English vocabulary development in bilingual kindergarteners: What are the best predictors?

Article *in* Bilingualism: Language and Cognition · March 2006

DOI: 10.1017/S1366728905002361

1 author:

Yuuko Uchikoshi
University of California, Davis
35 PUBLICATIONS **649** CITATIONS

SEE PROFILE

Bilingualism: Language and Cognition 9 (1), 2006, 33–49 © 2006 Cambridge University Press doi:10.1017/S1366728905002361

English vocabulary development in bilingual kindergarteners: What are the best predictors?*

YUUKO UCHIKOSHI
Harvard University

This study examines growth rates in vocabulary over an academic year for 150 Latino English language learners. In October, February, and June of kindergarten, participants completed standardized measures of receptive and expressive vocabulary. Before the second and third assessments, a third of the children watched Arthur *three times a week during school hours, while another third viewed* Between the Lions. *The last third did not view either show during school hours. Data on children's preschool experiences and home literacy activities were collected. Growth modeling analyses show while there were no effects of classroom viewing, children who viewed* Arthur *and* Between the Lions *at home had steeper growth trajectories than those who had not. Additional effects of native language home use and preschool attendance were seen. Boys displayed better English vocabulary skills than girls. These findings suggest the importance of English exposure and native language maintenance for English L2 vocabulary development.*

Early vocabulary knowledge has been shown to be a strong predictor of subsequent school progress (Walker, Greenwood, Hart and Carta, 1994), in particular reading achievement (Anderson and Freebody, 1981). The size of children's vocabularies has been related to their ability to comprehend the words they encounter in print (Anderson and Freebody, 1981; Adams, 1990). Past research has shown that the size of a child's vocabulary is heavily dependent on the amount of exposure for monolinguals (Huttenlocher, Haight, Bryk, Seltzer and Lyons, 1991; Hart and Risley, 1995), and on input per language for bilinguals (De Houwer, 1995; Pearson, Fernández, Lewedeg and Oller, 1997; Patterson, 2002). Upon school entry, a six-year-old monolingual English child knows about 10,000 words (Anglin, 1993). Yet, young bilinguals are, on average, already behind their middle-class English-speaking peers in English vocabulary by first grade, since they typically have limited English exposure in their first few years of life (Snow, Burns and Griffin, 1998).

* This research was supported by dissertation grants from the International Reading Association and Harvard University Graduate School of Education.

I am thankful to Catherine Snow, Terry Tivnan, and Maria Carlo for their valuable comments on previous versions of this article. I also thank Carlo Santos, Frida Gomez, Kim Keith, Elisa Jazo, Kaytie Dowcett, Jill Jacobs, Jody Clarke, Jude Higdon, Patti Sullivan-Hall, Sara Roberts, Robyn Viloria, and Elizabeth Willmott for their assistance with data collection. Additionally, I am grateful to WGBH, as well as the principals, teachers, staff, and children of the schools for their support and participation in this study.

Research conducted on monolingual children has shown that vocabulary acquisition through exposure to language is heavily influenced by preschool children's school experiences (Nagy, Anderson and Herman, 1987; Rice, Huston, Truglio and Wright, 1990; Tabors, Roach, Snow, 2001; Vermeer, 2001; Hubbs-Tait et al., 2002) and home experiences (Snow and Goldfield, 1983; Wells, 1985; Whitehurst et al., 1994; Hart and Risley, 1995; Reese and Cox, 1999; DeTemple, 2001; Tabors, Snow, and Dickinson, 2001; Patterson, 2002). At school, such contexts include daily interactions with teachers and peers, story-telling time, and instruction time. In the home, such contexts include joint book reading time, television viewing, and interactions with parents and siblings. In both cases, research suggests that monolingual children effectively learn new words and increase their lexicon. Tabors et al. found that monolingual children from literacy-rich home and school environments perform well above average, while children from literacy-poor home and school environments perform well below average on various literacy tasks, including vocabulary.

However, only a limited number of studies (e.g. De Houwer, 1995; Pearson et al., 1997; Patterson, 2002) have examined the school and home activities in which young children learning English as a second language (ELL) experience input in each language, and how those activities may affect their pre-reading English vocabulary knowledge and growth. As the number of children who have limited proficiency in English in U.S. schools has risen dramatically over the past two decades, there is now an urgent need for more systematic research to be

Address for correspondence
School of Education, University of California, Davis, 2059 Academic Surge, Davis, CA 95616, USA
E-mail: *yuchikoshi@ucdavis.edu*

conducted on the development of their L2 vocabulary skills, in particular whether and what school and home activities make the largest contribution to their English vocabulary growth.

A representative preschool experience for monolingual children from low-income homes is Head Start. Head Start was founded to increase the school readiness of preschool children from low-income families, who tended to be disadvantaged (Zigler and Styfco, 1994). In a study of 94 Head Start children in which 59% of the children were Caucasian and 37% multiethnic, Head Start attendance was positively related to receptive English vocabulary for children from families with higher risk, defined as families with low-income, low cognitive stimulation, high parental intrusive behavior, and high maternal depression (Hubbs-Tait et al., 2002). These findings suggest that Head Start programs can provide the cognitively challenging discourse that exposes children to rich vocabulary and assists in their lexical development. Whether such preschool experiences benefit ELL children need to be investigated.

Like preschool programs, home literacy activities such as joint book reading have been shown to influence pre-reading monolingual children's vocabulary development (Snow and Goldfield, 1983; Robbins and Ehri, 1994; DeTemple, 2001).Children often learn new words and expressions through hearing their parents use them in routine situations. For example, Snow and Goldfield (1983) showed that the routinization of book reading situations and the predictability of adult utterances aid in children's language acquisition. Through interactive book reading sessions where a mother and child repeat reading the same book, the child learns to employ the strategy of remembering and producing the utterance that his mother had produced in previous book reading sessions (Snow and Goldfield, 1983). Additionally, Patterson (2002) shows that the frequency of being read to in each language was related to bilingual two-year-old children's expressive vocabulary size in the corresponding language.

Parents of ELL children may also read to their children in their own native languages, thus assisting in the children's overall L1 development, which may influence their overall L2 development. Past research has shown a direct relationship between L1 and L2 performance on reading (Cummins et al., 1984; Royer and Carlo, 1991; Nagy, Garcia, Durgunoglu and Hancin-Bhatt, 1993) and writing (Lanauze and Snow, 1989).

However, results concerning transfer effects at the lexical level have been contradictory. Verhoeven (1994), following the bilingual development of 98 six-year-old Turkish children living in the Netherlands since infancy, found transfer effects at the level of lexicon and syntax to be quite limited, though transfer effects at levels of pragmatic skills, phonological skills, and literacy skills were seen. That is, vocabulary size in L1 did not predict L2 receptive or expressive vocabulary development for the Turkish–Dutch bilingual children. Yet, Ordóñez, Carlo, Snow, and McLaughlin (2002) found that Spanish superordinate performance was a significant predictor of English superordinate performance for Spanish–English bilinguals in 4th and 5th grades. Additionally, researchers have found that cognate vocabulary increases the ease with which L2 vocabulary is acquired (e.g. Nagy et al., 1993). More empirical evidence needs to be collected to determine whether L2 lexical knowledge develops more efficiently in the presence of greater L1 word knowledge.

