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**Spanish and English Biliteracy in Dual-Language Classrooms:
A Linear Growth Model for Two Parallel Processes**

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Introduction

Bilingual education has a long history in the United States, with decades of research documenting its effects. Baker, Basaraba & Polanco (2016) reviewed the effects of bilingual education on the academic performance of English learners from 1985 to 2003. They also reviewed the bilingual education studies since 2003 using meta-analyses. They found that bilingual education in the United States has been popular among different ethnic groups especially for students of Hispanic or Latino origin. It has gained attention from middle-income parents who view bilingual education as an opportunity for their children to obtain a broader view of the world and be more competitive in the job market.

Until recently, bilingual programs were more common in areas along the US-Mexico border where Spanish has been spoken for centuries. English-only programs were more predominant in the southwest as a means to acculturate Spanish-speaking children, but that changed when Lyndon Johnson signed the Bilingual Education Act, which encouraged the recognition of the needs of English language learners (Navarrete, 2018).

Using Brofenbrenner's ecological theory of child development (Brofenbrenner, 1977; Brofenbrenner & Ceci, 1994), this study will explore the systems within the classroom, both quantitatively and qualitatively, while taking into account the larger macro environment of the US-Mexico border. To be more specific, this research will explore how student's growth in English and student's growth in Spanish occur and interact with one another in dual-language programs in the southwestern United States in school systems with proximity to the US-Mexico border.

Brofenbrenner's theory consists of five systems that impact human development. The microsystem consists of the relationships between a person and their immediate environment, including close family relationships. The microsystem is a child's immediate environment, and

includes the family, school, church, etc. The mesosystem includes relationships in these major settings. The exosystem is social structures, including the major systems in society, such as mass media, social services, and local politics. The macrosystem refers to the overarching patterns of the culture or subculture such as economic and educational systems, and the chronosystem explores changes over time (Bronfenbrenner, 1977).

Literature Review

Bilingual Programs and Dual-Language Education

Bilingual education has been popular throughout the US as a way of assimilating immigrants into the larger community (De La Trinidad, 2015). It was common in east coast states during the 1800s and spread to western states. After World War I, foreign language programs were dismantled as the idea grew that immigrants needed to learn English. The pendulum swung back during World War II as demand grew in the southwest for education in Spanish. This trend continued through the 1960s, and Cuban emigres in Miami began to demand Spanish-language instruction (De la Trinidad, 2015), followed by the adoption of the Bilingual Education Act (Navarrete, 2018). Then the pendulum swung again with an English-only movement in the 1990s (Y. K. Kim, Hutchison, & Winsler, 2015), only to have dual-language programs emerge again in the 2000s when the benefits of knowing two languages become more well-known.

A bilingual program incorporates instruction in two languages with the goal of developing English proficiency. These are typically transitional bilingual education, where the student transfers into an English-only classroom as quickly as possible (Y. K. Kim et al., 2015). Dual-language models are a type of bilingual education (Acosta, Williams & Hunt, 2019). Most frequently in the US, dual-language programs' languages are English and Spanish, and the

programs are designed to serve native English speakers and native Spanish speakers concurrently, developing language skills for both types of students (Barrow & Markman-Pithers, 2016). One-way dual-language programs typically have Spanish-speaking students being taught in both languages. Two-way dual-language programs have both English and Spanish native speakers.

The most common models are the 50/50 model and the 90/10 model (Acosta, Williams & Hunt, 2019). The 50/50 model has half of the instruction in English and half in Spanish. The 90/10 model starts with 90% of instruction given in Spanish in kindergarten and then gradually increases the amount of English until students are taught 50% in English and 50% in Spanish. This program is typically implemented when young students may need help increasing their language skills in their native language.

Polanco and Baker (2018) investigated the traditional bilingual program (the 90/10 model) and the two-way bilingual program in the United States. They found that there are non-significant differences in reading outcomes between the two methods. Bilingual programs are not detrimental to English learners, and there are additional benefits to having a bilingual program beyond potentially enhancing reading outcomes. They also found that strategies that work well in a general education classroom for English native speakers also work well for English learners.

Reyes (2006) explored the ways in which young emergent bilingual children begin to develop literacy in Spanish and English using a qualitative socio-psycholinguistic perspective. Samples were from southern border in the state of Arizona. She found that these emergent bilinguals learn and develop their own theories and concepts about language and literacy from an early age. She also found that context is another important factor that contributes positively to the development of their emergent bilingualism and biliteracy.

The proliferation of dual-language programs in the US may be due to the body of research that reviews the benefits of being able to speak and understand two languages. The benefits of bilingualism include greater cognitive complexity and executive function, increased competitiveness in a global market, and perhaps a reduction in old age dementia in later life (Byrd, 2012).

Polanco (2019) studied whether Latino bilinguals are more likely to have a job and/or engage in volunteering activities compared to Latino non-bilinguals in the US. He found that Latino bilinguals are more marketable and make more income than Latino non-bilinguals. Latino bilinguals also engage in volunteering activities in communities more than Latino non-bilinguals. Bialystok & Senman (2004) found that bilingual preschoolers seem to have somewhat better skills than monolinguals in understanding others' perspectives, thoughts, desires, and intentions. Bilinguals appear to perform a little bit better than monolinguals on tasks that involve switching between activities and inhibiting previously learned responses (Bialystok, Craik, & Luk, 2012).

Bilingualism, not monolingualism, is now the global norm (Shanahan, 2009). Ricento (2005) found that there are now more people in the world who speak English as a second language than there are native English speakers. That said, bilingualism and biliteracy are rising in many parts of the world, with perhaps one in three people being bilingual or multilingual. Shanahan (2009) also found that first-language literacy can confer advantages to English-language learners. First-language oral proficiency influences development in second-language speech discrimination and production. First-language literacy is related to literacy development in English, including word reading, reading comprehension, reading strategies, spelling, and writing. Students who are literate in their first language are likely to have an advantage in the acquisition of English literacy.

