Case Study: Comparison of Language Skills of English-Spanish Bilingual, School-Age Twins with Differing Language Profiles

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Case study: Comparison of language skills of English-Spanish bilingual, school-age twins with differing language profiles

by

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B.S. Colorado State University, 2009

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The final copy of this thesis has been examined by the signatories, and we find that both the content and the form meet acceptable presentation standards of scholarly work in the above mentioned discipline.

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Case study: Comparison of language skills of English-Spanish bilingual, school-age twins with differing language profiles

Thesis directed by Associate Professor Pui Fong Kan

This longitudinal study compares the language profiles of a set of 8-year-old bilingual (English/Spanish) twins. One twin has a diagnosis of SLI and receives services, while the other has no documented language impairment. Standardized tests and language samples were administered in English and Spanish at three time points over a period of 9 months to assess their language profiles, rate of change in language skills and working memory skills. Analysis determined that while the twin with the diagnosis of SLI had a lower language profile overall. It is unclear whether the twin without a diagnosis performed below average due to a language difference or a language impairment. A difference in their performance on working memory tasks was noted and may be related to their differing perinatal health histories.
Acknowledgements

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Introduction

Background and Literature Review

Previous studies that examine monolingual twins have demonstrated the contributions of both genetics and environments on the variation of language development (Plomin & Dale, 2000). In this study, a set of English-Spanish sequential bilingual school-age twins who demonstrate different language profiles were examined. Sequential bilingual children are defined as those who learn one language (L1) at home first, then a second language (L2) during their childhood. For most sequential bilingual children, the second language is introduced at school. At the time of testing, Participant 1 was on an Individual Education Plan at school and had a diagnosis of Specific Language Impairment, while Participant 2 had no diagnosis and was not receiving any services at school. Typically, twins tend to have similar language profiles, as language traits are highly heritable (Bishop, 2002). Indeed, many twins create their own private language to communicate with each other (Hayashi, Mikami, Nishihara, Maeda, & Hayakawa, 2014).

Of interest in this study are twins who have different language profiles: typically developing and language impaired. That is, the twins demonstrated differences in their language traits. Differences in language profile were noted by parent report, as well as teacher report. Studying bilingual twins offers the opportunity to examine questions about language development, while controlling for home language environment, academic environment and genetic differences. There are notable limitations in studying bilinguals, namely the inability to accurately define their level of bilingualism and their language
dominance (Grosjean, Bhatia, & Ritchie, 2004). Studying bilingual twins may alleviate some of these negative effects by controlling for age of acquisition and exposure to L1 and L2. The results of this study potentially provide unique information about how multiple genetic and environmental factors (e.g., exposure to language input in two languages at home and in school) might contribute to bilingual children’s language development. Information about the process of Spanish-English bilingual language development gleaned from this study may guide intervention strategies for speech language pathologists involved with this growing demographic. Bilingual children with language disorders present as a subset of this demographic. The following section discusses both the linguistic and cognitive traits of bilingual children with language impairment.

**Bilingual Children with Language Disorders**

Typically developing children acquire language in a series of spurts and plateaus. This is also true for typically developing bilingual children. Simultaneous bilinguals learn both languages concurrently. In general, their acquisition trajectory depends on the level of exposure to each language, yet they have been shown to use first words and combine words at roughly the same time as monolinguals (Kohnert, 2010). Research has shown that receptive language in the minority language may lag behind that of the majority language (MacLeod, Fabiano-Smith, Boegner-Pagé, & Fontolliet, 2013) as exposure to the majority language outside the home increases. Castilla, Restrepo, and Perez-Leroux (2009) found that in sequential bilinguals, L2 acquisition in typically-developing children is highly related to language skills in their L1. Thus, those children with an innate propensity for language learning tend to excel in both their primary and secondary languages. Just as this innate ability influences language learning, so does language impairment. In bilingual
children with specific language impairment (SLI), language learning is delayed in both languages (Kohnert, 2010). This finding holds true regardless of whether they acquire their L2 sequentially or simultaneously. More specific information on language and cognition in English-Spanish bilingual children is discussed below.

SLI is the most common language disorder seen in both monolingual and bilingual children. As previously stated, for bilingual children, SLI manifests itself in both languages. Language traits that are typically seen in bilingual children with SLI include an overall delay in language acquisition, difficulty acquiring vocabulary (Hakansson, Salameh, & Nettelbladt, 2003; Kohnert, 2010) and significant morphosyntactic errors (Restrepo & Kruth, 2000). These errors in morphosyntax vary cross-linguistically, but are more prevalent and diverse than those seen in typically-developing bilingual children. In English-Spanish bilingual children, morphosyntactic errors in Spanish include substitutions of verbs and gender articles, omission of prepositions, difficulty with gender-agreement, and reduced complexity of language overall (Restrepo & Kruth, 2000). A significant loss of L1 was also noted by Restrepo and Kruth (2000).

In addition to a decreased in language performance, bilingual children with primary language disorders also demonstrate differences in cognitive function. While a below average IQ would contraindicate a diagnosis of SLI, other cognitive markers may be present. For example, a reduction in working memory may accompany SLI (Montgomery, 2002). Girbau and Schwartz (2008) found that in bilingual children a poor performance on a non-word repetition task was highly correlated with SLI, when the words were phonotactically related to the language in which they were being tested. This supports the theory that SLI affects phonological working memory. Additionally, Kohnert, Windsor and
Miller found that when given a word recognition task, processing speed in children with SLI lagged (2004).

Language acquisition is a complex and ongoing process, especially for a bilingual child. The language and cognitive traits seen in both languages in a child with SLI help differentiate them from their typically-developing peers. Yet, these traits make up one only aspect of this study. In addition to being bilingual, the participants are also monozygotic twins. The following section discusses the research on language disorders in twins.

**Language Disorders in Twins**

Twin studies allow researchers to control for factors that other studies using non-twins cannot, which allows increased focus on the target factors. This is true for research surrounding language development due to the strong roles that genetics and environment play in language development (Plomin & Dale, 2000). Historically, most twin studies have focused on monolingual English twins, but few have delved into bilingual language.

In previous studies, monolingual English-speaking twins have been tested on a variety of language skills and compared to their twin’s performance, as well as to their age-matched peers. In a case study by Tommerdahl and Drew (2008), two twin boys with a history of language delay were studied in order to determine the role that intelligence and genetics play in diagnosing SLI. In the study, one of the twins had low nonverbal intelligence scores and was diagnosed with SLI. The other twin had a similar language profile, but did not have a diagnosis due to higher nonverbal scores. Both boys participated in a nonverbal cognitive assessment (Performance Scale of the Wechsler Intelligence Scale for Children (*WISC-R*)) (Wechsler, 1949) and an informal language sample, which was analyzed using the *Language Assessment, Remediation and Screening Procedure (LARSP)*
conventions. The study found that despite the difference in scores on the WISC-R, the boys’ language profiles were remarkably similar. This finding raised the question of whether language skills are predominantly affected by intelligence or genetics, and whether intelligence is a significant factor in diagnosing SLI.