Research also shows that educational television, accessible at home to most children of all SES (socio-economic status), has the potential to serve as a facilitator of young children's first language acquisition (Lemish and Rice, 1986, Rice et al., 1990; Van Evra, 1998; Wright et al., 2001).[1] Rice (1983) showed that educational television writers adjust their dialogue depending on the intended audience. Certain language features are used in children's programming so that children can understand the content of the program. Rice pointed out differences in language use in programs between *Mr. Roger's Neighborhood* (targeted for a younger child audience) and *Electric Company* (targeted for an older child audience). Compared to the latter program, the former had more repetition of key words and phrases, which were emphasized by being presented in isolation or with vocal stress. Additionally, *Mr. Roger's Neighborhood* avoided novel words and nonliteral meanings, whereas such words were used in *Electric Company*. In a later study, Rice and Haught (1986) found that *Sesame Street*, also targeted for a younger child audience, used similar dialogue to *Mr. Roger's Neighborhood*. The features seen in these educational programs targeted for younger children are those typical of child-directed speech, which tends to be simpler than speech adults use to each other (Snow, 1984; Wells, 1985; Hoff-Ginsberg, 1986).

Additionally, studies show that monolingual English preschoolers can actually learn new English vocabulary while viewing educational television programs (Rice and Woodsmall, 1988; de Groot,1994). Rice and Woodsmall (1988) found that preschoolers could learn novel object, action, and attribute words in a viewing situation, with five-year-olds gaining more words than three-year-olds. Consistent *Sesame Street* viewing has also been associated with increased English vocabulary scores

[1] Educational television refers to shows that have a core educational or informational purpose. In 1990, the Federal Communications Commission (FCC) passed the Children's Television Act (CTA) which required commercial broadcasters to air programming that has a core educational and informational purpose targeted at children under age 16 (Hill-Scott, 2001). The programs must be regularly scheduled, weekly programs of at least 30 minutes aired between 7:00 a.m. and 10:00 p.m.

among monolingual children (Rice et al., 1990). Children aged 3–3;5 who were frequent viewers performed significantly better on the vocabulary test at age five than those who were not, controlling for initial vocabulary scores. While this study suggests that viewing *Sesame Street* influences vocabulary development, the authors acknowledge that the data are correlational and more evidence is necessary to establish causality.

Almost all of the studies on television viewing and children's language development have been conducted with monolingual children (Rice and Woodsmall, 1988; Rice et al., 1990). The limited research with ELLs has produced contradictory results. Research on elementary school-aged children has shown vocabulary in their second language can be acquired by viewing television programs in that language (Koolstra and Beentjes, 1999). Patterson (2002) found that the frequency of watching television by 64 bilingual children aged between 21 and 27 months was not significantly related to their vocabulary size in either language. Yet, television viewing in this study included non-educational television viewing hours. Results may differ if non-educational television hours were excluded. More research on the role of educational television, which has potential to be used as a scaleable intervention, needs to be examined.

Thus, one of the aims of this present study is to understand how two educational television programs, *Arthur* and *Between the Lions*, can influence vocabulary development among these ELL children from Spanish-speaking homes. Both *Arthur* and *Between the Lions* are 30-minute educational programs, broadcast on Public Broadcasting Services (PBS) stations across the United States, and targeted to audiences of preschool and kindergarten.

The *Arthur* television series are based on storybooks and children are exposed to various stories with moral points of interest to children. The show is about growing up. The characters in *Arthur* learn to make thoughtful decisions and resolve problems in each episode. The problems Arthur and his friends face are similar to the ones the viewers may face at home and at school. The show attempts to spark children's interest in reading and writing, and introduces new vocabulary embedded in the stories.

Between the Lions starts each episode with a read-aloud session. Yet, instead of focusing explicitly on the narrative, the show puts more emphasis on text structure, individual words, and other print features. Certain sounds and vocabulary words are focused on each episode. The series is designed to foster the literacy skills of its viewers. Each *Between the Lions* episode follows a "whole-part-whole" framework, adopted as the approach to literacy instruction. The story line of each *Between the Lions* episode begins with a read-aloud experience as the "whole," where portions of the text are displayed on the screen and words are highlighted as they are read (Rath, 2000). Then the "parts" are emphasized to point the viewers' attention to such topics as phonological awareness, letter-sound correspondence, word meanings, punctuations and other conventions of written English (Rath, 2000). At the end, the "whole" text is revisited and the "parts" are reviewed (Rath, 2000).

These shows were chosen for this study because they are educational television shows that are popular with kindergarteners and can provide ELL children with appropriate exposure to English vocabulary. Additionally, they were chosen as they are curriculum-driven shows and vocabulary is introduced in different ways; in *Arthur*, new vocabulary is embedded in the narratives, while in *Between the Lions*, new vocabulary is explicitly shown as words on the screen.

This study, therefore, addresses the limitations of previous research by focusing on the vocabulary development of ELL kindergarten children, specifically from Spanish-speaking homes. In particular, the following questions are addressed:

1. What is the impact of home and school viewings of *Arthur* and *Between the Lions* on vocabulary growth?
2. Are preschool experiences and other home literacy activities related to differences in receptive vocabulary and expressive vocabulary skills of early bilinguals?

Furthermore, this study employs individual growth modeling (IGM) (Singer and Willett, 2003; Willett 1994) to analyze the children's vocabulary development. As IGM makes use of repeated waves of data and conceptualizes change as a continuous process of development (Willett, 1994), it yields a more accurate picture of change over time than traditional techniques, such as ordinary regression methods.

Method

Participants

A total of 150 children (70 girls, 80 boys), attending 10 public schools in a large urban district located on the East Coast participated in the study. Spanish-English bilingual kindergarten classrooms were selected from these schools. Participants were recruited through these kindergarten classrooms, where teachers spoke to the children in both English and Spanish.

All children were from primarily Spanish-speaking homes and lived in neighborhoods that are heavily populated by Spanish-speaking people. District demographics and school data indicate that 80% or more of the participating students qualified for free lunch.

Design

Based on a stratified random sampling, half of the students in six classrooms (51 children) were assigned to watch *Arthur* during school hours, while the other half in the same six classrooms (57 children) were assigned to watch *Between the Lions* during school hours. In each classroom, the children were first grouped according to gender, and then they were rank ordered based on their October English Peabody Picture-Vocabulary Test (*PPVT-III*; Dunn and Dunn, 1997) vocabulary scores. I then randomized assignment to the two viewing conditions matching the children on their vocabulary scores, yielding viewing groups with very similar composition in gender and initial English vocabulary skills. Receptive vocabulary scores were chosen as a basis for stratification as children's understanding of the shows would be most influenced by their English vocabulary.

Both groups watched one 30-minute episode three times a week in a classroom at school from October to the beginning of May, for a total of 54 episodes. A frequency of three episodes a week was chosen due to the importance of repetition of interventions (Galdwell, 2000), children's liking for repetition and familiar events (Galdwell, 2000), and the feasibility and practicality of children viewing educational television during school hours. Teachers were instructed to only show the videos. They did not follow up with activities based on the episodes with the children. Four classrooms (42 children) did not view any shows during school hours. Children's home viewings of *Arthur* and *Between the Lions* were controlled for in the data analysis.

There were three waves of data collection.[2] All kindergartners were assessed at three time points throughout the school year: October (before the viewing groups watched any episodes in the classrooms), February (after the viewing groups had watched 27 episodes in the classrooms), and late May/early June (after the viewing groups had watched an additional 27 episodes in the classrooms). Total testing time for each individual session was 30–45 minutes.

Measures

Vocabulary was measured with standardized tests as opposed to *Arthur*/*Between the Lions* curriculum dependent tests. Since both *Arthur* and *Between the Lions* follow a curriculum aimed at fostering language and literacy growth for preschool and early elementary children, it was hypothesized that effects would be found in standardized tests. Additionally, it was decided that standardized tests would best assess overall vocabulary growth.

