity

The results yielded indicate that TD children perform better on nonverbal analogical reasoning task than do children with SLI. Furthermore, the results from this task demonstrated that similarities both within and between sequences increased the accuracy in both TD children and those with LI. The more significant increase in performance, however, was seen in children with LI. This indicates that more salient visual similarities may facilitate analogical reasoning in children with SLI. These results, though based on a nonverbal task, can have an effect on linguistic abilities as well. Because analogies have been shown to facilitate linguistic development through the use of abstract construction schemas, deficits in nonverbal analogical reasoning tasks can ultimately result in deficits in linguistic abilities (Leroy, Parisse & Maillart, 2012).

HOW IS AGE RELEVANT?

An important aspect to understanding analogical reasoning is determining the age at which this ability begins to emerge. However, a child's ability to accurately complete analogies does not necessarily prove that the child arrived at the correct answer via

analogical reasoning. Alternative theories suggests that children are sometimes able to successfully complete analogies by using lower level cognitive abilities that rely heavily on perceptual similarities (Gentner, 1988, 1989; Gentner & Toupin, 1986; (Markman & Hutchinson, 1984; Nelson, 1977; Smiley & Brown, 1979). One study by Goswami and Brown aimed to determine whether young children ages four, five, and nine possessed actual analogical reasoning abilities (1990). To differentiate between analogical reasoning abilities and less complex processes that rely on perceptual similarities, distractor options that were perceptually similar to the items presented were offered as options. The analogy task presented consisted of 10 basic picture analogies in A:B::C:D form. Examiners presented the children with pictures A, B, and C; the children were to choose the appropriate picture D from a group of four pictures, which included the distractors. The distractors consisted of objects that the child might be tempted to select if he were depending on perceptual similarities rather than analogical reasoning. These included objects thematically related to, in the same category as, or that looked similar to object C. Figure 3 provides an example of the task.

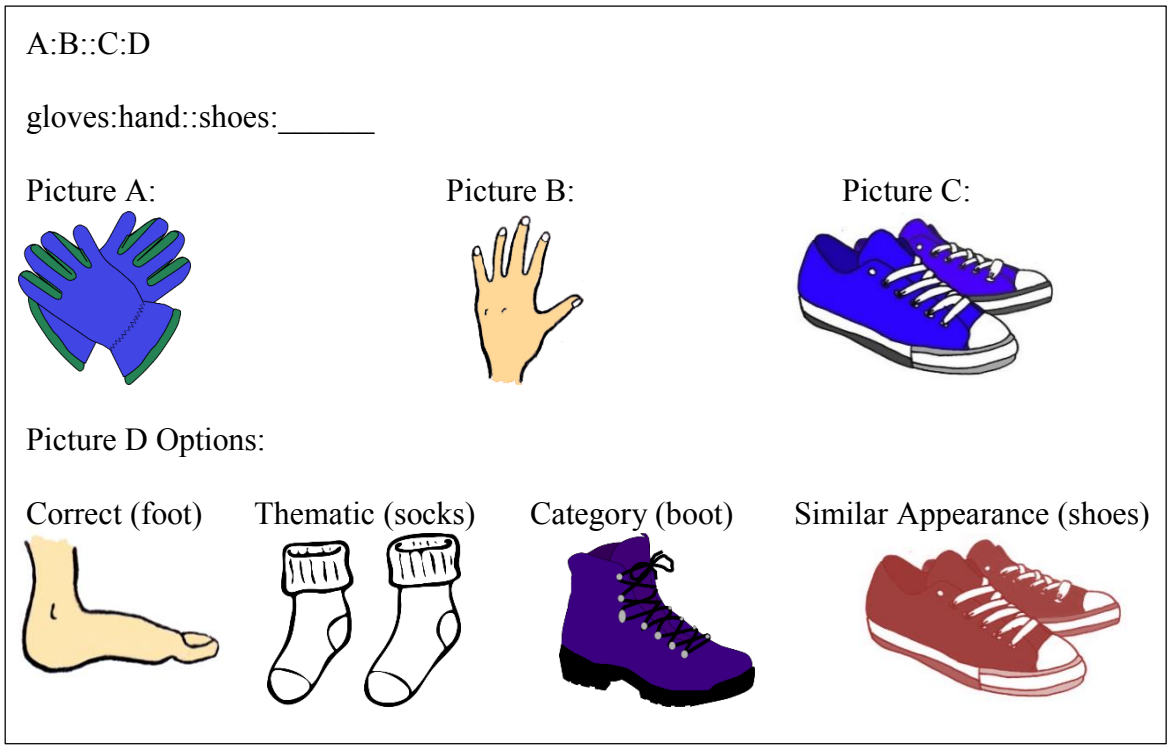

Figure 3: Example of Goswami & Brown analogy task (1990)