Bilingualism Versus Biliteracy

It is important to know that bilingualism is different from biliteracy. Students may be able to speak and understand both languages but literate only in one. Biliteracy is the ability to read and write proficiently in two languages. Armstrong (2019) defined biliteracy as *“the ability to read and write proficiently in two languages. Fluency in both reading and writing are present in biliteracy. Usually, someone who is biliterate has knowledge and skills to read and write in their home language and in a second language. Unlike a person who is biliterate that can read and write proficiently in two languages, the term bilingual is used to describe someone who can only fluently speak two languages. A person who is biliterate is also considered bilingual, but a person who is bilingual is not necessarily biliterate.”*

Biliteracy is a more recent goal of bilingual education since the benefits of knowing two languages have become more well-known. Less well-known is how growth in a native language corresponds to growth in a second language. Time spent on reading instruction for the second language may impede reading growth in the first language (Branum-Martin, Foorman, Francis, & Mehta, 2010). In an English-speaking curriculum, students who were biliterate in English and Spanish had higher scores in both languages than bilingual students who could only read in English (Proctor & Silverman, 2011). A longitudinal analysis of bilingual students in transitional English and English-immersion classrooms found that growth curves were similar for English and Spanish (Rojas & Iglesias, 2013).

Many countries outside of the US also have a long history of biliteracy and bilingual programs. Previous research applied either qualitative methodology (Baker, 2019; Lachance, 2018), quantitative methodology (Christoffels, Haan, Steenbergen, Wildenberg, & Colzato, 2015; D.-H. Kim, Lambert, & Burts, 2018; Lapayese, Huchting, & Grimalt, 2014; Woumans,

Van Herck, & Struys, 2019), or both methodologies (Dominguez & Trawick-Smith, 2018) to investigate bilingual/biliteracy programs. We were particularly interested in investigating the growth of Spanish and English in communities where two languages are often heard in the community. To our knowledge, no one has applied structural equation modeling to investigate biliteracy, and no studies investigate the impact of the slopes of English and Spanish, the intercepts in the two languages, and how one may be related to the other. For this reason, this study investigates how a student's growth in Spanish reading impacts a student's reading ability in English, and how a student's growth in English impacts reading ability in Spanish for students in elementary schools in US-Mexico border areas.

Methodology

Method

A mixed methodology design is applied in this study. First, we collected data from three school districts from two different states around the US-Mexico border and analyzed them using a longitudinal linear growth model for two parallel processes. Second, three school visits around the US-Mexico border were conducted by a team of four researchers. Teacher focus groups, principal interviews, and classroom observations were conducted in these three schools.

Part I: Quantitative Study

Samples and Measures

Samples in this study are students in kindergarten through fifth grades in three school districts in two states during the 2018-2019 school year. School District A is in a remote town with a population of approximately 15,000 people living in the district and an enrollment of approximately 5,000 students. The district is 71.6% Hispanic or Latino residents, 25.1% Non-Hispanic White, 1.9% African American, and 1.4% other races/ethnicities. A rural section of the

district is on the US-Mexico border. School District B is a large city directly on the US-Mexico border with approximately 58,000 students. The city has over 80% Hispanic or Latino residents. School District C is a midsize city with approximately 24,000 students, located within 60 miles of the US-Mexico border, and the city has approximately 59% Hispanic or Latino residents.

The instructional models varied across schools and districts. School district A allows the principals in the schools to decide whether to use a 90/10 or 50/50 program, depending on the characteristics of the student body. Most students enter a 90/10 program in kindergarten and quickly progress to 50/50 dual language in first grade. School district B has a mixture of both 90/10 and 50/50 programs, depending on the school. School District C uses a 50/50 model. We included all classrooms from school districts A and C. For school district B, we included only those classrooms that had a 50/50 dual-language model.

We obtained the data from Istation, an educational technology company located in Dallas, Texas. Each student took Istation's Indicators of Progress (ISIP™) reading assessments in English and Spanish monthly from September 2018 to May 2019. Students who had less than three data points of the overall reading ability score in English and 3 data points of the overall reading ability in Spanish were removed from the study. Because the overall reading ability score in Spanish and the overall reading ability score in English have different scaled scores, they cannot be compared to each other directly. Therefore, we used the percentile ranks to investigate the students' growth in Spanish and English. Students in these three school districts who took ISIP only in English or only in Spanish were removed from the analyses, as this study particularly focused on schools that used both assessments.

The ISIP assessments are computer adaptive testing (CAT) measures that provide continuous progress monitoring (CPM) in the critical domains of reading, and they are available

in English and Spanish. The English ISIP assessments are known as ISIP Early Reading (ISIP ER) and ISIP Advanced Reading (ISIP AR). ISIP ER was authored by Patricia Mathes, Joe Torgesen, and Jeannine Herron (2016), and it is for students in prekindergarten through third grade. ISIP AR is for students in fourth grade through eighth grade.

The Spanish ISIP assessments measure reading in Spanish in prekindergarten through fifth grade. They are known as ISIP Lectura Temprana (ISIP LT) for prekindergarten through third grade and ISIP Lectura Avanzada (ISIP LA) for fourth and fifth grades. The Spanish assessments, ISIP LT and ISIP LA, are not a translation or transadaptation of the English assessment. Rather, they were developed authentically in Spanish by Spanish educators, using culturally relevant content, and they cover skills that lead to literacy in Spanish. The Spanish assessments were based on theory regarding how reading is taught in Spanish (Istation, 2015) and drawn from the work of nationally known researchers in bilingual education, including Kathy Escamilla, Barbara Flores, and William Pulte.

Both assessments use two-parameter Item Response Theory and are driven by a fully computerized adaptive testing algorithm. ISIP gathers and reports frequent information about student progress in the critical reading domains throughout and across academic years (Patarapichayatham, Fahle, & Roden, 2013). All materials are online where students and teachers could easily access. Reports are available at student level, teacher level, classroom level, district level, and state level indicating single administration results and comparisons of results over time.

Table 1 shows the sample descriptions by district. A total of 3,437 students are included in this study: 417 students from school district A (86 students in kindergarten, 63 students in the first grade, 34 students in the second grade, 56 students from the third grade, 145 students from

the fourth grade, and 87 students from the fifth grade), 2,066 from school district B (282 students in kindergarten, 321 students in the first grade, 357 students in the second grade, 400 students from the third grade, 382 students from the fourth grade, and 324 students from the fifth grade), and 900 from school district C (84 students in kindergarten, 64 students in the first grade, 100 students in the second grade, 255 students from the third grade, 199 students from the fourth grade, and 198 students from the fifth grade).