English receptive vocabulary was measured with the Peabody Picture Vocabulary Test (*PPVT-III*; Dunn and Dunn, 1997). This is an individually administered test, in which the child is shown four pictures and asked to select the one that best exemplifies the given word. Sample English words are: *bus*, *cow*, *empty*, *shoulder*, *square* and *digging*. There are a total of 204 items. The test has been nationally standardized and is suitable for assessing children from as young as 2;6 to adults. *PPVT-III* is available in two parallel forms, A and B, for reliable testing and retesting. Form III-A was used in October and late May/early June. Form III-B was used in February.

Expressive vocabulary was measured with the Woodcock Language Proficiency Battery-Revised-Picture Vocabulary subtest (Woodcock, 1991) in English. This assessment measures children's oral vocabulary knowledge in English. It is an individually administered test, in which the child is asked to name pictured objects. Sample words are: *telephone*, *scissors*, *ball* and *light switch*. There are a total of 58 items. The test has also been nationally standardized and is suitable for assessing children from as young as age two to adults. There is only one version of the Picture Vocabulary subtest, so all children took the same test at all three time points. As all children took it at all time points, it was assumed that if there were practice effects, it would affect all groups equally.

Spanish receptive vocabulary was measured with the Test de Vocabulario en Imágenes Peabody (*TVIP*; Dunn, Padilla, Lugo and Dunn, 1986), the Spanish version of the Peabody Picture Vocabulary Test. Sample Spanish words are: *barco*, *vaca*, *flecha*, *cuello* and *abeja*. There are a total of 125 items. The test has also been standardized and is suitable for assessing children from as young as 2;6 to adults. Children were assessed on Spanish vocabulary knowledge only at the beginning of the school year in October. Both English and Spanish versions are norm-referenced up to age 22+. Spanish receptive vocabulary was only measured in October to measure initial native language levels.

To investigate preschool experience and home literacy activities, in particular book exposure and educational television home viewing, a parental questionnaire was sent home in both English and Spanish. Parents were asked whether or not their children had gone to Head Start or a preschool. Additionally, parents were asked whether their children were frequently taken to the library, as that would indicate children's exposure to books and joint book reading opportunities. They were also asked about the number of children's books in the home. Additionally, television-viewing habits at home were asked about. In

[2] Children were tested on a variety of literacy measures, such as English vocabulary, Spanish vocabulary, English phonological awareness, English letter naming, English reading, and English narrative skills. However, as the focus of this paper is on vocabulary development, only those tests which are associated with vocabulary will be discussed here.

particular, they were asked whether their children viewed *Arthur* or *Between the Lions*. Parents were also asked background questions, such as children's language history, number of older siblings, length of residence in the United States, and parental education.

Statistical analysis

First, a descriptive analysis was conducted on all predictor variables, as well as on English receptive vocabulary and English expressive vocabulary. English vocabulary measures were examined in relation to initial Spanish vocabulary. Correlation analyses were also conducted to investigate the relationships between the variables. Then, to examine the difference in the level and rate of change among individuals, the outcomes were analyzed using individual growth modeling.

Descriptive results

The responses to the parental questionnaires, inquiring about preschool experience and home literacy activities, are summarized in Table 1. First of all, 63.6% of the parents responded that their children had gone to either pre-kindergarten or a Head Start program. Although variation was large, from 0 to 300 books, parents responded that on average they had 23 children's books in the home, including both English and Spanish books. Slightly over a third said they took their children to libraries on a frequent basis. Educational levels of the mothers ranged from no education to professional degrees; the average parental educational level being some secondary education. The number of older siblings ranged from 0 to 5, with the average child having 1.2 older siblings. Years living in the United States ranged from three months to seven years, with the average being 4.8 years. The majority had been born in the United States; of those that responded, 26% had been born outside of the United States. At the start of the study in October, the average age of children in this study was 5;6 years old.

Table 2 shows the means and standard deviations for all vocabulary outcomes for all children, as well as by show and by gender.

Spanish receptive vocabulary scores

Spanish receptive vocabulary scores were not significantly different among the three SHOW groups (children who were assigned to view *Arthur* in class, children who were assigned to view *Between the Lions* in class, children who were not assigned either show during class time), $F(2146) = .11$, $p = .8935$. Nor were there significant differences between genders, $F(1147) = .97$, $p = .3254$.

These native-Spanish-speaking entering kindergarteners achieved scores expected from 4; 8–5;0 year old Spanish monolinguals residing in Mexico, according to the age norms of the test (Dunn et al., 1986). As the average age of children in this study was 5;6 years old, these ELL children had Spanish vocabulary levels that were slightly lower than their monolingual Spanish counterparts.

English receptive scores

English receptive vocabulary scores among the three groups were similar. They started at about 40 points in October, then increased about half of a standard deviation to about 50 points in February, and finally scored in the high 50s in May/June. On average, these native-Spanish-speaking children scored at the level of a 3;2 year old monolingual English child in October; by May/June they had acquired enough English vocabulary to achieve the level of a 4;5 year old monolingual English child. In a period of seven months, these ELL children had a vocabulary spurt that is roughly equivalent to a monolingual English child's 1;3 years. Interestingly, the boys seemed to outperform the girls in both in February and May/June. The large standard deviations seen in this study are consistent with the previous research showing a wide range of variability in vocabulary size among young children, especially in a second language (Patterson, 2002).

When looked at in relation to initial Spanish scores, there were marginal differences in initial English receptive scores, $F(2, 131) = 2.87$, $p < .10$, as well as in final English receptive scores, $F(2, 131) = 2.77$, $p < .10$, between the children with high Spanish vocabulary and low Spanish vocabulary. Children with the highest initial Spanish scores (those in the upper quartile with *TVIP* scores of 43 and above) scored higher than the others (those in the lower 3 quartiles with *TVIP* scores of less than 43) in October and May/June as shown in Table 3.

English expressive vocabulary scores

Similar results were seen for the expressive vocabulary scores, with the three show groups improving their English at similar rates. However, once again, boys appeared to outperform the girls at all time points. On average, these native-Spanish children scored at the level of a 3;0 year monolingual English child in October; by May/June they had acquired enough expressive vocabulary to achieve the level of a 3;9 year old monolingual English child. Once again, there was a wide range of variation in expressive vocabulary scores.

There were no significant differences between the children with high Spanish vocabulary and low Spanish vocabulary in English expressive scores at any of the three time points (see Table 4).

Table 1. *Means and standard deviations for background variables for all children, and by viewing groups and by gender (n = 150)*

	Total			*Arthur*		*Between the Lions*		No viewing		Boys		Girls	
Variables	Mean (SD)	n	Range	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n
Background variables													
Parental education*	3.75 (1.64)	124	0–8	3.76 (1.76)	45	3.63 (1.63)	48	3.94 (1.50)	31	3.61 (1.71)	66	3.91 (1.56)	58
Number of older siblings	1.20 (1.12)	122	0–5	1.09 (1.27)	44	1.23 (1.06)	48	1.33 (.99)	30	1.22 (1.08)	65	1.19 (1.17)	57
Years lived in the USA	4.79 (1.89)	130	.3–7	4.87 (1.85)	48	4.90 (1.78)	51	4.50 (2.14)	31	4.93 (1.80)	70	4.93 (1.80)	60
Number of Spanish books at home	14.30 (26.55)	122	0–250	7.39 (6.79)	46	17.51 (37.77)	45	19.90 (23.67)	31	11.05 (12.72)	65	11.05 (12.72)	57
Number of English books at home	9.12 (10.64)	123	0–55	5.60 (5.44)	47	12.57 (14.29)	45	9.45 (8.82)	31	8.47 (10.01)	66	8.47 (10.01)	57
Number of total books at home	23.48 (33.39)	123	0–300	13.11 (9.55)	47	30.02 (47.70)	45	29.35 (27.54)	31	19.65 (20.06)	66	19.65 (20.06)	57
Yes/No variables	% YES	n		% YES	n	% YES	n	% YES	n	% YES	n	% YES	n
Preschool experience	63.6	118		59.1	44	66.6	45	65.5	29	59.0	61	68.4	57
Arthur home viewing	61.3	150		68.6	51	59.6	57	54.8	42	57.5	80	65.7	70
Between the Lions home viewing	28.0	150		33.3	51	33.3	57	14.3	42	28.8	80	27.1	70
Library experience	37.4	123		27.7	47	46.7	45	38.7	31	41.5	65	32.8	58

*Parental education was on a scale from 0 to 8.