A child's ability to ignore these distractors and choose the correct answer provided strong evidence that he had reached his decision through the use of analogical reasoning. Results indicated that children across all age groups successfully ignored the distractors and chose the correct response. Children were considered successful if they correctly answered six or more analogies; success rates were 100% at age 9, 65% at age 5, and 60% at age 4. The steep increase in accuracy between the ages of five and nine suggests that analogical reasoning abilities improve with age (Goswami & Brown, 1990).

One hypothesis that aims to describe the development of analogical reasoning in children is the relational shift hypothesis. This hypothesis states that as children age, the

way in which they interpret analogies presented shifts. When they are younger, they are more likely to solve an analogy task by merely providing a response that is similar to the objects presented. Responses based merely on object similarity include responses thematically related to, in the same category as, or that simply look similar to object. As their age increases, however, their focus shifts towards the relational aspect of objects (Sternberg & Downing, 1982; Sternberg & Nigro, 1980). This suggests that the number of incorrect responses to analogies that focus on object similarity should decrease as age increases. Similarly, correct responses, which focus on relational similarities should increase with age. A study by Rattermann & Gentner aimed to explore if this theory proved true based on four- and five- year old children's responses to a picture analogy task (1998). The children were asked to choose the correct picture from four picture options described as correct, wrong object-correct transformation, correct object-wrong transformation, and mere-appearance. Once again, the task consisted of basic picture analogies in A:B::C:D form. An example of the task presented is *loaf of bread:slice of bread::lemon:*____. The child was asked to select the correct picture to complete the analogy from the following four picture options: slice of lemon (correct), slice of yellow cake (wrong object-correct transformation), squeezed lemons (correct object, wrong transformation), and a yellow Nerf football (mere appearance). Based on the relational shift hypothesis, increases in age should result in a decrease in mere appearance responses and an increase in correct responses provided. Results revealed that these trends did indeed appear (Rattermann & Gentner, 1998). This study provides strong evidence for the relational shift hypothesis.

RESEARCH QUESTIONS

Given the theories proposed above and the lack of research on how bilinguals learn analogies, extending research on analogical development to bilinguals is important. The relational shift hypothesis (RSH), in particular, may have meaningful implications in terms of language experience and ability. The types of errors produced by bilingual children with and without language impairment may provide evidence to support the relational shift hypothesis. Based on the RSH, we would expect to see a decrease in object similar responses and an increase in correct relational responses as the children grow older. We would expect to see these shifts in all groups of children, but perhaps favoring children with typical development. It is also likely that this shift would be more apparent in the better language. Typically developing children who are still in the process of learning English may not yet have the vocabulary to successfully complete analogical reasoning tasks in English at all. However, do they have the concept despite being unable to articulate it in the weaker language? If the task were presented in the stronger language, would they be more successful? Based on the theories above, children with language impairment would likely be unable to complete the analogy in either of their languages due to an incomplete knowledge of semantic concepts. Could the ability to successfully complete analogical tasks in the stronger language provide support for the RSH?

The current study aims to investigate the error patterns of typically developing, low normal, and language impaired bilingual school-age children when completing an expressive analogy task in English and Spanish. We seek to identify the types of errors

produced by children with and without language impairment in an attempt to better understand the underlying linguistic processes related to analogical reasoning.

Method

Participants

A total of 49 bilingual Spanish-English bilingual children enrolled in second grade were participants in the current study. At the time of initial testing, participants ranged in age from 7 years, 4 months (88 months) to 8 years, 9 months (105 months), with a mean age of approximately 8 years, 1 month (97 months). Of the total, ten children were identified as having a language impairment, ten scored in the low normal range, and 29 were typically developing. Language exposure in each language by group were comparable as determined by parent report. For the language impaired group, English input was 42%, while Spanish input was 58%. For the low normal group, English input was 47%, while Spanish input was 53%. For the typically developing group, English input was 40%, while Spanish input was 60%.