Approximately 50% are female students and 50% are male students. Most of the students (93%) are Hispanic. We did not have information on which was their first or second language. In summary, there were 452 students in the kindergarten, 448 students in the first grade, 491 students in the second grade, 711 students in the third grade, 726 students in the fourth grade, and 609 students in the fifth grade from these 3 schools districts combined.

Model and Analysis

This study utilized a parallel-process linear growth model for each grade level with students from all three districts combined. A linear growth model is a longitudinal statistical technique used in a structural equation modeling (SEM) framework to estimate growth trajectories over time. It allows one intercept and one slope in the model. This study aimed to examine the relationship between growth in English and Spanish literacy. Therefore, we modeled two linear growth models simultaneously, which is a linear growth model for two parallel processes. This model allows us to investigate the relationships between two linear growth models simultaneously, which cannot be estimated if we fit each linear growth model separately. Figure 1 shows a linear growth model for two parallel processes.

In Figure 1, S1 indicates time point one (September 2018 assessment month) for students' percentiles in Spanish, S2 is time point two (October 2018 assessment month), and S9

is time point nine (May 2019 assessment month). Labels i_1 and s_1 represent the intercept and slope for the Spanish linear growth model. Similarly, E_1 and E_2 represent the English percentile ranks in time point one (September 2018 assessment month) and time point two (October 2018 assessment month), E_9 is time point nine (May 2019 assessment month), and i_2 and s_2 represent the intercept and slope for the English linear growth model. For both growth processes, the time scores of the growth slope factor were fixed to 0, 1, 2, 3, 4, 5, 6, 7, and 8 to define a linear growth model with equal time intervals between months. The coefficients of the growth intercept factors were fixed at 1 as part of the regular growth model parameterization. All parameters were estimated with the *Mplus* software, using the Maximum Likelihood estimator with robust standard errors.

Part II: Qualitative Study

The purpose of conducting a qualitative study was to confirm the quantitative findings and explore them in depth with educators. The qualitative study could also help us understand how the dual-language program is implemented in a classroom. We gathered all related documents for the Institutional Review Board (IRB) application, including interview questions for teachers, administrators, and principals; a classroom observation form; school visit schedule; teacher and principal consent forms; human subjects research training certificates from a Principal Investigator (PI) and all three key personnel, and a letter of support from school district A. The materials were submitted to the Southern Methodist University IRB to get permission to conduct school site visits. In the meantime, we trained our researchers for classroom observations and teacher focus groups. The PI (researcher 1) has a Ph.D. in educational measurement and evaluation. She has worked in Psychometrics, assessment, and educational research for 10 years. Key personnel 1 (researcher II) has a Ph.D. in Applied Demography. She

has worked in clinical assessment test development for over 20 years, with over 15 years spent managing large field research projects. She has worked in the educational technology field for one year. Key personnel 2 (researcher III) has a bachelor's degree in Computer Science and earned her master's degree in Computer Science and Cognitive Systems. She is a 25-year experienced bilingual teacher and has worked in the educational technology field for the past 7 years. Key personnel 3 (researcher IV) earned his master's degree in bilingual education. He is a 15-year veteran teacher and has worked in the educational technology field for the past four years.

Soon after the IRB was approved, we arranged a school visit with district-level staff. A consent form was sent to teachers and principals prior to our school visit. In each school visit, we conducted a teacher focus group with 4 or 5 teachers participating in each school. Focus groups took approximately an hour, and all sessions were recorded for accuracy. One of our researchers led the focus group, and the rest of our team participated and took notes. The principal interviews were conducted with the PI and one researcher. Each interview took approximately 60-90 minutes and was recorded.

Classroom observations were conducted at three schools. The researchers conducted the observations in teams and observed each classroom for approximately 30 minutes. Six to eight classroom observations across kindergarten through fifth grade were conducted by each team in each school. The schools used a model that had Spanish and English taught in the same classroom for the lower grades, and in the upper grades the students took some classes in English and then switched classrooms for their coursework in Spanish. We conducted classroom observations in dual-language classrooms, Spanish-only classrooms, and English-only classrooms. Photos were taken during the classroom observations and school visits, but we did

not take photos of students' or teachers' faces. We had some brief conversations with teachers during the classroom observations. The administration interview was conducted on the last day of our visit. One of our researchers interviewed the administration and the rest of our team participated, asked additional questions, and took notes. This interview took approximately 90 minutes and was recorded.

Results and Discussion

A mixed methodology design is applied in this current study. The quantitative data analyses were completed in fall 2020. Three school visits were conducted in early winter 2020. Teacher focus groups, principal interviews, and classroom observations were conducted.

Part I: Quantitative Study

Observed Mean Percentile Ranks of Spanish and English

Observed mean percentile ranks of Spanish and English from September 2018 to May 2019 for kindergarten to fifth grade in district A are plotted in Figure 2. Kindergarten students had higher scores in Spanish, and this trend continued for first and second graders. In third grade, students' intercept and slope continued to be higher in Spanish, and this trend continued in fourth and fifth grades. Students' Spanish scores were significantly higher than their English scores. Overall students in district A had higher performance in Spanish over English from kindergarten until the fifth grade.

Students in district B (see Figure 3), on the other hand, performed differently. In kindergarten, they started off at the same intercept for both languages, and students progressed further in Spanish than English during the year, but their performance in English and Spanish was almost the same at the end of the year. In first grade, students started at the same intercept, and the students' performance in English was higher than Spanish for the rest of the academic

year. Second and third graders looked somewhat different, as performance in English continued to be higher than Spanish in second and third grades. Their progression in English was significantly higher than in Spanish throughout the year. Fourth and fifth graders had English and Spanish scores that were almost identical, indicating they were equally proficient in both languages.

Students in district C (see Figure 4) showed almost identical results to district B. Students started off at the same intercept in the fall of kindergarten, and then students progressed further in Spanish than English throughout the year. In first grade, students started at the same intercept, and then the English scores were higher than Spanish for the rest of the year. Students' Spanish scores were higher than English in second and third grades. In fourth and fifth grades, however, their English and Spanish scores were almost identical, indicating they were equally proficient in English and Spanish.

Even though these three school districts implement a 50/50 model dual-language program, the results show students' performance in English and Spanish are different between districts. Students in districts B and C performed very similar to each other in both English and Spanish from kindergarten to fifth grades. They are in larger cities with more opportunities to hear English outside of their home. District A, however, performed quite differently from districts B and C. School district A has a remote village as part of the district, and the school is within 3 miles of the border. It is possible that the results from not only what students learn from a classroom but also their background, especially their first language (either the first language is English or Spanish). School district A will be explored in greater detail in the qualitative section of this paper.