Another study related to genetics was done by Hayiou-Thomas, Dale and Plomin (2005), who conducted a large longitudinal study on monolingual English-speaking preschool-age twins in Wales in order to explore the effect of genetic and environmental factors on language. In their case study, they compared children with low language skills and low nonverbal skills to those with low language skills whose nonverbal skills were either borderline or average. This delineated between those with a Nonspecific Language Impairment (NLI), which was attributed to low nonverbal skills, and those with Specific Language Impairment (SLI), which was not attributed to low nonverbal skills. The children were tested longitudinally at three time points (at 2, 3, and 4 years of age) using a variety of language assessment tools, including parent questionnaires and portions of the McCarthy Scales of Children’s Abilities, Renfrew Language Scales, British Language Scales, Children’s test of Nonword Repetition and the Goldman-Fristoe Test of Articulation. Information about family history of language disorders and the linguistic environment of the child were taken into consideration. Upon analysis of the groups, the authors found that children with NLI had language skills that were strongly related to environmental factors and slightly less related to genetic factors. In those children with SLI, the genetic impact was less than for those with NLI.

In addition to genetic factors, perinatal and prenatal factors may also affect language in children. One study by Bishop (1997) aimed to compare the pre- and peri-natal
backgrounds of children with and without speech and language disorders. Twin pairs in which one or both twins presented with SLI were compared with twin pairs with no history of speech language difficulties. All children were given a variety of tests. It was found that perinatal hazards may not be an important cause of SLI in children and rate of perinatal hazard was unrelated to the subtype of SLI. Overall, this study failed to confirm that perinatal hazard could be an etiological agent.

Yet, in a study conducted by Briscoe, Gathercole and Marlow (1998), extreme prematurity at birth was found to be a possible indicator for deficits in both short-term memory and language skills at age 8, specifically SLI. This study focused on the language and cognitive profiles of 26 preterm (prior to 32 weeks) and 26 full-term children. The participants were given a variety of assessments, including those that tested vocabulary, phonological memory, nonverbal cognitive and expressive and receptive language skills. At least one-third of the children who were born prematurely were found to be at-risk for persistent language deficits consistent with SLI. Additionally, a study by Frisk and Whyte (1994) found that periventricular lesions in low-birthweight infants born prematurely (prior to 33 weeks) was highly correlated with reduced working memory and sentence comprehension in children. The discrepancies between the aforementioned studies warrant that peri- and prenatal factors be considered when assessing children’s language skills. In this study, these factors were taken into consideration.

There is a substantial paucity of literature focused on second language acquisition and bilingualism in twins. The first study utilizing the classic twin study model was published in 2010 by Dale, Harlaar, Haworth, and Plomin. The study focused on sequential bilingualism (e.g. learning a second language after the first language is already established).
It analyzed a group of adolescent twins who had participated in the Twins Early Development Study (TEDS) who were studying a foreign language in an academic setting. The twins were directly tested at age 12 and their progress was monitored at 14 years of age using a teacher rating scale. Through these measures the authors compared the twins’ general aptitude for learning a second language. It was found that second language acquisition skills are heritable (.67 effect size). The correlation was much lower for shared environmental factors. There are obvious differences in research design and purpose between the TEDS study and this current one. The fact that this is the only study that evaluated a group of twins, who were acquiring a second language, highlights the lack of research in this area.

In sum, the lack of previous research studies conducted on bilingual twins who have differing language profiles is striking. Theoretically, the studies that have been conducted support the theory that both genetic and environmental factors play a large role in dictating language characteristics. However, there are very few research studies of bilingual twins, let alone those with significant language discrepancies who have been tested in both languages. In contrast, most studies have looked at monolingual twins, or only tested twins in their dominant language. The one study that considered both languages was conducted on adolescents who were learning a second language in the academic setting, rather than living in a bilingual home environment. As our society becomes increasingly more bilingual, the need for research in this area grows. Specifically, there continues to be a significant increase in Spanish-English bilingual children in public schools. Bilingual children require specialized language services that take into account the unique needs of this population. The addition of this research will further our
understanding of bilingual language development and add another source of data about issues surrounding bilingualism and language differences between twins.

**The Current Study**

The purpose of this study was to evaluate the language profiles in a set of Spanish-English bilingual twins in order to explore the impact of genetic and environmental factors on bilingual language development. In this study, data was gathered over a period of 9 months in both English and Spanish using standardized tests and informal language samples. A longitudinal approach was chosen so that data on language growth could be gathered, since children’s language skills change rapidly. It was decided that 3 time points over a period of 9 months would allow for linear growth to be charted. Then, these findings were compared between the twins, as well as to standardized data of age-matched peers. Peri-, pre- and postnatal medical history were also considered in the analysis. Using these data, the overall differences in language profiles in a set of school-aged bilingual twins were explored.

**Specific Research Questions.** This study involved two main research questions. The first asks: What are the differences in the language and cognitive profiles of a set of twins as measured by: mean length utterance, number of different words, working memory, and standardized receptive and expressive language scores? The second question posed in this study was the following: Are there changes over time in the participants’ language profiles, and is there a difference in the rate of change?

**Research Design.** The current study was conducted as a case study focused on a limited number of subjects with specific demographics. The study endeavored to increase the knowledge base on the topic of language impairment in the bilingual population. It was
qualitative in nature, describing the current language skills of the participants and commenting on potential factors that influenced their performance. Quantitative and qualitative data in the form of standardized language assessments was collected over a period of 9 months in order to objectively compare growth of the twins to their age-matched peers and each other. No statistical analysis was conducted. Additionally, this may be considered a causal comparative study, as it seeks to understand the potential cause(s) for the difference in the twins’ language profiles.

This study was longitudinal. The timeline was determined based on time constraints and research goals, and took the participants’ time commitment into consideration. Based on these factors, it was decided that three time points over a period of 9 months would be sufficient to gather the necessary data about their language growth without placing an unnecessary burden on the participants. The following section discusses the specific research questions and hypotheses about the results of the study.