Instrument

The experimental version of the semantics subtest of the Bilingual English Spanish Assessment-Middle Extension (BESAME) consists of 42 items in six categories. Item types include similarities and differences, characteristics and properties, categorization, repeated associations, definitions, and analogies: expressive. Items of interest for the current analysis included responses recorded during administration of the expressive analogy section of the BESAME. The analogy task format was 1:2::3:4, where 1:2 establishes the relationship, 3 is given, and 4 is the child's response. The English expressive analogy section consisted of three items, and the Spanish version consisted of five items.

Sampling Procedures

Children were tested one-on-one by trained bilingual research associates when they were in the second grade in the context of a developmental and experimental language

battery in both English and Spanish. Children completed developmental testing first within a two week period of time. They were asked questions requiring a verbal response or pointing and their responses were written down verbatim.

CLASSIFICATION

In the year prior to the study, children completed the Bilingual English Spanish Oral Screener (BESOS) in Spanish and English. This test has a 90% accuracy rate (Lugo-Neris, Peña, Bedore, & Gillam, in press) using a cut off of -1SD below the mean across all 4 subtests. In follow-up testing one year later, children completed the BESAME in both languages, as well as the Test of Narrative Language (Gillam & Pearson, 2004) in English and an experimental adaptation in Spanish. Parent and teacher questionnaires were completed at this time using the inventory to assess language knowledge (ITALK) from the Bilingual English Spanish Assessment (BESA) (Peña, Gutierrez-Clellen, Iglesias, Goldstein & Bedore, 2014). This inventory is used to help parents and teachers characterize children's language skills in each language. Responses were recorded for reliability and transcribed verbatim by the examiner.

Scores of more than -1SD below the mean in both languages were flagged as an indicator of language impairment. Scores between 0 and -1 SD below the mean in both languages were flagged as risk for impairment. On the ITALK, a score below 4.2 in the stronger language is indicative of language impairment. A score between 4.2 and 4.4 in the stronger language was flagged as risk for impairment. IQ testing using the Universal Non-Verbal Intelligence Test (UNIT) (Bracken & McCallum, 1998) was completed.

Children were considered to have LI if they presented with three or more indicators of LI across standardized tests and reports. They were considered low normal if they presented with three or more risk indicators for LI or if they presented with two risk

indicators and one or two LI indicators. Children with typical development presented no more than 2 risk indicators or 1 LI indicator. All children scored 70 or greater on the UNIT.

CODING

Responses provided in response to the analogy task (1:2::3:4) were coded using a system created based on the work of Goswami and Brown (1990) and Rattermann and Gentner (1998). All responses provided by the child were coded. Responses were coded as correct (C), thematic/category error (THEM/CAT), wrong object, correct relationship error (WO-CR), unrelated error (UNREL), or repetition/no response (REP/NR). Items were coded as C if the response given successfully fit in slot 4 hence completing the analogy. An example of a correct response would be "farm" in response to the following stimuli: "Elephant (1) is to zoo (2) as pig (3) is to ____ (4)." THEM/CAT items were responses that are thematically related to or in the same category as slot 3 of the analogy. Examples of a thematic error would be those with sematic associations to slots 1 or 2 (e.g., "mud" or "barn") in response to the stimuli mentioned above. Examples of a category error would be any response that is in the category of farm animal (i.e., "bunny)." Items were coded WO-CR if the response provided related to slots 1 or 2 of the analogy. This error suggests that the child understands that 1:2 and 3:4 must relate to one another, but are unable to accurately identify 3 as the main object of the incomplete part of the analogy. An example of a wrong object, correct relationship error would be a response such as a zoo animal (e.g. "giraffe) or a place where other animals might live (e.g., "house" or "sea"). UNREL items are responses that are completely unrelated to any part of the analogy. An example of an unrelated error would be a response of "walk." Items were coded NR/REP to indicate that the child either merely repeated any part of the analogy provided by the administrator or did not respond at all.

MEASURES AND COVARIATES

An analysis of variance (ANOVA) was conducted to compare overall differences in accuracy by typically developing, low normal, and language impaired bilingual children when completing an expressive analogy task at 2nd and 3rd grade. Follow-up analyses included measures of distribution using chi-square analyses to examine distribution of response types.

VARIABLES

Independent variables for the ANOVA study are ability (language impaired, low normal, and typically developing), time (2nd grade, 3rd grade) and language (English, Spanish). The dependent variables are the percentage of items correct as measured by their score. For the error analysis, dependent variables include the number of each type of error.