SEM Results Using Linear Growth Model for Two Parallel Processes

The combined samples from all three districts are analyzed using a linear growth model for two parallel processes under SEM by grade level with nine data points from September to May. The observed mean percentile ranks at the beginning of the year assessment month (September-BOY), the middle of the year assessment month (January-MOY), and the end of the year assessment month (May-EOY) are shown in Table 2. Students started off higher in English across grades. Their English ability kept rising from BOY to MOY and EOY in kindergarten, first, second, and third grades. In fourth and fifth grades, their English ability remained almost the same from BOY to MOY and EOY. On the other hand, their Spanish ability kept rising from BOY to MOY and EOY in kindergarten, first, fourth, and fifth grades. Their Spanish ability slightly decreased from BOY to MOY and EOY in second and third grades.

Results from SEM using the two parallel processes procedure are summarized in Table 3. Fit indices from SEM showed a good fit model across grades. The Chi-square indicates overall fit with a rule of thumb of $p < 0.05$, our p -values were all $p < 0.001$ across grades. The Root Mean Square Error of Approximation (RMSEA) indicates a parsimony-adjusted index. Values closer to 0 represent a good fit with a rule of thumb of 0.08. Our RMSEA were 0.07, 0.05, 0.06, 0.06, 0.06, and 0.05 for kindergarten to fifth grades, respectively. The Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) indicate good model fit with a rule of thumb of 0.90 or greater. Our CFI and TLI ranged from 0.94 to 0.98 indicating very good fit between the model and the sample. Mplus software also provided the Standardized Root Mean Square Residual (SRMR) index. For SRMR, values closer to 0 represent a good fit with a rule of thumb of 0.08. Our SRMR were 0.11, 0.03, 0.05, 0.06, 0.07, and 0.06 for kindergarten to fifth grades, respectively. All fit indices confirm a good fit between our selected model and our data.

The estimated Spanish intercepts were 35.12, 35.29, 37.62, 32.42, 48.31, and 48.00 for kindergarten to fifth grade, respectively. On the other hand, the estimated English intercepts were 32.21, 34.84, 43.79, 42.87, 43.54, and 45.40 for kindergarten to fifth grade, respectively. Overall, students' performance in Spanish and English at the beginning of the year was almost identical in kindergarten, first, and fifth grades. In second and third grades, students' English performance is higher than their Spanish performance. In fourth grade, however, their Spanish performance was higher than English at the beginning of the year. Overall, students' English performance kept rising slowly from kindergarten through the fifth grade. They start off at 32nd percentile rank in kindergarten. They are at 45th percentile rank in fifth grade. Their Spanish performance also kept rising slowly from kindergarten (35th percentile rank) to the fifth grade (48th percentile rank), however their Spanish performance dipped in third grade (32nd percentile rank). The results show that students improve in both Spanish and English across grades.

The Spanish slope had a weak association with English intercepts. They were 0.13, -0.21, -0.14, -0.13, -0.33, and -0.17 for kindergarten to fifth grade, respectively. Student's growth in Spanish was positively associated with the English scores in Fall in kindergarten, but student's growth in Spanish was negative for the English scores in Fall in first through fifth grades. The English slope also had a weak association with Spanish intercepts. They were 0.07, 0.15, 0.17, 0.31, 0.08, and -0.01 for kindergarten to fifth grade, respectively. Student's growth in English was positively associated with Spanish scores in Fall across grades except fifth grade students.

The correlations between the Spanish and English intercepts were 0.36, 0.72, 0.37, 0.25, 0.45, and 0.42 for kindergarten to fifth grade, respectively. Student's reading ability in Spanish and English had a stronger relationship in first grade than in other grades, where the correlations

were small or moderate. If a student does well in Spanish, it is likely that he/she will do well in English at the beginning of the year as well. On the other hand, the correlations between the Spanish slope and the English slope behaved differently. They were 0.35, 0.39, 0.45, 0.50, 0.50, and 0.70 for kindergarten to fifth grade, respectively. These results indicate students had a hard time trying to merge and blend the two languages together in the early grades. Student's growth in Spanish were quite similar to their growth in English in third and fourth grades. Student's growth in Spanish were very similar to their growth in English in fifth grades. It is shown that students able to read at their grade level through the end of their third grade. Through third grade, literacy in these languages is emerging.

The findings suggest that the dual-language programs in this study are successful in terms of preparing students' English and Spanish in elementary schools. Students had a difficult time learning another language or learning both languages at the early grade levels. By third grade, their English and Spanish were close to proficient, and by the end of third grade, the gap between the two is starting to close. Fourth and fifth grade students were proficient in both English and Spanish. Fiester, Leila, and Ralph Smith (2010) explained why it is very important that students' reading should be proficient by the end of the third grade: *“Reading proficiency by the end of third grade can be a make-or-break benchmark in a child's educational development. Up until the end of third grade, most children are learning to read. Beginning of fourth grade, however, they are reading to learn.”*

Our results support their findings. It appears that these school districts have implemented dual-language programs with the goal of having their students become literate in both languages, and success begins to show in later elementary school.

Part II: Qualitative Study

Environment in the District, School, and Classrooms

We conducted qualitative research in school district A to better understand the systems at the school, within the broader macrosystem along the US-Mexico border. We visited three elementary schools in school district A, which is located within 30 miles from the US-Mexico border. These K-5 schools implement a 50/50 model and regular 100% English classrooms. Kindergarten classes typically start with a 90/10 model, transitioning students into 50/50 by first grade. One school used a 90/10, 80/20 model, meaning that English was gradually increased each year until there was an equal 50/50 split in third grade. They are Title 1 schools in a high-poverty area, with one school less than 3 miles from the US-Mexico border. There are approximately 500 students and 80 teachers and staff in each school. The schools were well equipped and in newer buildings. The main discussion during the teacher focus group, principal interviews, and administration interviews was the relationships between Spanish and English in the dual-language program, specifically how growth in Spanish reading impacts a student's reading ability in English, how growth in English impacts reading ability in Spanish, and the challenges they face when teaching both languages in the classroom.