Table 2. *Descriptive statistics of vocabulary outcomes for all children, for each show groups, and for each gender (n = 150)*

	Total			*Arthur*		*Between the Lions*		No viewing		Boys		Girls	
Variables	Mean (SD)	n	Range	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n
English receptive scores October	40.04 (20.23)	142	0–91	40.94 (20.47)	49	38.73 (20.76)	51	40.60 (19.69)	42	42.80 (18.49)	74	37.04 (21.71)	68
English receptive scores February	49.91 (18.84)	150	14–99	51.39 (17.35)	51	48.30 (20.12)	57	50.29 (19.06)	42	53.30 (18.26)	80	46.03 (18.88)	70
English receptive scores May/June	57.21 (19.30)	142	15–111	58.91 (17.11)	47	54.47 (20.12)	55	58.98 (20.58)	40	61.16 (17.88)	75	52.79 (19.98)	67
English expressive scores October	435.40 (20.48)	142	370–479	437.22 (17.57)	49	434.73 (23.12)	51	434.10 (20.55)	42	440.08 (16.95)	74	430.31 (22.78)	68
English expressive scores February	440.13 (19.97)	150	387–476	442.08 (17.46)	51	438.81 (22.12)	57	439.57 (20.05)	42	444.06 (17.75)	80	435.64 (21.49)	70
English expressive scores May/June	448.89 (19.58)	143	396–494	449.54 (17.54)	48	448.25 (21.62)	55	448.98 (19.39)	40	454.21 (17.11)	76	442.85 (20.54)	67
Initial Spanish receptive vocabulary	32.17 (13.35)	149	2–69	32.65 (12.49)	51	31.51 (14.06)	57	32.49 (13.66)	41	31.15 (13.29)	79	33.31 (13.42)	70

Table 3. *Means and standard deviations of English receptive scores for all children in relation to initial Spanish scores (n = 150)*

	Under first quartile Spanish scores		Between first and third quartile Spanish scores		Over third quartile Spanish scores	
	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n
Receptive October	37.84 (17.02)	37	37.24 (18.62)	71	49.15 (24.45)∼	33
Receptive February	49.45 (17.42)	38	48.38 (17.86)	72	53.64 (21.76)	39
Receptive May/June	56.67 (15.64)	36	55.44 (17.73)	68	60.89 (24.47)∼	38

∼p < .10.

Table 4. *Means and standard deviations of English expressive scores for all children in relation to initial Spanish scores (n = 150)*

	Under first quartile Spanish scores		Between first and third quartile Spanish scores		Over third quartile Spanish scores	
	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n
Expressive October	435.76 (20.89)	37	433.73 (19.84)	72	439.21 (21.48)	33
Expressive February	444.95 (20.81)	38	439.76 (18.30)	72	440.36 (22.60)	39
Expressive May/June	450.25 (18.19)	36	447.44 (18.40)	68	450.15 (22.88)	39

Table 5. *Correlation matrix for English receptive vocabularies, English expressive vocabularies, and initial Spanish receptive vocabulary (n = 150)*

Variables	1	2	3	4	5	6	7
1. Initial Spanish receptive	–	.12	.03	.07	.0007	−.04	−.05
2. Receptive English October		–	.80***	.83***	.83***	.77***	.77***
3. Receptive English February			–	.80***	.78***	.79***	.77***
4. Receptive English May/June				–	.76***	.78***	.77***
5. Expressive English October					–	.89***	.84***
6. Expressive English February						–	.85***
7. Expressive English May/June							–

***p < .001.

Table 5 shows the correlations among Spanish receptive scores, English receptive scores, and English expressive scores. The English receptive vocabulary scores and the English expressive scores are strongly correlated to each other at each time point as well as over time, r = .77–.84, p <.001. Spanish receptive vocabulary was not correlated with English vocabulary.

Individual growth modeling: Effect of Arthur *or* Between the Lions*?*

To examine differences in the level and rate of change among individuals, individual growth modeling (IGM) was used. IGM was the appropriate analysis tool for this dataset for several reasons. First of all, IGM is designed for exploring longitudinal data on individuals over time (Littell, Milliken, Stroup and Wolfinger, 1996; Singer, 1998; Singer and Willett, 2003). Secondly, IGM allows for the spacing of waves of data to vary across individuals (Littell et al., 1996; Singer and Willett, 2003). In this dataset, measurements were taken at slightly different times. For some children, the times between assessments were three months, whereas for others it was closer to four months. Thirdly, IGM can analyze data sets with varying number of waves of data (Littell et al., 1996; Singer and Willett, 2003). That is, unlike other approaches, IGM includes all subjects in the estimation, regardless of missing data. The majority of children in this study had an assessment score at all three time points.

In the first set of analyses, only children who viewed either *Arthur* or *Between the Lions* were included (n = 108). As there was no difference in vocabulary development between the *Arthur* and the *Between the*

Lions groups, all children were included in the models in building the second series of models (n = 150).

To arrive at a final model that best predicted English vocabulary development, I built a taxonomy of theoretically motivated individual growth models for both receptive and expressive vocabulary. Time was denoted in number of months rather than assessment occasions, because assessments were carried out with some variation among individuals in exact timing. As most subjects had three data points each, a linear model was used (Singer and Willett, 2003; Willett, Singer and Martin, 1998).

In the first stage, I fit an unconditional means model, which included no predictors. This model describes variation in the outcomes (Singer and Willett, 2003). I then fit a growth model where I examined WITHIN-PERSON change by fitting growth trajectories for each child over time. Finally, I looked at BETWEEN-PERSON variation by adding the predictor SHOW to investigate whether individual changes in the measures were related to viewing of *Between the Lions*.

Combining the WITHIN-PERSON and BETWEEN-PERSON models yields the following model:

$$\begin{aligned} \text{OUTCOME}_{ti} = &[ß_{00} + ß_{01}\ \text{SHOW}_i + ß_{10}\ \text{TIME}_{ti} \\ &+ ß_{11}\ \text{SHOW}_i\ \text{TIME}_{ti}] \\ &+ [u_{0i} + u_{1i}\ \text{TIME}_{ti} + r_{ti}] \end{aligned}$$

The parameters in the above model represent the effect of show on the INITIAL LEVEL of OUTCOME ($ß_{01}$) and the effect of show on the RATE OF CHANGE in OUTCOME ($ß_{11}$). As I was comparing models that differ in their fixed effects, but not their variance components, I used full maximum likelihood estimates (see Singer, 1998).

As a general modeling strategy, I first evaluated the above full model Equation for significance. SHOW was kept in the model even if it was not significant, as it was a key predictor. Indicators of home viewing, that is watching *Arthur* at home and watching *Between the Lions* at home, were also kept in the model to control for home viewing. Subsequent analyses investigated whether other variables such as gender, parents' educational history, pre-kindergarten experience, home *Arthur* viewing, home *Between the Lions* viewing, number of older siblings, number of years the child had resided in the United States, child's initial vocabulary level in Spanish and English, number of children's books in the home, and library exposure were significant predictors.