Results

First, a repeated measures ANOVA was used to compare children's analogy scores by time, ability, and language. The between subjects factor was ability (TD, LN, LI). Within-subjects factors were language (Spanish and English) and time (2^{nd} and 3^{rd} grade). Results demonstrated significant differences for ability $F(2, 46) = 9.571$, $p<.001$, partial eta square=.294. Typically developing children (mean = 57.00%) scored significantly higher ($p = .012$) compared to low normal children (mean = 26.5%) and language impaired children (mean = 31.5%), who did not significantly differ from each other ($p \geq .880$). There were no significant differences for time $F(1,46)=1.829$, $p=.183$, partial eta square=.038. There were no significant differences for language $F(1,46)=1.937$, $p=.171$, partial eta square =.040. There were no significant interactions among the variables.

Second, we were interested in the type and distribution of responses made by children in each language in second and third grade. Four chi square tests investigated the error patterns of typically developing (TD), low normal (LN), and language impaired (LI) bilingual children in English and Spanish. We compared the responses provided by children by response type (C, THEM/CAT, WO-CR, UNREL, or REP/NR). For each of the four analyses a chi-square test was used to determine whether there was a significant difference between the three ability groups in the response types they used. Follow up analyses used the standardized residual of ±1.00z as the critical value to compare each type of error across ability groups.

Results for the 2^{nd} grade Spanish error patterns indicated differences in responses patterns by ability, $X^2(8)=34.38$, $p<.001$. For children with language impairment, the critical value of +3.4 indicated that they provided "no response/repetition" answers 103.1% more often than expected. Typically developing children provided 39.4% fewer "no

response/repetition" answers than expected (critical value = -2.21). There were no significant differences between groups for the frequency of "wrong object-correct relationship" answers given (critical values < 1.0). For children with language impairment, the critical value of +1.08 indicated that they provided "unrelated" answers 54.7% more often than expected. Language impaired children also provided 40% fewer "thematic/category" answers than expected (critical value = -1.26). For low normal children, the critical value of +1.58 indicated that they provided "thematic/category" answers 50% more often than expected. Language impaired children provided 43.6% fewer "correct" answers than expected (critical value = -2.1). For low normal children, the critical value of -1.47 indicated that they provided "correct" answers 30.6% less often than expected. Typically developing children provided 25.6% more "correct" answers than expected (critical value = +2.09). These results are summarized in Figure 4.