**Hypotheses and Predictions.** It was hypothesized that there would be a difference in the twins’ expressive and receptive languages. By definition, SLI is a language impairment that is present in the absence of deficits in nonverbal cognition (Haynes & Naidoo, 1991). SLI can affect both expressive and receptive language. However, in the case study by Tommerdahl and Drew (2008), the greatest disparity between the twins was their performance on expressive language tasks, while their receptive language skills were strikingly similar. This highlights the possibility for receptive language to be less affected. The language skills of the twins were compared to one another in order to determine if differences impact one type of language skill more.
Despite the fact that SLI, by definition, does not affect nonverbal intelligence, there may be subtle differences in the cognitive ability of children with SLI. Childhood cognitive ability consists of a variety of components such as intelligence (verbal and nonverbal), attention, processing speed and memory (Hampson & Morris, 1996). Many external and internal factors affect one’s cognition. Environmental opportunities, such as parental input, are considered external factors (Tucker-Drob, Briley, & Harden, 2013; MacLeod, Fabiano-Smith, Boegner-Pagé & Fontolliet, 2013), while genetics is an internal factor (Wright, De Geus, Ando, Luciano, Posthuma, Ono, ... & Smith, 2001). For monolingual children, these factors could lead to a great variability in their cognitive skills. However, genetics are controlled for when comparing monozygotic twins (Bishop, North & Donlan, 1995). Additionally, the environmental factor of parental input that may contribute to intelligence was also controlled for in the current study due to the twins having the same home environment. This being said, typically developing children may experience a slightly different level of interaction within the home than their siblings with language impairment. In this study, attention was informally observed throughout testing. Working memory was assessed separately. It was hypothesized that despite the shared genetic and environmental factors between the twins, their cognitive abilities may differ due to the presence of SLI in one participant.

Additionally, it was hypothesized that there would be variability in their language skills longitudinally due to the fact that the twins are learning two languages. As children are in the process of becoming bilingual, their language dominance and proficiency can fluctuate as they become more proficient in L2 (Kohnert, 2010). In this case study, the twins attended a school in which L2 is the only language of instruction, but used their L1 at
home and with those in the community. As L2 vocabulary and literature are introduced in
the academic setting, their language dominance may shift from L1 to L2. These changes
may affect the twins’ ability to retain their language skills in L1, resulting in a slight loss of
language in L1. This study took into account this variability of language skills when
assessing language growth across the 9-month period.

Despite the predicted variability, it was anticipated that the twin with the lower
language profile would demonstrate a lower rate of change in language development. This
study spanned three time points over the course of 9 months. Due to the relatively short
timeframe, only minor changes in performance were anticipated. It was expected that
Participant 1 would demonstrate a typical rate of change, while Participant 2’s rate of
change would lag behind.

Methods

Participants

For this study, the two participants were a set of school-aged, monozygotic twins
selected based on a convenience sample and a set of criteria. Inclusion criteria were as
follows:

● The twins/triplets would reside in a bilingual (Spanish/English) home where
  Spanish is the dominant language. The siblings would not live in separate
  households.

● The twins would be school-aged (1st-5th grade).

● There would be a difference in language or cognitive skills between the siblings.

● They would not have motor-planning difficulties, or other disorders or disabilities
  that negatively impact speech.
At the time of initial testing, the participants were 8 years and 1 month, and attending second grade at a local neighborhood school. They resided at home with their mother, stepfather, and four siblings ranging from 18 years to 18 months of age. No other siblings have identified language difficulties in either English or Spanish. The participants’ mother and biological father are of Mexican descent; their stepfather is of Guatemalan descent, and has lived in the United States for over 20 years. Their mother did not finish high school in Mexico, whereas their stepfather graduated from a local high school. Their biological father has not had contact with the participants since their birth.

Notable medical history of the twins included premature birth (29 weeks). They remained in the Neonatal Intensive Care Unit (NICU) for two months before being discharged. Of interest is that Participant 2 received a lower APGAR score at birth and remained in the NICU for two weeks longer than Participant 1 for respiratory distress. The APGAR score is a measure of newborn vital signs at birth. Medical records indicate that no brain injury was sustained by either twin during or after birth; however, the twins were not screened for cerebral damage such as periventricular lesions typically found in premature infants. After one year of age there is no medical history significant to this study.

There was an apparent difference in language abilities between the participants. Patient 2 has received a diagnosis of SLI through her school-based speech-language pathologist. She has regularly received speech and language services from a Speech Language Pathologist at her school since preschool, while Participant 1 only received services during preschool.
As reported in the language profile questionnaire completed by the participants’ mother, the primary language spoken in the home environment was Spanish. This was true both during the week and on weekends, regardless of time of day. All siblings in the home were fluent in Spanish and used this language to communicate with their parents and each other. The twins attended a local elementary school where the language of instruction is English. No formal support was offered in Spanish. As reported on the questionnaire, the twins primarily communicated in English with their peers, though many are of Hispanic descent and speak Spanish in the home.

**Testing Methods**

During this longitudinal study, data was gathered at three time points (April, June, and September) during a 12-month period. Participants’ language skills were measured longitudinally using standardized language assessment tools and an informal language sample. Testing was done in both English and Spanish.

Standardized tests administered included the Clinical Evaluation of Language Fundamentals (CELF-4), the Peabody Picture Vocabulary Test (PPVT), the Test de Imagenes Peabody (TVIP), and the Digit Span task from the Woodcock Johnson Test of Achievement- Third Edition (see procedures below). These tests were selected based on the availability of English and Spanish language versions and extensive normative data. Additionally, a wordless picture book (*Frog, Where are you?*) was used to elicit an informal language sample in each language. These samples were analyzed for narrative development level (Stadler & Ward, 2005), as well as expressive language skill data including mean length of utterance and number of different words used.
In order to limit code switching during the tasks, a different person administered the English and Spanish portions of the evaluation. Both administers were considered fluent speakers of the language in which she administered the test. This helped establish a single-language environment for the children. After all assessments were collected, the data was compiled and analyzed. Comparisons were made between the twins and normative data was utilized to tentatively establish their standing in comparison to age-matched peers.

**Testing Procedure for Each Measure**

**Clinical Evaluation of Language Fundamentals-5 (CELF-5)/CELF-4, Spanish.**

The CELF is used for measuring various aspects of language skills. The CELF-5 in English and the CELF-4 in Spanish contain the same subtests. The test is developed for use with students ages 5-21. It is normed on neurotypical and language-typical children within the United States. The Spanish version reflects the language of the Hispanic population within the United States. The normative sample was conducted predominantly on students whose primary language was Spanish, though some were considered bilingual. This test was not administered in its entirety, as some expressive and receptive skills were evaluated using other standardized assessments. The following subtests of the CELF were administered:

- **Recalling Sentences (Recordando oraciones):** This subtest requires the participant to repeat verbatim sentences of increasing length and complexity that are presented by the administrator.
- **Sentence Formulation (Formulación de oraciones):** This subtest requires the participant to utilize a given word or phrase in a complete, grammatically correct sentence about a presented picture. The given words/phrases increase in complexity as the task progresses.
**Peabody Picture Vocabulary Test/Test de vocabulario de imágenes Peabody.**
The PPVT and TVIP were administered in their entirety according to the standard procedures to each twin. These tests evaluate receptive vocabulary through the presentation of several out of context picture stimuli on a page and a verbal word prompt. The participant is asked to point to the picture that matches the verbal prompt. The test is also often used as an indicator of overall cognition. The English version of the test was normed on over 2,000 monolingual English participants aged 2 years to over 80 years. The Spanish version was normed on English-Spanish bilingual individuals aged 2 years to over 80 years with varying levels of proficiency. As stated above, each version of the test was administered in a single-language environment.