Past research employs mother's education to control for SES. Yet in this study, most children were from low SES homes and the mother's education variable was not significant. Furthermore, as total number of children's books in the home appeared to measure home literacy values just as well as parental education and as total number of books was significant, total number of children's books in the home was included in the models while mother's education was removed.

Classroom differences were also investigated. However, as all the children in the four non-viewing classrooms were also in the "non-viewing" group, CLASS and SHOW became confounding variables. In the "viewing" classrooms, students were randomly divided into the *Arthur* and *Between the Lions* groups, so there were within-classroom differences. But the comparison group of "non-viewing" students came from different classrooms. As a result, both variables could not be included together in the models. Models with SHOW and models with CLASS produced similar results. As the effect of SHOW is one of the main research questions, and as the results between the models with SHOW and CLASS were very similar, I will only present the results for the models with SHOW.

Individual growth modeling results

Individual growth modeling results examining only the two viewing groups (n = 108) found no effect of classroom show viewing on the estimated average initial level of receptive English vocabulary, $ß_{01} = 1.27$, p = .6812, or on the rate of growth, $ß_{11} = .51$, p = .1724, after controlling for class, home viewing, gender, years lived in the United States, parental education, and library experience.

Similar results were seen with the expressive English measure. Individual growth modeling results examining only the two viewing groups (n = 108) found no effect of classroom show viewing on the estimated average initial level of expressive English measure, $ß_{01} = 4.83$, p = .1706, or on the rate of growth, $ß_{11} = –.30$, p = .3367, after controlling for class, home viewing, gender, years lived in the United States, preschool education, and number of English children's books at home.

Thus, further analyses were conducted on all children, including those in the non-viewing group (n = 150). After fitting baseline models for both receptive and expressive vocabulary, I built a taxonomy of theoretically-motivated individual growth models that included all children in the study as shown in Tables 6 and 7.

For receptive vocabulary, when I fit an unconditional linear growth model that included both the fixed and random effects for both the intercept and the growth rate, the fixed and random effects could not be estimated in the model because the error-covariance matrix was not positive definite. This may happen when a data set is severely unbalanced or if many subjects do not have enough waves of data (Caswell, 2002; Singer and Willet, 2003). To resolve the problem, it was necessary to simplify the model by removing the random component of the growth rate in all further models. This strategy assumes that all students have the same underlying value for the growth rate; we are not estimating the variance in growth rates across individuals. In this approach, the growth rate is regarded as fixed and average group differences can be tested for children with different characteristics.

Table 6. *Estimates of fixed and random effects from a series of fitted individual growth models in which SHOW,* Arthur *home viewing,* Between the Lions *(*BTL*) home viewing, gender, years in the United States, initial Spanish vocabulary scores, and number of Spanish children's books in the home predict the average* ***receptive vocabulary*** *at the start of kindergarten and rate of change in* ***receptive vocabulary*** *during the kindergarten year for all children (n = 150). Final Model: Model 10.*

		Parameter estimate (standard error)									
		Model 1: Unconditional means	Model 2: Time	Model 3: Show	Model 4: Show× time	Model 5: Home TV	Model 6: Gender	Model 7: Years in USA	Model 8: Spanish vocabulary	Model 9: Spanish books	Model 10: Gender× time
Fixed effects											
Intercept	$ß_{00}$	48.69***	38.08***	39.19***	38.21***	33.92***	29.76***	18.25***	9.58	7.17	**8.12**
	SE	(1.49)	(1.58)	(2.81)	(2.99)	(3.25)	(3.45)	(4.97)	(6.89)	(6.79)	**(6.79)**
Time (in months)	$ß_{10}$		2.46***	2.46***	2.70***	2.69***	2.70***	2.77***	2.77***	2.77***	**2.52*** **
	SE		(.14)	(.14)	(.28)	(.28)	(.28)	(.33)	(.33)	(.33)	**(.35)**
Show: *Arthur*	$ß_{01}$			.10	.81	–1.90	–2.76	–.86	–.40	.93	**1.31**
	SE			(3.71)	(4.04)	(3.90)	(3.81)	(4.06)	(4.03)	(4.02)	**(4.01)**
Show: *BTL*	$ß_{01}$			–3.03	–1.12	–3.37	–4.38	–2.96	–2.40	–1.32	**–.87**
	SE			(3.62)	(3.94)	(3.80)	(3.72)	(4.04)	(4.01)	(4.00)	**(.82)**
Home TV: *Arthur*	$ß_{02}$					5.09∼	5.95*	3.58	3.66	4.01	**4.06**
	SE					(2.98)	(2.91)	(3.18)	(3.14)	(3.17)	**(3.17)**
Home TV: *BTL*	$ß_{03}$					10.55**	10.28**	9.87**	9.14**	8.57**	**8.53** **
	SE					(3.27)	(3.18)	(3.05)	(3.04)	(3.07)	**(3.07)**
Gender: Boys	$ß_{04}$						8.22**	7.79**	7.86**	8.63**	**6.04**∼
	SE						(2.70)	(2.79)	(2.76)	(2.78)	**(3.10)**
Years in USA	$ß_{05}$							2.60***	3.00***	2.78***	**2.79*** **
	SE							(.74)	(.77)	(.76)	**(.76)**
Spanish vocabulary	$ß_{06}$								.20∼	.19∼	**.19**∼
	SE								(.11)	(.11)	**(.11)**
Spanish books	$ß_{07}$									.16**	**.16** **
	SE									(.05)	**(.05)**
Arthur× time	$ß_{11}$				–.17	–.17	–.18	–.30	–.30	–.24	**–.32**
	SE				(.37)	(.37)	(.37)	(.41)	(.41)	(.41)	**(.41)**
BTL×time	$ß_{11}$				–.45	–.45	–.46	–.53	–.52	–.51	**–.61**
	SE				(.36)	(.36)	(.36)	(.41)	(.41)	(.41)	**(.41)**
Gender× time	$ß_{14}$										**.59**∼
	SE										**(.31)**
Random effects (variance components)											
Intercept											
Estimate		284.26***	293.79***	291.59***	292.33***	257.94***	241.54***	217.19***	211.39***	195.84***	**195.93*** **
SE		(39.10)	(36.98)	(36.73)	(36.79)	(32.81)	(30.91)	(30.14)	(29.44)	(28.33)	**(28.30)**
Residual											
Estimate		145.20***	72.59***	72.59***	72.10***	72.07***	72.06***	73.32***	73.31***	71.85***	**70.83*** **
SE		(12.21)	(6.10)	(6.10)	(6.06)	(6.05)	(6.05)	(6.53)	(6.53)	(6.62)	**(6.52)**
Proportional reduction in variance from model 1:											
Intercept			N/A	N/A	N/A	9.3%	15.0%	23.6%	25.6%	31.1%	**31.1%**
Akaike's Information Criterion		3681.9	3479.7	3482.7	3485.0	3471.7	3464.7	3043.7	3042.5	2841.9	**2810.3**

∼p < .10, *p < .05, **p < .01, ***p < .001.