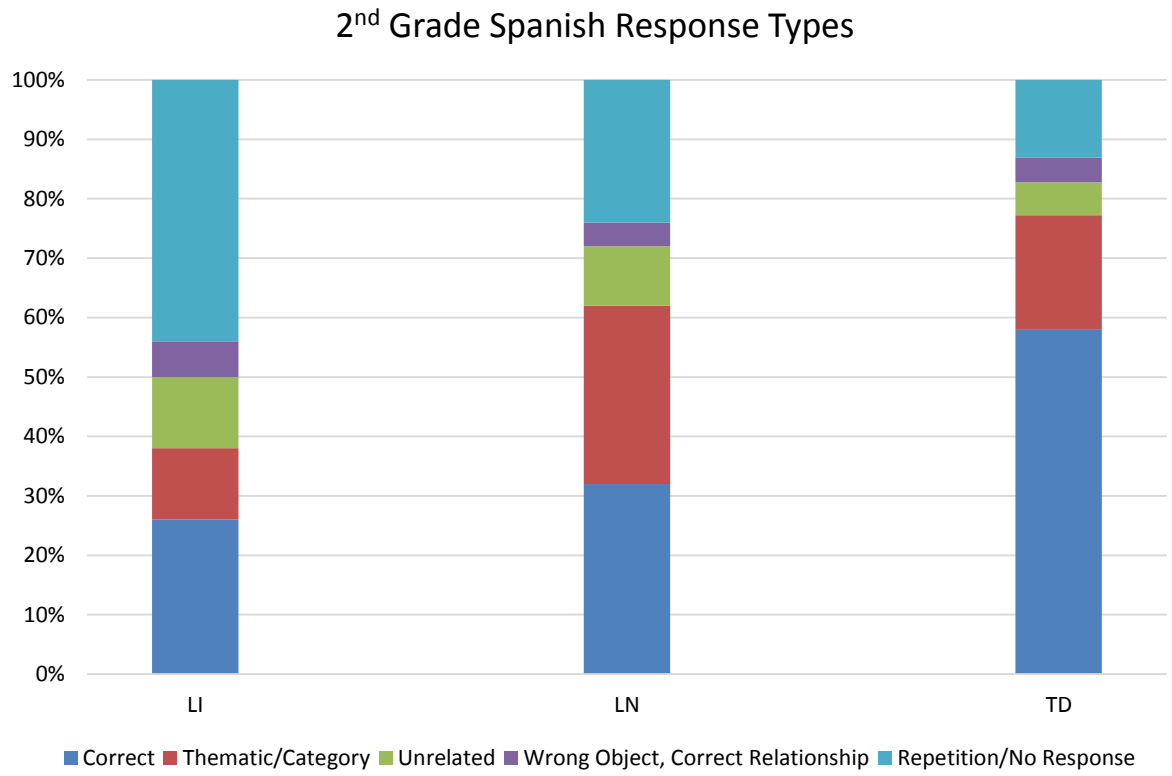

Figure 4: Spanish 2nd grade response types frequency by ability level

Results for the 3rd grade Spanish assessment indicated differences in responses patterns by ability, $X^2(8) = 35.42$, $p<.001$. For children with language impairment, the critical value of +1.96 indicated that they provided "no response/repetition" answers 60.2% more often than expected. Low normal children provided 50.8% more "no response/repetition" answers than expected (critical value = +1.65). Typically developing children provided 38.3% fewer "no response/repetition" answers than expected (critical value = -2.12). There were no significant differences between groups for the frequency of "wrong object-correct relationship" answers given (critical values < 1.0). For children with language impairment, the critical value of +1.08 indicated that they provided "unrelated" answers 54.7% more often than expected. Language impaired children also provided 91.7% more "thematic/category" answers than expected (critical value = +1.99). For typically developing children, the critical value of -1.52 indicated that they provided "thematic/category" answers 41.2% less often than expected. For children with language impairment, the critical value of -2.24 indicated that they provided "correct" answers 43.5% less often than expected. Low normal children provided 35.9% fewer "correct" answers than expected (critical value = -1.85). Typically developing children provided 27.4% more "correct" answers than expected (critical value = +2.4). These results are summarized in Figure 5.