Exposure to English

Teachers and administrators reported that students speak Spanish at home, and they are from high-poverty families. At the school nearest the border (i.e., the border school), many students are exposed to English for the first time in kindergarten, and their English exposure is limited to the classroom. They primarily watch Mexican television, and the border community is predominately Spanish speaking. Another school is located in town (i.e., the town school) and has a somewhat higher socioeconomic level. This school uses the 90/10 model, gradually increasing English to 50/50 by third grade. Students have more exposure to English in the

broader environment and watch US English, US Spanish, and Mexican television. There are a few students from English-speaking households in the dual-language program. The third school uses the 90/10 model in kindergarten followed by 50/50 dual language in first grade. This school had a higher poverty rate and encompassed an area that was part town, part rural (i.e., the town/rural school). The town/rural school was located across the street from a migrant worker apartment complex, and the other housing stock around the school is older and more dilapidated than the houses around the town school.

Teachers and school principals at all three schools reported that it is very difficult to get the young students to speak English during the school day. Teachers at the border school and the town/rural school also reported that many students are not proficient in Spanish, as they come from households with low literacy levels, few — if any — books, and limited access to the internet. The principal at the town/rural school indicated some students had exposure to methamphetamines in the home. The students who live in the migrant worker apartments are often responsible for getting to school on their own, even very young students. Teachers at the border school reported that parents teach their children to only speak when they are spoken to, and the parents have low vocabulary skills in Spanish. These students came from households with higher poverty than the students in the town or town/rural schools.

Dual-Language Curriculum

At all three schools, most of the curriculum in kindergarten is centered around teaching students Spanish and increasing their phonemic awareness, letter knowledge, and vocabulary skills in their native language. English is limited to 10% of instruction because students are struggling to learn Spanish as well as English. The school principals agreed that learning English is the biggest challenge for their students. Shanahan (2009) studied the development of literacy

in second-language learners. He found that second-language oral-language skills highly correlate with second-language literacy development, especially in the area of comprehension. Oral language does not increase reading comprehension, but it is necessary in order to be able to express comprehension. His findings help explain why these students encounter a difficult time speaking English at their early grades and confirms our findings from the quantitative and qualitative analysis.

In the dual-language classrooms, students learn the same grade-level curriculum aligned to the state standards. The schools have a mission to get their students ready for a state test in English in third grade or fifth grade at the latest. One school principal mentioned to us that “*one ultimate goal for our schools is that our students are ready to take a state test in English in the third grade.*” It is clear these schools are very aware of how important it is to prepare their students’ English to be on track by the end of third grade. Our results confirm research from Fiester, Leila, and Ralph Smith (2010), which indicates that schools should emphasize literacy by third grade.

A lack of Spanish teacher resources is a challenge for these schools. Teachers and school principals agree that a big challenge of their dual-language programs is having enough class materials in Spanish. Teachers report that they have adequate available resources in English, but they need more resources in Spanish. Teachers need support from the school and the district to be able to access to appropriate Spanish resources in order to make the best on 50/50 model in their dual-language classrooms. The administrators confirmed that more Spanish resources are needed and acknowledged that dual-language teachers do double the amount of work because they are teaching in both English and Spanish.

The qualitative study confirmed what we found in the quantitative analysis. Most of the students in the district were of Hispanic origin, and English is their second language. The administrators were dedicated to providing the opportunity to their students to learn English while preserving their Spanish. For most of the students at the schools we visited, Spanish is their first language, and it is their language of strength even after they have acquired English. When students are proficient in their first language, they are more likely to become proficient in a second language (Shanahan, 2009), and therefore the emphasis on Spanish in the early grades helps students acquire both languages, as the quantitative results demonstrate.

In the classroom, Spanish is used to bridge or transfer from their first language to their second language. Teachers and administrators said that the growth in English and Spanish complement one another in the later grades, and this confirms the correlations between the Spanish and English slopes we described earlier. The dual-language programs help these students improve their English skills over time, which helps them succeed in later grades. If they are not proficient in English, they may have a difficult time in middle school and high school as most of the coursework is in English. It is important to increase their literacy in English in elementary school, because research indicates that students who are not proficient in English by third grade have a higher likelihood of dropping out before completing a high school diploma (Fiester & Smith, 2010).

We also found that the success of the dual-language program is location or population specific. The larger school districts, located in mid-size and large cities, had greater success. The more remote district had higher socioeconomic disadvantage, and teachers reported that the students were not as exposed to local media in English when they were at home.

Classroom Observations

Our researchers observed six to eight classrooms in each school in dual-language classrooms, Spanish-only classrooms, and English-only classrooms. In kindergarten, Spanish and English were taught in the same classroom. Starting in first grade, students would switch classrooms, and English would be taught with one teacher, and Spanish with another. In the English classroom, all materials were in English, and teachers only spoke English. When a student asked a question in Spanish, the teacher would answer in English. In the Spanish classrooms, the teachers spoke Spanish, and all class materials in Spanish. Students seldom asked questions in English. For all dual-language classrooms, there was a mixture of English and Spanish in all classrooms we observed, but it would vary depending on the English or Spanish proficiency of the teacher. One classroom observation in the town school was conducted while fifth grade students were presenting their class projects in English. Some Spanish was spoken, but most of the presentations and questions were in English. The students we observed giving the presentations spoke English fluently without hesitation.

Teachers did not teach the same content in both languages, meaning that it was the students' responsibility to blend what they learned in two languages together and move forward daily. Teachers at all of the schools expressed concern that the curriculum moved very fast, and they were concerned that students had not grasped one standard before it was time to move on to another.

We saw similar patterns of instruction at all three schools. All classrooms we visited had evidence of a social/emotional component in the classroom, as well as academic. There were approximately 20-25 students in each classroom. We predominately observed students working in small groups of 4-6 students. One group of 2 or 3 students would work with a teacher and

receive small-group instruction. Other students studied online lessons through a laptop or a tablet. Some classrooms had one or two teaching assistants that helped deliver instruction.

The schools adapted well to the differences in the student body evident at each school. The border school had a strong emphasis on student biliteracy, and had the biggest challenge with teaching students to read since the students had limited access to English at home. The town school had somewhat higher socioeconomics, higher test scores, and was more middle class. The town/rural school was more similar to the border school in that the students came from households with greater socioeconomic disadvantage, particularly the students living in migrant worker housing. The town/rural school appeared to struggle the most academically with several changes in how the program had been implemented within the school.