Table 7. *Estimates of fixed and random effects from a series of fitted individual growth models in which show,* Arthur *home viewing,* Between the Lions *(*BTL*) home viewing, gender, years in the United States, preschool experience, and total number of children's book in the home predict the average* ***expressive vocabulary*** *at the start of kindergarten and rate of change in* ***expressive vocabulary*** *during the kindergarten year for all children (n = 150). Final Model: Model 10.*

		Parameter estimate (standard error)									
		Model 1: Unconditional means model	Model 2: Unconditional growth model	Model 3: Show	Model 4: Show× time	Model 5: Home TV	Model 6: Gender	Model 7: Years in USA	Model 8: Years in USA× time	Model 9: Preschool experience	Model 10: Books at home
Fixed effects											
Intercept	ß$_{00}$	440.89***	432.46***	434.41***	431.65***	427.23***	421.57***	413.30***	407.14***	402.68***	**399.38*** **
	SE	(1.58)	(1.74)	(2.93)	(3.28)	(3.54)	(3.70)	(5.19)	(5.56)	(5.90)	**(5.62)**
Time (in	ß$_{10}$		2.01***	2.00***	2.12***	2.12***	2.13***	2.10***	3.11***	3.19***	**3.26*** **
months)	SE		(.13)	(.13)	(.26)	(.26)	(.26)	(.29)	(.44)	(.44)	**(.45)**
Show:	ß$_{01}$			.79	3.54	1.06	–.07	–.26	–.25	–3.55	**–1.99**
Arthur	SE			(3.82)	(4.42)	(4.29)	(4.18)	(4.39)	(4.35)	(4.36)	**(4.15)**
Show:	ß$_{01}$			–.54	–1.07	–3.04	–4.42	–3.61	–4.20	–8.20∼	**–7.28∼**
BTL	SE			(3.74)	(4.31)	(4.18)	(4.08)	(4.36)	(4.33)	(4.39)	**(4.15)**
Home TV:	ß$_{02}$					5.79∼	6.88*	4.72	4.53	7.14*	**6.69***
Arthur	SE					(3.11)	(2.97)	(3.22)	(3.21)	(3.29)	**(3.21)**
Home TV:	ß$_{03}$					8.87*	8.52**	8.12**	8.19**	8.21**	**7.71***
BTL	SE					(3.40)	(3.22)	(3.07)	(3.07)	(3.00)	**(2.95)**
Gender:	ß$_{04}$						11.21***	10.00***	9.97***	8.97**	**9.66*** **
Boys	SE						(2.75)	(2.83)	(2.82)	(2.81)	**(2.74)**
Years in	ß$_{05}$							2.16**	3.55***	4.04***	**3.91*** **
USA	SE							(.76)	(.89)	(.89)	**(.84)**
Preschool	ß$_{06}$									6.22*	**5.19∼**
experience	SE									(2.90)	**(2.82)**
Books at	ß$_{07}$										**.16*** **
home	SE										**(.04)**
Arthur ×	ß$_{11}$				–.42	–.42	–.44	–.44	–.36	–.21	**–.13**
time	SE				(.34)	(.34)	(.34)	(.36)	(.36)	(.36)	**(.37)**
BTL ×	ß$_{11}$				.08	.08	.07	.14	.24	.33	**.17**
time	SE				(.34)	(.34)	(.33)	(.36)	(.36)	(.37)	**(.38)**
Years in USA	ß$_{15}$								–.22**	–.28***	**–.29*** **
× time	SE								(.07)	(.08)	**(.08)**
Random effects (variance components)											
Intercept											
Estimate		340.36***	403.68***	401.60***	400.04***	364.07***	340.77***	302.34***	296.51***	274.87***	**229.22*** **
SE		(43.57)	(52.60)	(52.59)	(52.19)	(48.26)	(45.60)	(44.93)	(43.54)	(42.66)	**(38.07)**
Slope											
Estimate			.78*	.78*	.73*	.72*	.71*	.57∼	.45	.44	**.38**
SE			(.37)	(.37)	(.37)	(.36)	(.36)	(.37)	(.35)	(.36)	**(.38)**
Residual											
Estimate		98.78***	43.93***	43.93***	44.03***	44.04***	44.15***	45.18***	44.88***	43.34***	**44.65*** **
SE		(8.31)	(5.12)	(5.12)	(5.13)	(5.13)	(5.14)	(5.60)	(5.54)	(5.63)	**(5.93)**
Proportional reduction in variance from model 2:											
Intercept				.5%	.9%	9.8%	15.6%	25.1%	26.5%	31.9%	**43.2%**
Slope				N/A	6.4%	7.7%	9.0%	26.9%	42.3%	43.6%	**51.3%**
Akaike's Information criterion		3589.4	3400.7	3404.6	3405.7	3395.9	3382.2	2963.0	2956.3	2664.3	**2518.4**

∼p < .10, *p < .05, **p < .01, ***p < .001.

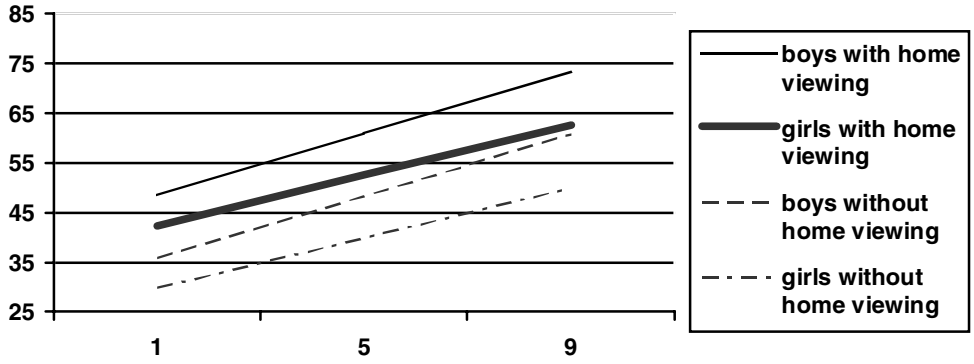

Figure 1. Fitting average growth trajectories describing the effects of home *Arthur* and *Between the Lions* viewing and gender on the change in RECEPTIVE MEASURES for ELL children who had lived in the United States for the average number of years (4.79 years), had an average number of Spanish books (14 books) in the home, and average initial Spanish vocabulary (32.17 points on the *TVIP*) (n = 150).

Model 10 in Table 6 was chosen as the final model for receptive vocabulary and will be interpreted in the following sections.

For expressive vocabulary, it was possible to estimate all of the fixed and random effects in the model as is shown in Table 7. The variance components in Model 1 (unconditional means model) indicate that the average child's English expressive vocabulary varied over time and that the children differed from each other. Using the results of this model, I calculated the intraclass correlation coefficient to be.78, which indicated that over three quarters of the total variation in expressive English vocabulary is attributable to differences among children. By comparing the variance components in Model 2 (unconditional growth model) to Model 1, we find that 56% of the WITHIN-PERSON variation in expressive vocabulary is systematically associated with linear time. Furthermore, as there was non-zero variability in both true initial status and true rate of change, Model 2 suggested the value of adding more predictors into the model to explain heterogeneity in each parameter. After fitting more models, Model 10 in Table 7 was chosen as the final model for expressive vocabulary and will be interpreted in the following sections.

Educational television: Effect of classroom viewing

The estimated coefficients for SHOW, indicating classroom viewing groups, were not statistically significant for receptive vocabulary, indicating that the three groups did not significantly differ from each other at the start of kindergarten, after controlling for the other variables in the model. The SHOW variable was also not associated with the rate of growth on the receptive vocabulary measure.

Additionally, the SHOW variable was not associated with the rate of growth on the expressive vocabulary measure. However, on average, the children who were assigned to view *Between the Lions* during class time started kindergarten 7.28 points, p = .0827, lower on the expressive vocabulary measure compared to the other two groups, after controlling for home viewing, gender, years lived in the United States, preschool experience, and total number of children's books in the home. As there was no difference in rate of growth among the three groups, this 7.11-point difference, though only marginally significant, remained throughout the school year.