**Digit Span Task.** A digit span task from the Woodcock Johnson Test of Achievement- Third Edition was given in English only at Time 2 and in both languages at Time 3. The task involves repeating a series of numbers of increasing length, first forward and then backwards. This task assesses working memory, which is necessary for learning and language acquisition (Baddeley, 2003).

**Wordless Picture Book.** A wordless picture book (Mayer, 1969) was utilized to elicit a language sample from each twin in each language. This was accomplished by first looking through the book and then asking the participant to retell the story using the same picture book (e.g. “Can you tell me the story of the frog?” “¿Puedes contarme el cuento de la rana?”). If the participant did not respond, or hesitated during the story retell, the administrator prompted them to continue or elaborate (e.g. “Tell me more. What else happened?”) During the responses, the administrator used an audio recording device to capture the interaction. This process was also conducted in a single-language environment.
Due to time constraints, only one English and one Spanish-language sample were taken over the course of testing. These samples were then transcribed orthographically. The number of different words in each sample were counted. Additionally, the number of words per utterance was also counted to calculate Mean Length Utterance (MLU). An assessment of their story retell was conducted using the narrative levels discussed in Stadler and Ward (2005). These were then compared to each other, as well as to age-based norms.

**General Procedures**

The study was conducted over a span of nine months. Time points were approximately 3 months apart and each took one testing session to complete. The assessments were administered by two administrators who were fluent in both English and Spanish. For efficiency, testing occurred simultaneously, with one participants being tested in English while the other was tested in Spanish. The order of the assessment battery in English was as follows: PPVT, CELF subtests, Digit Span (Time 2 and 3 only), wordless picture book narrative. In Spanish, the battery was given in the following order: TVIP, CELF subtests, Digit Span (Time 3 only) wordless picture book narrative. The participants were given breaks between tests, upon request and after the completion of the battery in each language. Each testing session lasted a total of 2.5 hours. The location of testing varied across the time points. The first two sessions were conducted at the participants’ home while the final session occurred at a local park.
Results

This study assessed the language and working memory skills of a set of bilingual school-age twins. These assessments were conducted in both of the twins’ languages, English and Spanish. Due to time constraints and extraneous circumstances, both participants were not available for testing across the 3 time points. Table 1 summarizes the tasks that have been completed. Note narrative audio recordings from Time 1 accidentally deleted. Thus, though the narratives were completed at that time, the data was not analyzed. Time constraints impeded collection of narrative data at Time 3.

Table 1.
Tasks completed across the 3 time points.

<table>
<thead>
<tr>
<th></th>
<th>Time 1</th>
<th>Time 2</th>
<th>Time 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>TVIP</td>
<td>Completed</td>
<td>Completed</td>
<td>Completed</td>
</tr>
<tr>
<td>PPVT</td>
<td>Completed</td>
<td>Completed</td>
<td>Completed</td>
</tr>
<tr>
<td>CELF (RO &amp; FS) Spanish</td>
<td>Completed</td>
<td>Completed</td>
<td>Completed</td>
</tr>
<tr>
<td>CELF (RO &amp; FS) English</td>
<td>Completed</td>
<td>Completed</td>
<td>Completed</td>
</tr>
<tr>
<td>Language sample (MLU &amp; NDW)</td>
<td>Lost</td>
<td>Completed</td>
<td>Not completed</td>
</tr>
<tr>
<td>Digit Span English</td>
<td>Not completed</td>
<td>Completed</td>
<td>Completed</td>
</tr>
<tr>
<td>Digit Span Spanish</td>
<td>Not completed</td>
<td>Not completed</td>
<td>Completed</td>
</tr>
</tbody>
</table>

The results show similarities and differences between the twins’ abilities. The participants’ scores at each of the three time points are summarized in Tables 2, 3 and 4. A
comparison of their receptive and expressive skills is shown in Figures 1, 2, 3 and 4. In addition to quantitative measures, qualitative analysis is presented in the following sections.

**Receptive Language Skills in P1 and P2**

PPVT and TVIP were used to measure participants’ receptive language in Spanish and in English. As shown in Table 2, the participants’ scores on the PPVT and TVIP improved between data points 1 and 2. There was a regression seen in both participants’ scores between points 2 and 3. The most notable similarity in the participants’ scores was on the PPVT at the first time point. At this time point, Participant 1 scored a standard score of 79 (8th percentile) while Participant 2 scored 78 (7th percentile). The scores then greatly varied at the two subsequent time points. At these time points, Participant 1 had standard scores of 101 and 85 (53rd and 16th percentiles, respectively). Participant 2 had standard scores of 73 and 65 (5th and 1st percentiles, respectively).

The participants’ performance on the TVIP is also seen in Table 2. A greater disparity at time point 1 was noted in these scores, but they followed a similar pattern as described above. At Time Point 1, Participant 1 scored 88 (21st percentile) followed by a score of 106 (66th percentile) at the other two time points. Participant 2 scored a 55 (0.1 percentile) at the first time point, then 88 (18th percentile) and 77 (5th percentile), respectively. In English, P2 did not correctly select vocabulary words related to body parts (e.g. waist, ankle). She did identify similar words in Spanish, however (e.g. cuello, rodilla). She also did well on emotion words (e.g. horrified, surprised) in English but missed the same words in Spanish (e.g. sorprendido). Both the English and Spanish results can be seen in Figure 1.
In general, P1’s receptive vocabulary appeared to have a bell-like shape, which resulted in a slightly increase in both English and Spanish vocabulary. P2’s Spanish receptive vocabulary was also shaped in this way, while her English vocabulary was a consistently negative line. Based on these results, it appears that the twins are continuing to increase their overall receptive vocabulary in both languages, without any substantial loss of L1. It is unclear why P2’s English vocabulary decreased across the time points, though attention may have played a factor in her performance.

**Expressive Language Skills in P1 and P2**

Participants’ expressive language skills were measured using two subtests of the CELF (*Recalling Sentences* and *Formulating Sentences*) and a language sample. As seen in Table 3, the participants’ performances on the *Recalling Sentences* portion of the CELF varied. In English, Participant 1 achieved scaled scores of 5 (5th percentile), 8 (25th) and 6 (9th). Participant 2 demonstrated noted difficulty with this subtest. She scored in the very low range at all time points with the following scores: 2 (>1st percentile), 4 (2nd), and 5 (5th). All of these scores fall below 2 standard deviations below the mean. When the Spanish version of this subtest was administered, Participant 1 scored somewhat higher than in English. She scored 7, 9 and 9. Participant 2 scored 2, 4 and 4, which closely matched her English performance. Percentiles were not available for the Spanish version of this subtest. During testing, Participant 2 attempted to repeat the sentence as the administrator was saying it. It was also noted that she demonstrated avoidance behaviors during this particular subtest; she is likely aware that this type of task is challenging for her.
Table 3 also shows scores for the *Formulating Sentences* subtest. Participant 1’s performance in English was shown in her scaled scores of 6 at the first two time points followed by 7 at the third time point. This translated to an increase from the 9th to the 16th percentile, which are all below 1.5 SD below the mean. Participant 2 scored 2, 5, and 3, which showed an improvement from the >1st to the 5th percentile but remained in the very low range. Again, percentiles were not available in Spanish. Participant 1’s scaled scores in Spanish were 6, 9 and 8; whereas Participant 2’s score increased from 2 at the first time point to 4 at the subsequent points.