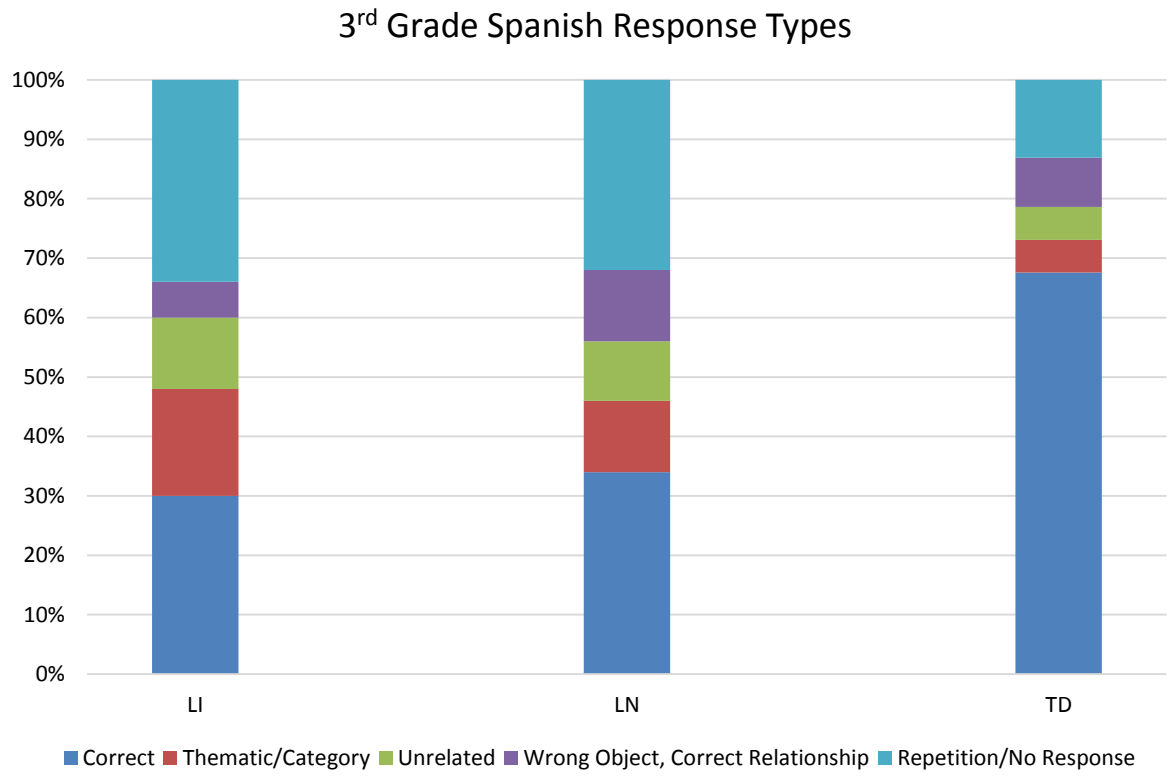

Figure 5: Spanish 3rd grade response types frequency by ability level

Results for the 2nd grade English assessment indicated differences in responses patterns by ability, $X^2(8)=5.73$, p=.677. For low normal children, the critical value of +1.29 indicated that they provided "no response/repetition" answers 41% more often than expected. There were no significant differences between groups for the frequency of "wrong object-correct relationship," "unrelated," or "thematic/category" answers given (critical values < 1.0). For low normal children, the critical value of -1.04 indicated that they provided "correct" answers 32.3% less often than expected. These results are summarized in Figure 6.

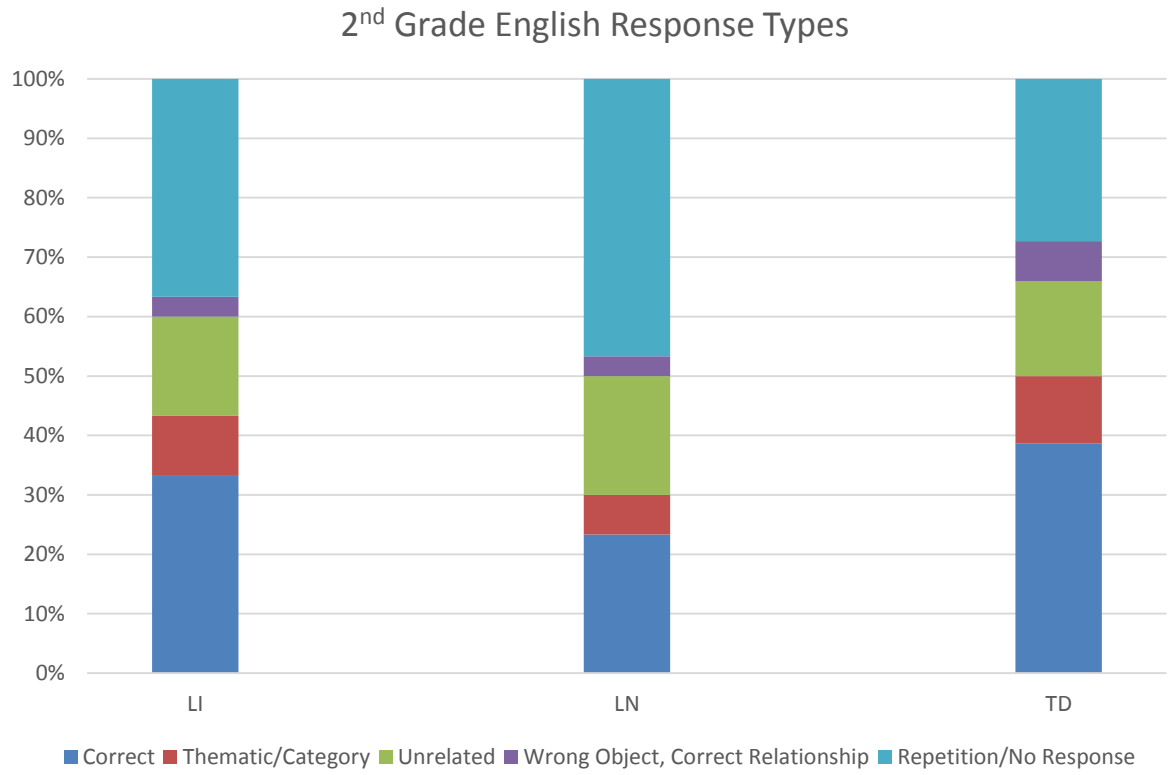

Figure 6: English 2nd grade response types frequency by ability level

Results for the 3rd grade English assessment indicated differences in responses patterns by ability, $X^2(8)=32.45$, $p<.001$. There was no significant differences between groups for the frequency of "no response/repetition" answers given (critical values < 1.0). For children with language impairment, the critical value of -1.1 indicated that they provided "wrong object-correct relationship" answers 100% less often than expected. Low normal children provided 228.9% more "wrong object-correct relationship" answers than expected (critical value = +2.52). For low normal children, the critical value of +2.64 indicated that they provided "unrelated" answers 117.1% more often than expected. Typically developing children provided 52.9% fewer "unrelated" answers than expected (critical value = -2.04). There was no significant differences between groups for the frequency of "thematic/category" answers given (critical values < 1.0). For low normal children, the critical value -2.48 indicated that they provided 65.3% fewer "correct" answers than expected. Typically developing children provided 30.3% more "correct" answers than expected (critical value = +1.97). These results are summarized in Figure 7.