Conclusion

Because of the uniqueness of the population around the US-Mexico border areas, the dual-language programs in the two states in this study may be different from dual-language programs elsewhere. However, as it is shown in this study, student's proficiency in English and Spanish is somewhat different depending on their background, the resources available at the school, and in the community. The schools we visited, although they were in the same school district, had unique characteristics and the schools adapted well to the different characteristics evident in their students.

Just as there were qualitative differences at the three schools we visited, there were quantitative differences between the three school districts in the performance of the dual-language program. Across all three school districts, we saw evidence quantitatively and qualitatively that the programs are meeting with success. Two languages are merging by the end of the third grade.

There are a number of factors to take into consideration when reviewing how the growth in both languages are related to each other. Students' first language, their support outside of the classroom, the location of the schools, their family background, and resources, teachers' training in dual-language program curriculum, and school and state policy are related to students' outcome in their reading ability in English and Spanish.

While language development in children in early grades is essential, it is also important to understand that early childhood is also a time of profound emotional, social, physical, and cognitive development. While biliteracy is important for some families, it might be less important for other families. Some families may focus on other development such as physical development or cognitive development. An administrator in school district A indicated that he sometimes has to convince Spanish-speaking parents to put their children in a dual-language classroom rather than an English-only classroom, as the parents recognize the importance of knowing English. He said when talking with parents, he stresses the importance of being literate in both languages and not just English.

Limitations and Future Study

The findings of this study will help inform parents, teachers, and policy makers better understand the relationship between a student's growth in Spanish and English in a dual-language program environment in a bilingual area of the country. While the results show the positive relationship between these two languages from kindergarten to fifth grades, there are several limitations in this study we need to mention.

First, we did not have students' first language and their second language. Information from teacher focus groups, principal interviews, and administration interviews show that many students are exposed to English only in the classroom in school district A, and that may not be

the case in school district B or C. In school district A, many students have parents that could not speak English and their parents preferred their students to be in a dual-language classroom so they can learn English. Teachers reported that they heard from some parents that they liked to work with the children at home so that the parents could learn English too. At the town school, there were some students that spoke English at home, and parents preferred that their children learned Spanish. Therefore, there are two subgroups of students in a dual-language classroom: students who speak Spanish at home and students who speak English at home. These two groups of students may have different growth patterns. We also believe student's first and second language information would be helpful to better classify and understand students in dual-language programs. These factors need to be included in future research.

Secondly, in school district A, only a subset of students took both the English and Spanish assessments. The majority of the students, especially in the earlier grades, only took the ISIP in their language of strength, in this instance, Spanish. Using data from Istation, it appears that there are also students in school districts B and C that only take the ISIP in Spanish, and this could bias our results since they were limited to those students that took both assessments.

Thirdly, while the Istation assessments have many subtests within each grade level, this study investigated only the overall reading ability in Spanish and English. The overall ability reading scores in English and Spanish are calculated using information from all items across subtests. Because each subtest represents a specific sub-skill and students need specific skills to solve a problem, we do not know the specific relationship between similar subtests in English and Spanish that might further explain the growth patterns. Future research should investigate the relationships between the different subtests.

Another limitation is that while we were able to look at effects longitudinally across the school year, we were not able to follow students across grades. Each grade in essence is a separate cohort of children. Future research should explore looking at the literacy patterns of the same students from kindergarten through fifth grade to better understand how learning to read in English and Spanish influence one another across the years. We were also not able to obtain much individual level information about the students and their home life, and thus we were not able to control for their immediate environment, other than the qualitative observations at the three different schools. To more fully implement Brofenbrenner’s theory, we would need to include more information about the immediate home environment.

Finally, given the unique context of the US-Mexico border area and its distinctive culture and history, the generalizability to dual-language programs in other areas of the US that have more recent arrivals may be limited. Newer arrival locations such as North Carolina, Nebraska, and other areas do not have the saturation of Spanish-language media that is evident along the US-Mexico border, and it may be easier for students to maintain their Spanish while growing their English skills in this environment. More future studies are needed to disentangle some of these effects that may contribute to biliteracy growth in two languages.