During the *Formulating Sentences* task in English, P2 had noted difficulty with grammar. Her responses frequently lacked pronouns, articles (e.g. “Airplane is flying”, “Car is driving”, “Third going to drink some water”). She also misused past tense forms (e.g. “Quickly she is eat her apple”). These types of errors were not seen in P1’s responses (e.g. “The woman is riding in the car”, “The boy is third in line”). P1’s errors were primarily a result of incomplete thoughts such that her responses did not qualify as correct usage of the vocabulary words provided (e.g. “Because I stopped at the street”).

In the *Recalling Sentences* subtest, P1 tended to simplify the given sentences (e.g. “was not returned” was changed to “wasn’t given”) such that the sentences’ meaning remained mostly intact; however, P2 drastically reduced or altered the given sentences. For example, the sentence “My mother is the nurse who works in the community clinic” was reduced to “My mom works clinic”. During the entire task, P2 attempted to say the sentence simultaneously with the administrator while P1 waited until the administrator had completed the sentence before repeating. In Spanish, P1 performed similarly, while P2 was unable to correctly repeat any sentences. For the sentence “Mi amigo no llevó su almuerzo
a la escuela”, she simply stated “hermano”, which is not semantically or linguistically related to the given sentence. Analysis of the participant’s narrative sample is discussed next.

Language Sample analyses were used to further analyze both participants’ expressive language skills. The language sample was taken at the first two points; however, due to a deletion of the audio recordings, only Time 2 was analyzed. As shown in Table 5, the language samples gathered showed discrepancies in language skills between the participants. In the English language sample, Participant 1 used 68 different words and had an MLU of 11.5. In Spanish, she used 81 different words and had an MLU of 10.8. In contrast, Participant 2 used 42 different words both in the English and Spanish samples, and had an MLU of 4.4 and 5.8, respectively. Both girls demonstrated narrative skills at the Listing level, which is characterized by repetitive syntax (e.g. “And then”, “Luego”, “estaba”) and simple statements about characters and scenes in the story that are not connected by temporal elements (Stadler & Ward, 2005).

Despite the similarity in narrative level, the two girls’ stories varied greatly. Only Participant 1 used mental state words (e.g. mad, sad, happy, enojado). Her vocabulary was appropriate for both the English and Spanish stories. She included a clear ending to her English story (e.g. “The end”). Despite these strengths, she did not utilize temporal or causal components in her stories, which her age-matched peers would be using. In addition to lacking temporal or causal components, Participant 2’s stories were marked with false starts and revisions to her utterances. In Spanish, Participant 2 demonstrated errors in syntax (e.g. “en el arbol adentro”), as well as preposition selection (e.g. “por” vs. “para”). At times she added prepositions when unnecessary (e.g. “tocando para un rana”). Participant
2 used incorrect vocabulary in both English and Spanish (e.g. incorrectly calling a deer “chivo” rather than “benado”). Additionally, she incorrectly assigned noun genders in Spanish (e.g. un rana, unos abejas, la agua) which is uncommon in children whose L1 is Spanish (Montrul & Potowski, 2007).

**Working Memory**

The participants also completed a Digit Span task to assess working memory. Due to time constraints, this task was only completed in English twice, at Time’s 2 and 3, and in Spanish once at Time 3. The results of this task are seen in Table 4. Though no normative data was available for this task, the raw scores show a distinct difference in the twins’ performance in English. Participant 1 scored 12 at Time Point 2 and 9 at Time Point 3. At Time Points 2 and 3, Participant 2 scored 4 and 5, respectively. In Spanish at Time Point 3, both participants scored 5. During this task, P1 was able to repeat some numbers up to six-digits in length forward and two-digits backward. In contrast, P2 was only able to repeat up to 3-digit numbers forward, and unable to repeat any numbers backward.

In addition to Digit Span, the *Recalling Sentences* task should be considered a measure of working memory due to the participants’ need to hold phonological information before repeating it. As seen in Table 3, the disparity between the twins’ performances in Digit Span were mirrored in the RS subtest. Participant 2’s highest scaled score achieved on this subtest was 5, which placed her in the 5th percentile. As previously discussed, she attempted to begin repeating the prompt before the administrator finished. Participant 2’s difficulty with these tasks points to a deficit in the area of working memory that affects her overall language learning ability.
Overall, Participant 1 demonstrated receptive language skills within 1.25 Standard Deviations from the mean when compared to her age matched monolingual English-speaking peers, according to normative data at all data points. Her receptive vocabulary increased from Time 1 to Time 3, with a spike at Time 2. Her expressive language in both English and Spanish were generally grammatically correct, but lacked syntactic complexity. All but one of her scores were within -1.5 SD of the mean when compared to her age-matched monolingual English-speaking peers. Participant 1’s performance on most measures in both languages showed positive, nonlinear changes across time points. Her performances on the Digit Span and Recalling Sentences tasks suggest an intact working memory.

Participant 2 scored the same or lower than her twin in all areas. Her highest scores on all standardized tests, except the Formulacion de Oraciones subtest and Digit Span task, fell within one percentile of her twin’s score. Her Spanish receptive language increased slightly, while her English vocabulary consistently decreased across time points. Her expressive language in L2 increased slightly from Time 1 and Time 3, while her L2 performance varied (i.e. her performances in RS increased, while FS decreased overall). Participant 2’s receptive and expressive language skills were below 1.5 SD on all but one subtest. She demonstrated particular difficulty with tasks that required working memory, such as Digit Span and Sentence Recall.
### Table 2.
*Receptive Vocabulary Development In Spanish & English*

<table>
<thead>
<tr>
<th></th>
<th>Time 1</th>
<th>Time 2</th>
<th>Time 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TVIP Spanish</td>
<td>PPVT English</td>
<td>TVIP Spanish</td>
</tr>
<tr>
<td>P1</td>
<td>88</td>
<td>79</td>
<td>106</td>
</tr>
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<tr>
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</tr>
<tr>
<td>%ile</td>
<td>0.1</td>
<td>7</td>
<td>18</td>
</tr>
</tbody>
</table>
### Table 3.
**Expressive Vocabulary Development In Spanish & English**