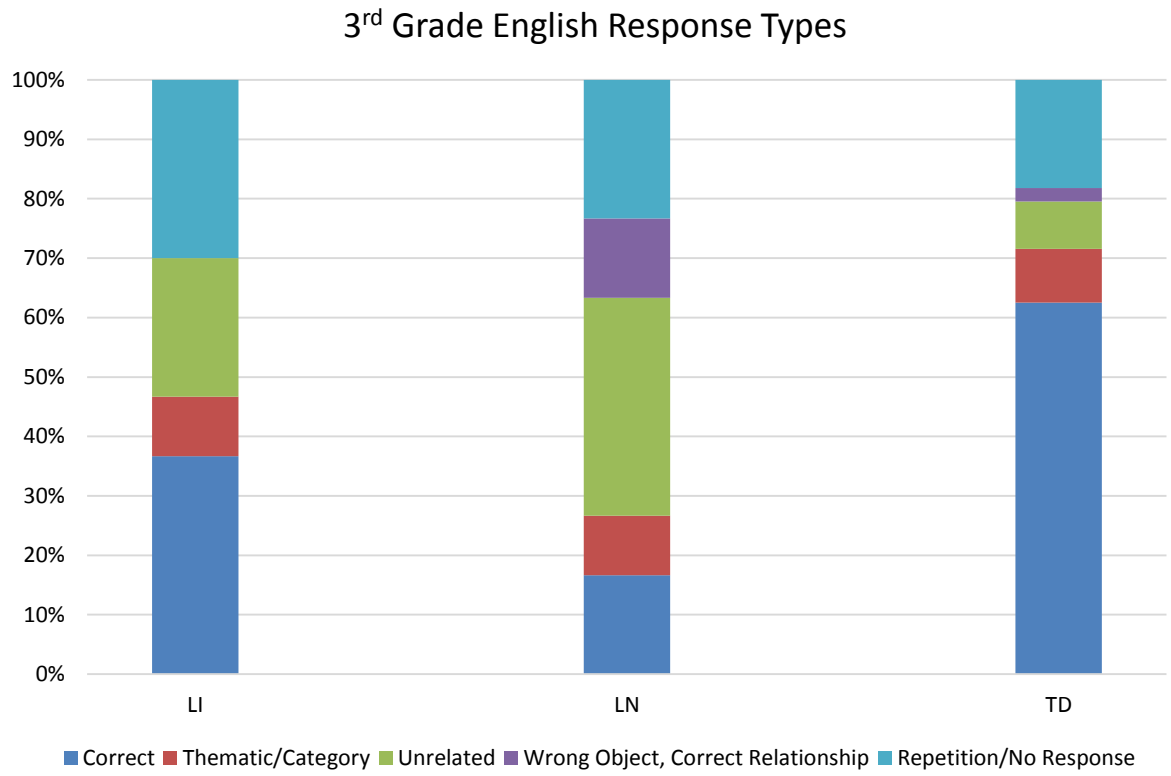

Figure 7: English 3rd grade response types frequency by ability level

Discussion

The goal of this study was to investigate the error patterns of typically developing, low normal, and language impaired bilingual school-age children when completing an expressive analogy task in English and Spanish. We sought to identify the types of errors produced by children with and without language impairment in an attempt to better understand the underlying linguistic processes related to analogical reasoning.

Results from the 2nd and 3rd grade Spanish assessments indicate that children with LI provided "repetition/no response" (REP/NR) answers significantly more often than expected, while TD children provided significantly fewer REP/NR answers than expected. A significant deviation from the expected number of REP/NR responses was not seen in the LN group in the 2nd grade. However, during the 3rd grade, the LN children produced significantly more REP/NR responses than expected. Furthermore, the children with LI provided "correct" answers significantly less often than expected, while TD children provided "correct" answers significantly more often than expected across both grade levels. Similarly, children in the LN group provided significantly fewer "correct' responses than expected, while still providing more "correct" answers than children with LI across both grade levels. These findings support research that indicates that children who are language-impaired have difficulty completing verbal analogical reasoning tasks (Kamhi, Gentry, Mauer & Gholston, 1990; Masterson, Evans & Aloia, 1993; Masterson & Perrey, 1994).