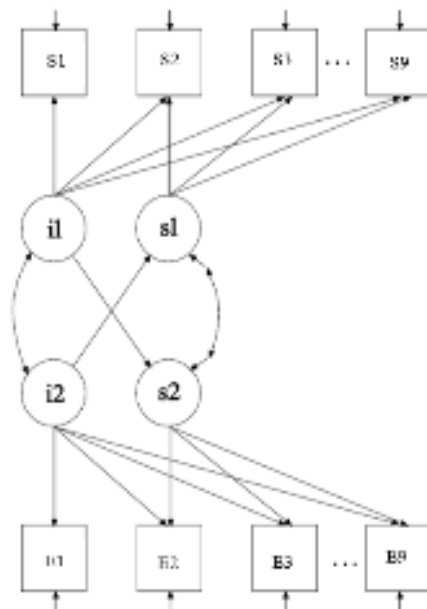


Figure 1: A Linear Growth Model for Two Parallel Processes

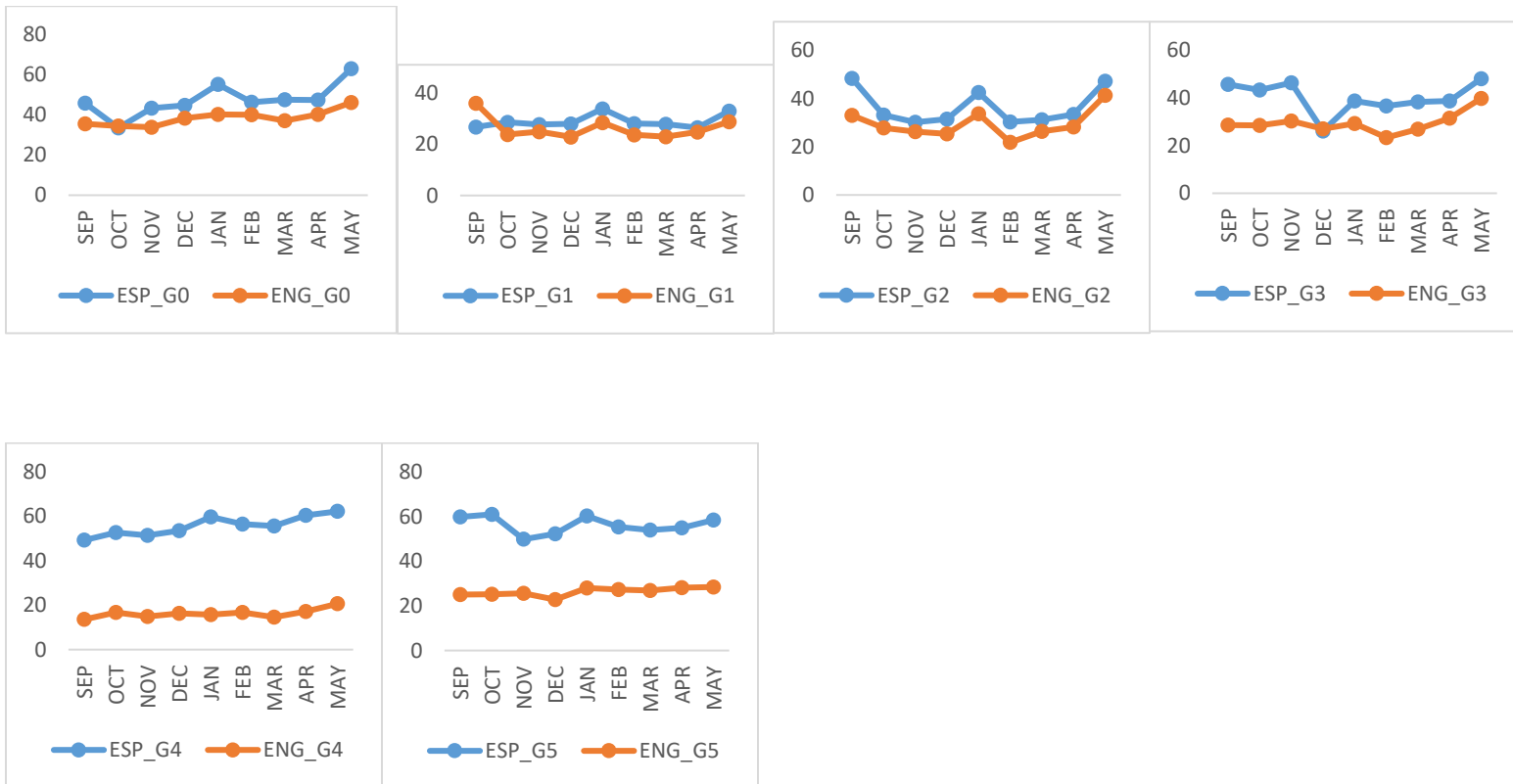


Figure 2: Observed Mean Percentile Ranks of Spanish and English for Kindergarten to Fifth Grade in District A

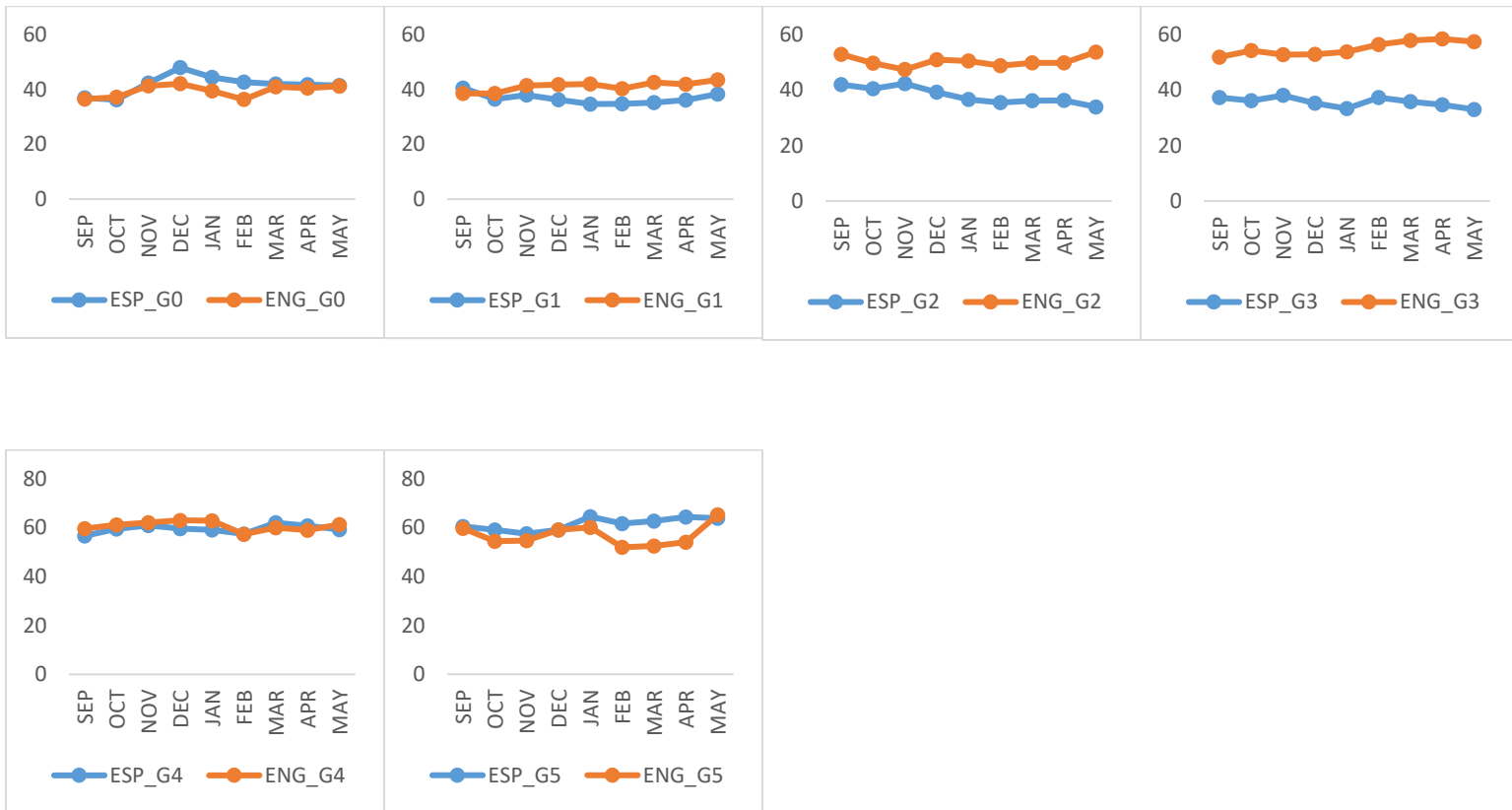


Figure 3: Observed Mean Percentile Ranks of Spanish and English for Kindergarten to Fifth Grade in District B