<table>
<thead>
<tr>
<th></th>
<th>Time 1</th>
<th>Time 2</th>
<th>Time 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CELF-4</td>
<td>CELF-5</td>
<td>CELF-4</td>
</tr>
<tr>
<td></td>
<td>Spanish</td>
<td>English</td>
<td>Spanish</td>
</tr>
<tr>
<td></td>
<td>RS</td>
<td>FS</td>
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<tr>
<td>P1 Scaled score</td>
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<td>6</td>
<td>5</td>
</tr>
<tr>
<td>%ile</td>
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<td>N/A</td>
<td>5</td>
</tr>
<tr>
<td>P2 Scaled score</td>
<td>2</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>%ile</td>
<td>N/A</td>
<td>N/A</td>
<td>&lt;1</td>
</tr>
</tbody>
</table>

*Note. FS represents Formulating Sentences. RS represents Recalling Sentences.*
Figure 1. Participant 1 and Participant 2’s receptive vocabulary in both English and Spanish per scores on the PPVT and TVIP.
Figure 2. Participant 1 & 2’s expressive language per scores on the Recalling Sentences task.
Figure 3. Participant 1 & 2’s expressive language per scores on the Formulating Sentences task.
Table 4. Working Memory Per Digit Span Task

<table>
<thead>
<tr>
<th>Time</th>
<th>English</th>
<th>Spanish</th>
<th>English</th>
<th>Spanish</th>
<th>English</th>
<th>Spanish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time 1</td>
<td></td>
<td></td>
<td>12</td>
<td>N/A</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>Time 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time 3</td>
<td></td>
<td></td>
<td>4</td>
<td>N/A</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

Note. MLU refers to Mean Length of Utterance. NDW refers to Number of Different Words. The narrative levels used in this study are taken from Stadler & Ward (2005).

Table 5. Mean Length of Utterance, Number of Different Words and Narrative Level Used In Spanish & English

<table>
<thead>
<tr>
<th>Time</th>
<th>English</th>
<th>Spanish</th>
<th>English</th>
<th>Spanish</th>
<th>English</th>
<th>Spanish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time 1</td>
<td>N/A</td>
<td>N/A</td>
<td>11.5</td>
<td>10.8</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Time 2</td>
<td>N/A</td>
<td>N/A</td>
<td>68</td>
<td>81</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Time 3</td>
<td>N/A</td>
<td>N/A</td>
<td>Listing</td>
<td>Listing</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Note. MLU refers to Mean Length of Utterance. NDW refers to Number of Different Words. The narrative levels used in this study are taken from Stadler & Ward (2005).
Discussion

This case study examined the growth of the language skills of a bilingual school-age student with a diagnosis of SLI and her presumed language-typical twin over a period of 9 months. Specifically, a battery of standardized and nonstandardized tests were administered in both English and Spanish to assess their language and working memory skills at three time points over the course of 9 months. The results showed that while the twin with SLI scored lower on all assessments, her sister's performance also suggested an atypical language profile, which may or may not be explained by the interactions of L1 and L2. The following section further discusses the outcome of the study, including potential reasons for the similarities and differences in their profiles.

Language Profiles

Research Question: What are the differences in the language and cognitive growth of a set of twins as measured by: mean length utterance, number of different words, working memory, and standardized receptive and expressive language scores?

The current study looked at the language growth of a set of bilingual twins in both English and Spanish. The first aim of this study was to determine the differences in the language and cognitive profiles of the twins. After analysis of the data, it was determined that although the twins did have differing language profiles, both twins demonstrated characteristics of atypical language. Participant 1 presented with a language profile characterized by low average receptive language skills, very low expressive language skills and an average MLU as compared to her age-matched peers. Participant 2 demonstrated increased deficits in all areas tested. Her best performance on most standardized tests
matched her twin’s lowest performance on the same tests. Overall, she presented with very low receptive, expressive and MLU when compared to her age-matched peers.

Despite performing substantially higher on the receptive language portion than her twin, Participant 1 still scored within the low average to very low range on all tests, especially expressive language tests, in both languages. There are two possible explanations. First, it is likely that P1’s low performance in both languages are related to the fact that she is learning 2 languages at different times. Over the course of the 9-month testing period, her scores dropped at Time 3. This may denote a loss of language, which can be seen in those children who are learning two languages (Kohnert, 2010), as their language dominance shifts to L2. This loss would be more significant as that seen in bilingual children with SLI (Restrepo & Kruth, 2000). Additionally, her English expressive language skills were less developed than those of her age-matched monolingual peers, and her receptive vocabulary in both languages were slightly less robust. These findings could, again, be attributed to the fact that English is not her native language and she is still in the process of acquiring skills that her monolingual peers have already mastered (Bialystok et al., 2010).

Another possible explanation about P1’s performance in both languages may suggest that Participant 1 has a language Impairment (LI). Key deficits noted in her simplistic narrative and low scores on the Formulating Sentences subtest indicate that her LI primarily affects her expressive language skills; however, the extent and severity of this impairment are unknown. In order to qualify for academic services, such as those provided through and IEP, the Colorado Department of Education requires that a student qualify for services per the evaluation of a team of educators via the Colorado Communication
Severity Rating Scale (www.cde.state.co.us/cdesped/sli_guidelines). Additional information concerning the extent to which a LI impacts Participant 1’s academic performance would be necessary to determine her eligibility for formal services on this form.

While Participant 1’s language skills may affect her academic performance, Participant 2’s deficits in expressive language, working memory and attention pose a much higher barrier to success in a classroom setting. Based on the IEP services that she receives, it appears that she is struggling to access classroom material without educational supports. In the classroom, her attention deficit would impede her ability to participate in activities while her working memory deficit would make retention of information problematic. Additionally, she would have difficulty participating in classroom discussions or writing assignments due to her expressive language deficits. Overall, Participant 1’s deficits seen during testing are would stunt her academic progress and support her need for substantial educational supports.

In terms of cognition, the twins may have similar nonverbal intelligence and support Participant 2’s diagnosis of SLI. Prior twin studies, as stated in Bishop (2009), have found that cognitive traits are moderately to highly heritable. This trend can be seen in the twins’ similar receptive language scores at Time 1. This finding, in conjunction with her low performance on expressive language assessments, supports Participant 2’s diagnosis of SLI. It also supports several research studies which document the influence of genetics on intelligence and language (Bishop, North & Donlan, 1995; Bishop, Laws, Adams & Norbury, 2006); McGregor, & Capone, 2004; Tomblin & Buckwalter, 1998). According to the research by Bishop, North and Donlan (1995), there is strong heritability of language disorders, such
as SLI. Despite this connection, Participant 1 has never been diagnosed with SLI or any language impairment, which echoes the findings of Tommerdahl and Drew (2008) who noted the striking similarities in language profiles of a set of twins whose intelligence differed.