Educational television: Effect of home viewing

After controlling for the other variables in the model, *Between the Lions* home viewing had a significant effect on the estimated average initial level of receptive vocabulary, $ß_{03} = 8.53$, p = .0064. Children who viewed *Between the Lions* at home began and ended kindergarten with an 8.53-point advantage in receptive vocabulary over children who did not view it at home. The standard deviation on the receptive vocabulary measure pooled across all occasions was 20.76 points. Thus, the coefficient 8.53 for *Between the Lions* corresponds to an effect size of slightly less than one half of a standard deviation. This is shown in Figure 1.

For expressive vocabulary, home viewings of both *Arthur*, $ß_{02} = 6.69$, p = .0399, and *Between the Lions*, $ß_{03} = 7.71$, p = .0104, had positive and significant effects on the estimated average initial level. Children who viewed *Arthur* at home began kindergarten with a 6.69-point (effect size of one third of a standard deviation) advantage in expressive vocabulary over children who did not view it at home. Children who viewed *Between the Lions* at home began kindergarten with a 7.71-point (effect size of slightly over one third of a standard deviation) advantage in expressive vocabulary over children who did not view it at home. Children who had viewed both *Arthur* and *Between the Lions* at home started kindergarten with a 14.4-point (effect size of nearly three quarters of a standard deviation) advantage in expressive

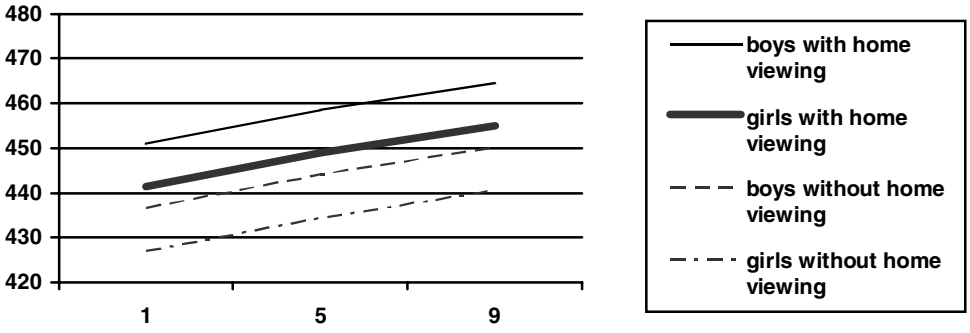

Figure 2. Fitting average growth trajectories describing the effects of home *Arthur* and *Between the Lions* viewing and gender on the change in EXPRESSIVE MEASURES for ELL children who had attended preschool and had an average number of books (23 books) in the home (n = 150).

vocabulary scores over children who did not view both shows at home. Once again, these differences remained throughout the kindergarten year. This is shown in Figure 2.

Additional models were examined to test cross-level interaction effects on both receptive and expressive vocabulary. However, results show that the effect of watching *Arthur* or *Between the Lions* at school did not depend on the amount of watching these programs at home.

Preschool experience

After controlling for show, home viewing, gender, years lived in the United States, and total number of children's books in the home, preschool experience had a marginally significant effect on the estimated average initial level of the expressive vocabulary measure, $ß_{06} = 5.19$, $p = .0689$. On average, children who had attended preschool or Head Start had a 5.19-point advantage in expressive vocabulary over children who had stayed at home, and this difference remained throughout the school year. The standard deviation on the expressive measure pooled across all occasions was 20.68 points. Thus, the coefficient 5.19 for preschool experience corresponds to an effect size of one quarter of a standard deviation.

Exposure to books at home

The total number of children's books in the home represents home literacy values, including mother's educational levels and SES. After controlling for the other variables in the model, total number of children's books, including both English and Spanish books, in the home had a significant effect on the estimated average initial level of the expressive vocabulary measure, $ß_{07} = .16$, $p = .0001$. For receptive English vocabulary, after controlling for the other variables in the model, only the total number of Spanish children's book in the home had a significant effect on the estimated average initial level, $ß_{07} = .16$, $p = .0028$. On average, every 100 books in the home made a 16-point (effect size of slightly over three quarters of a standard deviation) difference in expressive and receptive English vocabulary at the start of kindergarten and this difference remained constant through kindergarten. There was no effect of the frequency with which children were taken to the library.

Years in the United States

After controlling for the other variables in the model, length of residence in the United States had a significant effect on the estimated average initial level of both receptive and expressive vocabulary. On average, every one-year stay in the United States was associated with a 2.79-point (effect size of slightly over one tenth of a standard deviation) increase in receptive scores and a 3.91-point (effect size of one fifth of a standard deviation) increase in expressive vocabulary. That is, on average, children who had resided in the United States longer started kindergarten with higher receptive and expressive vocabulary than those who had just arrived. This variable was negatively associated with rates of growth on expressive vocabulary, $ß_{15} = -.29$, $p < .001$, yet this was not associated with the rate of growth on the receptive vocabulary measure. This is shown in Figures 3 and 4.

Gender

After controlling for the other variables in the model, GENDER had a significant effect on the estimated average initial level of both receptive and expressive vocabulary. Additionally the interaction between GENDER and TIME was significant for receptive vocabulary. This indicates that, after controlling for the other variables in the model, on average boys began with 9.66-point (effect size of nearly one half of a standard deviation) lead in expressive vocabulary at the start of kindergarten over

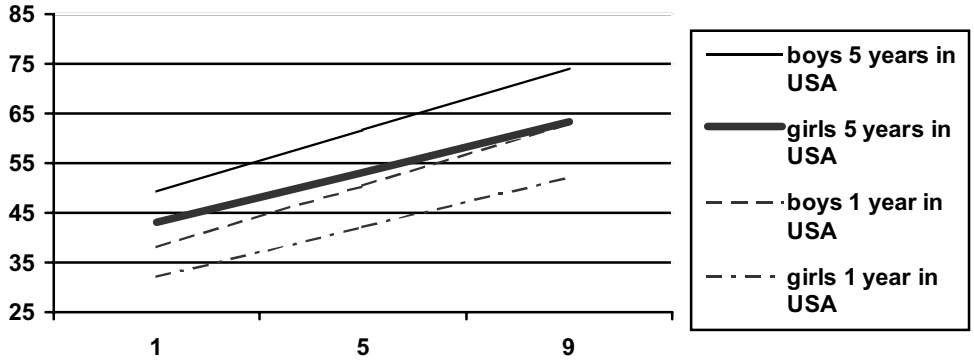

Figure 3. Fitting average growth trajectories describing the effects of years living in the United States and gender on the change in RECEPTIVE MEASURES for ELL children who had viewed both *Arthur* and *Between the Lions* at home and had an average number of Spanish books (14 books) in the home and average initial Spanish vocabulary (32.17 points on the TVIP) (n = 150).