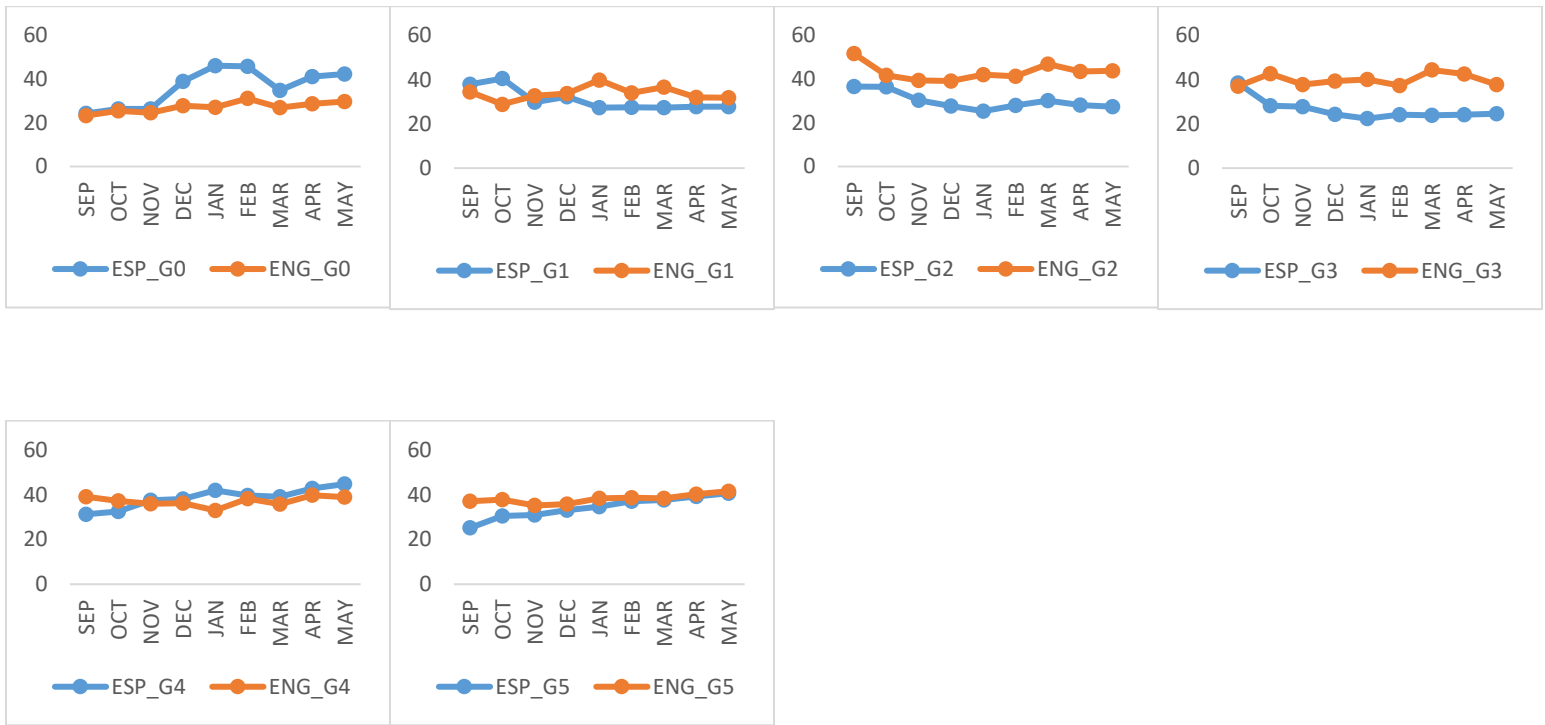


Figure 4: Observed Mean Percentile Ranks of Spanish and English for Kindergarten to Fifth Grade in District C

Table 1: Description of Samples

Grade	District A	District B	District C
Kindergarten	86	282	84
First	63	321	64
Second	34	357	100
Third	56	400	255
Fourth	145	382	199
Fifth	87	324	198
Total	471	2,066	900

Table 2: Observed Mean Percentile Rank at Beginning of the Year (BOY), Middle of the Year (MOY), and End of the Year (EOY) Benchmarking Assessment Months

Grade	n	Spanish			English		
		BOY	MOY	EOY	BOY	MOY	EOY
Kindergarten	452	26.31	46.27	44.49	34.50	37.56	40.02
First	448	34.94	33.83	36.44	38.13	40.57	40.12
Second	491	39.27	35.00	33.30	52.05	48.12	50.87
Third	711	34.35	29.93	31.21	47.94	48.50	49.26
Fourth	726	38.46	54.53	55.47	45.18	45.66	44.07
Fifth	609	43.22	53.67	53.93	48.84	49.30	47.27

Table 3: Two Parallel Processes Results

Grade	Chi-Square	RMSEA	CFI	TLI	SRMR	Spanish Slope on English Intercept	English Slope on Spanish Intercept	Spanish Intercept with English Intercept	Spanish Slope with English Slope	Mean Intercept Spanish	Mean Intercept English
Kindergarten	490.297 DF=159 P<0.000	0.068	0.938	0.940	0.113	0.128	0.073	0.359	0.354	35.117	32.206
First	371.394 DF=159 P<0.000	0.055	0.979	0.979	0.038	-0.205	0.153	0.723	0.390	35.286	34.837
Second	481.310 DF=159 P<0.000	0.064	0.967	0.968	0.055	-0.138	0.173	0.366	0.447	37.623	43.787
Third	553.309 DF=159 P<0.000	0.059	0.973	0.974	0.061	-0.133	0.309	0.245	0.504	32.423	42.872
Fourth	555.912 DF=159 P<0.000	0.059	0.971	0.972	0.072	-0.334	0.079	0.452	0.498	48.310	43.540
Fifth	406.707 DF=159 P<0.000	0.051	0.975	0.976	0.056	-0.170	-0.007	0.417	0.701	48.000	45.404

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