Despite similarities in receptive language, the twins’ performances on tasks that required working memory, including Digit Span and Recalling Sentences, were markedly different. Their scores on these subtests did not fall within one percentile or standard score. During the Recalling Sentences subtest, Participant 2 repeated the presented sentences as the administrator said them, which suggests an inability to hold the information for even a short period of time before repeating it. This was in sharp contrast to Participant 1’s behavior, who waited for the administrator to finish each sentence before attempting to repeat it. The twins’ similar performance on Digit Span in Spanish may be attributed to their lack of Spanish language math instruction, which lowered Participant 1’s score but did not greatly alterParticipant 2’s score due to her difficulty with the task overall.

In addition to Participant 2’s deficits in working memory, she also demonstrated trouble attending to the tasks at hand. Throughout all testing sessions, she needed frequent redirection to remain on task. At times, it was necessary to remind her of the task directions and prompt her to respond to questions because items in the testing environment distracted her. No attention deficits were mentioned in the parent interview, yet her behavior during testing showed clear deficits in this area. The impact that this had on her performance is impossible to quantify without specific testing but seems significant, especially when combined with her deficits in working memory. The effect that this has on
her ability to learn language and participate in an academic classroom is most likely considerable.

Another difference in their language profiles can be seen in Table 4, which shows the disparity between the twins’ MLUs in the narratives both in English and Spanish. Participant 1 used over 10 morphemes per utterance during her narrative, whereas participant 2 only used 4-6 morphemes per utterance. MLU tends to increase by 1.2 morphemes per year until age 5 (Miller & Chapman, 1981). By age 8, most children have obtained an MLU of 5+ words, which both participants did; however the disparity in morphemes was striking.

Furthermore, the twins have differing perinatal histories that may account for the differences in their working memory and expressive language skills. This would support research by Briscoe, Gathercole and Marlow (1998), who found that preterm infants were at risk for SLI, but contrast research by Aram, Hack, Hawkins, Weissman and Borawski-Clark (1991) which states that SLI is not more common in very low birthweight children. In the study by Briscoe, Gathercole and Marlow, deficits were shown by impairments in short-term memory, as noted by a reduction in performance on digit span, expressive language and receptive and expressive vocabulary. The study concluded that complications of premature birth may cause a deficit in phonological short-term memory that leads to overall deficits in language development, but not necessarily in general intellectual ability. Thus, the current study supports the findings of Briscoe, Gathercole and Marlow, as both participants were born prematurely, but Participant 2 suffered greater complications of premature birth. This, in turn, may have lead to a deficit in working memory, as noted in her performance in Digit Span and Sentence Recall, which rely heavily on working memory.
Other factors may have also affected the participants’ performances. Calvo and Bialystok (2014) researched the effects of bilingualism and socioeconomic status on language development in young children. They found that both bilingualism and low socioeconomic status were related to lower scores on language measures. The participants in the current study are both bilingual, and considered to be from a working class family. These factors would affect both participants’ scores similarly, resulting in lower scores than their peers overall, though to what degree is unknown.

Additionally, it is possible that Participant 1 is underperforming or mimicking her twin’s low performance to gain attention, to protect the emotional bond between them, or for another unknown reason. Finally, Participant 2 may have an undiagnosed intellectual impairment that contributed to her lower overall performance. At the time of testing, neither the participants’ mother nor the school had expressed any concerns in this area; however, Participant 2 does receive Special Education services beyond those in the area of Speech/Language. Because this study did not specifically address nonverbal intelligence, it is difficult to estimate the participants’ actual IQ or the degree to which this contributed to her testing.

**Rate of Change**

Research Question: *Are there changes over time in the participants’ language profiles, and is there a difference in the rate of change?*

It appears that there was a change over time in P1 and P2’s language skills. However, the rate of change in the twins’ language development was nonlinear. P1 was observed to have a bell-shaped growth curve for her receptive vocabulary, Spanish FS, English RS and Spanish RS. Her English FS was U-shaped. P2 showed a bell-shaped growth
curve in her Spanish receptive vocabulary, English RS and English FS. Her English receptive vocabulary was negatively linear, while her English and Spanish RS curves were positively linear. Both participants presented with a positive, nonlinear rate of change on most tasks. The exceptions being P2’s performances on the Formulating Sentences in Spanish, which was negatively nonlinear, and her English receptive vocabulary, which decreased at each time point. The decrease in English seems unusual in light the twins’ exposure to increasingly complex language in the classroom, whereas there was no increase in complexity of the home language of Spanish. Thus, this seems in contrast to research by Lindsey, Manis, and Bailey (2003) and by Kohnert (2010) who found that maintaining proficiency in Spanish depended heavily on home language use whereas English proficiency increased as a result of academic use. It is possible that distractions in the testing environment, as well as P2’s inability to attend during long testing sessions may have affected her performance. Additionally, a regression due to the timing of the testing is possible. This is discussed next.

As seen in Figures 1-4, there was a spike in the twins’ performances at Time 2 in several subtests. The reason for this spike is unknown, and it is notable as it occurred just after the school year ended. A slight regression was then seen at Time Point 3, just after the new school year began. This dip in scores might have been caused by the preceding break from school that can lead to a regression of skills in some students. A research study by Lawrence (2012) showed that students whose parents speak a minority language (L1) at home show a large setback in vocabulary learning during the summer months when they have less exposure to the academic language (L2). Similar research has noted that a summer reading program or workbook activities may counteract some of this regression, if
the program materials are well-matched to the students (Kim & Guryan, 2010). It is suggested that parents and teachers seek ways to continue incorporate L2 into summer activities, whether they be academic or social. If substantial regression can be documented, then Extended School Year may be appropriate for both participants in order to address language loss.

**Clinical Implications**

While clinicians should take all information into consideration when assessing and diagnosing language impairments, caution should be taken when comparing language skills between twins. Each client’s skills should be evaluated on an individual level and compared to age-matched peers to avoid false assumptions, such as those seen in the current study. Furthermore, the strong emotional link between twins should be taken into consideration when working with this population (Hayashi, Mikami, Nishihara, Maeda, & Hayakawa, 2014). A client may malinger or mimic to maintain this emotional link or gain equal attention.

As discussed above, a striking regression in both participants’ receptive vocabulary scores was seen at Time 3, which altered the growth curve trajectory for both L1 and L2. A similar trend was seen in their expressive language growth curves. This regression may be caused by a lack of exposure to L2, and perhaps L1 in a social context with their Spanish-speaking peers, which is inhibiting their language growth overall. While it may not be reasonable to expect significant growth in vocabulary over the summer break, attempts should be made to maintain the gains made during the school year. If this is not possible, additional services during the summer may be appropriate.
Working memory is not a skill that is explicitly taught in the classroom; however, it is necessary for learning. P2 performed much better than her twin on both measures of working memory (Recalling Sentences and Digit Span), yet she still demonstrated difficulty with these tasks. Similar to the regression discussed above, P1 demonstrated a slight dip in her total in the Digit Span task at Time 3. P2’s Digit Span score increased slightly between time points, as did her score on Recalling Sentences, which does not denote a significant improvement. Since both participants show working memory to be a relative weakness, and demonstrated little to no growth in this area, they may benefit from focused instruction or practice in this area.