Results from the 2nd and 3rd grade Spanish assessments provide partial support for the relational shift hypothesis. Based on this hypothesis, the THEM/CAT responses, which rely on surface similarities, should decrease with age while correct responses increase. This

trend was partially observed in the between the 2nd and 3rd grade for the LN and TD groups, but not for the children with LI. The LN children provided 30% THEM/CAT responses during 2nd grade, but decreased to 12% during 3rd grade. The number of correct responses provided, however, remained virtually the same. The TD children provided 19% THEM/CAT response during 2nd grade, but decreased to 6% during 3rd grade. The number of correct responses increased from 58% during 2nd grade to 68% during 3rd grade. In the LI group, however, the percentage of THEM/CAT and correct responses at both grade levels remained virtually the same. Furthermore, the children with LI provided "thematic/category" (THEM/CAT) answers significantly less often than expected in the 2nd grade, yet significantly more often than expected in the 3rd grade. This increase in THEM/CAT responses corresponds with a decrease in REP/NR responses in children with LI in the 3rd grade; all other category responses remained relatively unchanged across both grade levels. "Unrelated" (UNREL) responses, for example, are given more often than expected by children with LI; this remains constant in 2nd and 3rd grade. These findings therefore provide only partial support for the relational shift hypothesis (Rattermann & Gentner, 1998; Sternberg & Downing, 1982; Sternberg & Nigro, 1980). These results suggest that the relational shift hypothesis may not apply to children with LI. It is also possible, however, that their language impairment delays the thematic shift beyond the 3rd grade.

Results from the 2nd and 3rd grade English assessments, however, do not follow the patterns seen in the Spanish assessments. Significant deviations from the expected number REP/NR and "correct" responses were not seen in the LI or TD groups in the 2nd or 3rd

grade. Children in the LN group provided significantly more REP/NR responses that expected; however, this pattern had disappeared by the 3rd grade. Children in the LN group also provided significantly fewer "correct" responses than expected across both grade levels; they provided fewer "correct responses" than even the children with LI. By the 3rd grade, TD children were able to provide more "correct" responses than expected, which corresponds with the pattern seen in Spanish. UNREL and WO-CR responses were provided more often than expected by LN children 3rd grade. TD children, on the other hand, provided UNREL responses less often than expected in the 3rd grade. These results may reflect the children's inability to complete a more complex analogical task in a language in which they were not yet proficient. Despite these inconsistent results, TD children did provide more correct responses than LN and LI children.

The theoretical implications of these results lie in the fact that the types of errors produced by bilingual children with and without language impairment when performing an expressive analogy task in their stronger language provides partial support for the relational shift hypothesis (RSH). As suggested by the RHS, THEM/CAT responses decreased with age in LN and TD children in Spanish. In addition, the number of correct responses increased in TD children in Spanish. In children with LI, however, the number of THEM/CAT and correct responses remained virtually the same with age in Spanish. Bilinguals' ability to achieve this relational shift may provide valuable information about their cognitive, and by extension linguistic, abilities.

LIMITATIONS

Because this study was conducted using a relatively small sample size (N=49), there is a certain degree of uncertainty associated with its findings. While this study provides insight into the error patterns produced by Spanish-English bilingual school age children with and without SLI when completing an expressive analogy task, the information gleaned cannot be generalized due to the small sample size. To increase confidence in our findings, studies with larger samples sizes should be conducted (N>100).

FUTURE RESEARCH

Future research should focus on investigating the error patterns of typically developing, low normal, and language impaired bilingual school-age children when completing a nonverbal analogy task in English and Spanish. Such a study would enable comparisons to determine if error patterns seen in this study are specific to analogies expressed verbally or if they occur across all modalities. Additionally, different language pairs should be tested to determine what effect, if any, a given language has on the errors made when attempting to complete an analogical reasoning task. Finally, future studies should explore a wider age range via longitudinal studies that span a child's development from pre-school age into adulthood. This would provide a more comprehensive idea of the manner and rate at which analogical reasoning develops in those with and without specific language impairment.

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