Research by MacLeod, Fabiano-Smith, Boegner-Pagé and Fontolliet (2013) showed that as exposure to the majority language increased, receptive vocabulary in the minority home language tended to lag. Increasing or maintaining diverse opportunities for exposure to the minority/home language may help counteract this trend. To this end, it is suggested that parents continue to focus on using the minority language as much as possible at home and in community settings. Teachers and speech pathologists should encourage the use of the home language whenever appropriate. Reading is one way to expand students’ exposure to diverse vocabulary in the home language. Many mainstream books are available in minority languages, especially Spanish, and can be found for any reading level.

Overall it appears that both twins may benefit from receiving speech and language services. This is based on the twins’ lack of complexity in their expressive language in comparison to their age-matched peers, as seen in their narrative language and scores at or below 1.5 standard deviations from the mean on expressive language assessments. Though P1 may only qualify for minimal interventions, she may still benefit from additional
support. Currently only the twin with the more significantly impaired language is receiving any services. This may be due to the fact that the twin with higher language skills is more intelligible, more social and has less behavioral issues, as well as having less difficulties with working memory, which highlight her twin’s impairment. As stated above, other factors may be contributing to the data in this study, such as underperformance or an undiagnosed IQ impairment, which are masking an accurate evaluation of the twins’ language profiles.

**Theoretical Implications**

In the current study, the presence and severity of periventricular lesions is unknown, but possible these lesions can occur as a complication of treatment of neonatal respiratory distress such as that suffered by Participant 2 (Patrianakos-Hoobler, Msall, Marks, Huo, Schreiber, 2009). These lesions have been linked to deficits in phonological working memory. Thus, the increased difficulty with phonological working memory in Participant 2 may be caused by increased perinatal cerebral trauma. Additionally, P1 may suffer from a milder form of LI due to similar complications related to her premature birth. The knowledge that this risk factor exists is promising for twins/multiples and other children who are born prematurely. Clinicians working with children should review health histories when assessing clients. Early intervention in the area of language development, particularly phonological working memory, should be considered for this demographic.

This study attempted to fill a gap in the paucity of research surrounding language disorders in bilingual twins, specifically examining a set of twins with differing language profiles. While findings supported P2’s diagnosis of SLI, P2’s lag in language growth can be explained by two theories. As previously discussed, the first is a monolingual approach,
which compares her performance in each language to her age-matched monolingual peers in the same language. According to this approach, she would appear to have a language impairment that primarily affects her expressive language, especially in English. Her purported impairment would support research of the heritability of language disorders in twins (Newbury, Bishop & Monaco, 2005).

In contrast, the bilingual approach views the participant’s overall language skills as an aggregate of their skills in each language. From this standpoint, P1’s lagging language growth would be caused by her bilingualism. Based on the fact that P1 had greater difficulty with English, her second language, the findings seem to point to the latter approach. Thus, the study offers additional information for clinicians on the possible differences that may be seen in twins’ language, despite controlling for genetics, language dominance and some environmental factors in a way that larger bilingual studies cannot.

Yet, it is not clear if external factors such as emotional bonding and expectations from others might contribute to the long-term outcomes of both P1 and P2. Due to the strong tie between twins, it is possible that P1 may be malingering to receive additional attention or to minimize the apparent differences between them (Hayashi, Mikami, Nishihara, Maeda & Hayakawa, 2014). On the other hand, it is possible that pressure from peers and support from educators may accelerate the participants’ language growth. While the impact of these external factors is not known, it is hoped that researchers can utilize this case study as an example of possible language growth in a set of bilingual twins.

Moreover, the results of this study are consistent with previous research on the impact that working memory and attention deficits can have on language learning. Research by Briscoe, Gathercole, and Marlow (1998) found a propensity for children born
prematurely to have deficits in short-term memory. This phenomenon was seen in this case study, as both participants had some difficulty with working memory tasks, though P2 had significantly more. This deficit impedes retaining and processing language models in the environment (Baddeley, 2003). Furthermore, it was found that attention disorders and language impairment are often comorbid (Tirosh & Cohen, 1998). Overall, P2’s deficit in working memory and her inability to attend to information in the environment negatively impact her ability to learn either L1 or L2.

Limitations and Future Directions

All research is prone to certain limitations. The following limitations apply to the current study. Data was only collected at three time points. This limits the validity of the rate of change. Furthermore, time points were not conducted within the same school year; Time Point 3 fell during the summer months, which is often a moment of minor relapse in learning for many students. Future research may choose to expand the time frame and include more time points within a single school year to clarify the rate of change over time.

The current study was conducted using a convenience sample of only one set of twins, which limits the reliability of the results overall. Future research may benefit from expanding the study to include additional monozygotic twin/triplets, though it should be noted that the level of bilingualism would vary between each set of participants.

Another area of limitation pertains to the testing environment. Participants were tested in their home during the first two time points. Due to a temporary family situation, testing occurred at a public park during the third time point. Thus, the testing environment was inconsistent across time points. This inconsistency could have impacted the participants’ performance. Despite attempts to limit distractions, all testing environments...
during this study were less than ideal, due to auditory and visual distractions. These included siblings in the home, as well as outdoor distractions during testing at Time Point 3. Future research should attempt to further limit interferences with the participants’ focus during testing.

In terms of administration of the protocols, there may have been a reduction in intrarater reliability in scoring due to the limited training received by the secondary administrator. This may have caused some variation in scoring. Any subsequent studies should attempt to decrease this by providing additional training and/or requesting that a trained third party verify the scores.

In order to compare the participants’ Spanish and English language skills, corresponding tests were chosen in each language. In general, the availability of Spanish-language standardized tests is limited. This restricted the choice of corresponding testing materials. Specifically, the TVIP is outdated and contains some vocabulary words that are not likely to be used or known by the participants. Moreover, the dialect of Spanish presented in both of the standardized tests (TVIP and CELF Spanish) is considered Mexican American, which likely varies in some aspects from that spoken in the home (i.e. Guatemala and Northern Mexican dialects). Without the creation of updated testing materials, these limitations would be difficult to resolve.

Finally, a diagnosis of SLI is based on language impairment in an individual who has a typical nonverbal intelligence (Plante, 1998). The current study utilized the PPVT, a receptive language test, to assess intelligence. This decision was based on research by Hodapp & Gerken, 1999) which supports a strong correlation between receptive language and nonverbal intelligence. However, the fact remains that the PPVT is a language-based
assessment and, thus, cannot be considered fully reliable in assessing general intelligence. Future research could include a nonverbal intelligence test, such as the Comprehensive Test of Nonverbal Intelligence (CTONI).
References


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