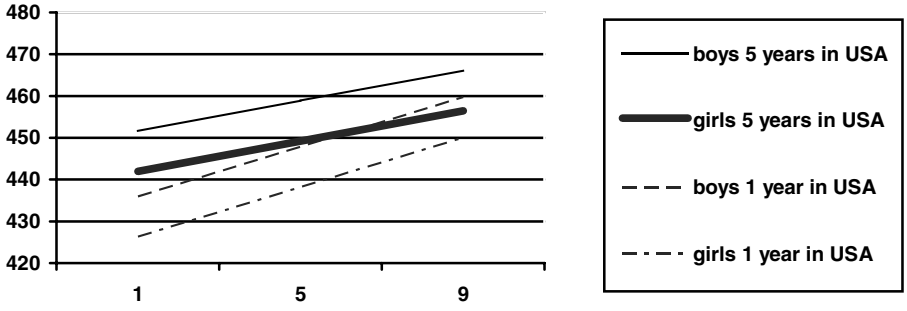

Figure 4. Fitting average growth trajectories describing the effects of years living in the United States and gender on the change in EXPRESSIVE MEASURES for ELL children who had viewed both *Arthur* and *Between the Lions* at home and had an average number of books (23 books) in the home (n = 150).

girls, and this difference remained throughout the school year. For receptive vocabulary however, on average, boys began with a 6.64-point (effect size of slightly over one third of a standard deviation) lead over girls and their scores increased at an even faster pace than girls' scores, after controlling for show, home viewing, years lived in the United States, initial Spanish vocabulary, and total number of Spanish children's books in the home. This is shown in Figures 1–4.

Initial Spanish vocabulary

After controlling for show, home viewing, gender, years lived in the United States, and total number of Spanish children's books in the home, initial Spanish vocabulary had a marginal effect on the estimated average initial level of the receptive vocabulary measure, $ß_{06} = .19$, $p = .0793$. On average, every 15-point (effect size of nearly one standard deviation) increase in initial Spanish vocabulary was associated with a 2.85-point (effect size of between one and two tenths of a standard deviation) increase in receptive scores; that is, children with high initial Spanish vocabulary had high initial English vocabulary. Initial Spanish vocabulary was not associated with the rate of growth on receptive scores.

Discussion

Although classroom intervention effects were not seen, home viewing was found to be a predictor of vocabulary growth. This study suggests that home literacy experiences and preschool experiences contribute to vocabulary development in early ELL children. Additionally, the present work suggests that receptive and expressive vocabulary skills of bilingual children are highly correlated and increase at a fast pace during their kindergarten year.

Contrary to expectations, there was no impact of either *Arthur* or *Between the Lions* classroom viewing on vocabulary growth. All three groups increased their vocabulary knowledge at about the same pace. This may be due to the fact that no reinforcement followed the viewing sessions. As both halves of each classroom

watched different shows, it was not possible for the teacher or researchers to follow up with exercises to reinforce learning of specific words from the shows. This supports Patterson's (2002) research that television may not provide incidental vocabulary learning. In order for children to increase their vocabulary size, repetition and reinforcement, as found in parent–child book reading, may be necessary.

Nevertheless, there was a relationship between vocabulary scores and *Arthur* and *Between the Lions* home viewing. Home viewers started kindergarten with an advantage over children who had not viewed these shows at home during pre-kindergarten. *Arthur* home viewing was associated with higher expressive vocabulary scores at the start of kindergarten and *Between the Lions* home viewing was associated with higher receptive and expressive vocabulary scores at the start of kindergarten. *Arthur* introduces new vocabulary, not like *Between the Lions* as "the word for the day," but instead embedded in the story. Children who viewed *Arthur* at home may have been less shy to articulate or question new words they had heard on the screen than when viewing at school, leading to higher initial expressive vocabulary scores. Additionally, through home viewings of *Between the Lions*, as each episode introduces new vocabulary words and their meanings through "key words" (Rath, 2000), ELL children may have been exposed to new English vocabulary that parents and older siblings may have reinforced during the show as well as throughout the day. Parents may also have done follow-up activities with their children, which was not possible during viewing sessions at school.

Yet, these findings should be interpreted carefully as this home viewing factor may not only indicate viewing hours, but also imply overall supportive family environments. That is, those children who watch educational television at home may have family members who encourage literacy learning and may live in literacy-rich home environments. Additionally, children who had higher English vocabulary may have been more motivated to watch these shows as compared with children with lower English vocabulary.

Home viewing was weakly correlated with total number of English books in the home, $r = .15$, $p < .10$, and with library experience, $r = .16$, $p < .10$. As expected, the total number of children's books at home had a positive association with children's English expressive scores. The number of children's books in the home, also representing mothers' education and SES, suggests evidence of joint book reading experiences.

There appears to be an association between the children's Spanish environment and English receptive scores. Although marginally significant, children with higher initial Spanish receptive vocabulary scores tended to start kindergarten with higher English receptive vocabulary scores than those who had low initial Spanish receptive vocabulary scores. This suggests a relationship between L1 and L2 lexical knowledge. Yet, Spanish receptive scores were not related to growth rates in English receptive scores. More data for larger number of subjects and for longer periods of time will be needed to determine associations between L1 and L2 lexicon, as well as transfer effects from L1 to L2 at the lexical level.

Results suggest that preschool experience can influence English vocabulary growth. Children who had enrolled in a preschool or a Head Start tended to start kindergarten with higher English expressive vocabulary scores than children who had stayed at home. Although the effect was marginally significant, this is in line with general findings that show the benefits of Head Start programs (e.g. Hubbs-Tait et al., 2002) and the relationships between language exposure and vocabulary scores (Hart and Risley, 1995; Pearson et al., 1997; Patterson, 2002). As past research suggests that the number of conversations and the variety of words that children hear affects the speed of their language and literacy growth (Tabors, Beals and Weizman, 2001), the extra English exposure during pre-kindergarten may have aided in faster English vocabulary growth. Future research should further examine ELL children's preschool experiences.

This effect of language exposure was also seen in the relationship between the number of years of residence in the United States and English vocabulary. On average, those who had been born in the United States started kindergarten with higher English receptive and expressive vocabulary scores than those who been born abroad. Additionally, for expressive vocabulary, the less time the child had resided in the United States, the steeper the growth trajectory.

Interestingly, there was a significant effect of gender in this study, with boys starting with and maintaining higher scores than girls in both receptive and expressive English vocabulary. Additionally, boys showed a steeper trajectory than girls for receptive English vocabulary. Initial receptive Spanish scores did not differ significantly by gender. For receptive English vocabulary, the effect was only marginally significant, but a larger sample size may give more significant results.

Past research with monolingual English children has shown that on average girls have higher overall literacy skills than boys (Bornstein, Haynes and Painter, 1998; Karmiloff and Karmiloff-Smith, 2001). Yet, concerning vocabulary, there have been some contradictory findings showing that boys do better than girls in such areas as listening vocabulary in both first language and second language (Boyle, 1987).

Although further research is necessary to verify patterns identified here, these results are suggestive of several hypotheses. Boys and girl may have different

exposure histories, such as girls being more likely to be taken care of by Spanish-speaking relatives and having fewer interactions with their English neighbors than boys. This may also depend on the age of acquisition, as well as age of testing. In addition, differences in cultural values may play a role. Parents may emphasize academic language attainment more to boys than girls. Boys may be required to verbalize and express themselves more than girls. Future research should investigate larger samples, including children from other ethnic backgrounds, as well as impact over longer time periods.

Given that early vocabulary knowledge is a good predictor of later reading achievement (Anderson and Freebody, 1981), these findings also have potential practical importance. The results from this study suggest that, just as for monolingual English-speaking children (e.g. Tabors et al., 2001), the combination of literacy-rich home environments and preschool experience and can assist in ELL children's lexical development. Literacy-rich home environments include evidence of children's books in the home, joint-book reading time with parents, and exposures to rich native language vocabulary from parents and to rich English language from educational television. Children, especially girls, from non-English homes would benefit most in literacy-rich homes and from preschool attendance while developing their native lexical knowledge.

Conclusion

The findings of this study suggest the importance of English exposure, as well as of native language maintenance, for English L2 vocabulary development. These results have implications for instructional purposes and for guidance to parents of young bilingual children. Yet, the present results are only a first step in investigating English vocabulary development in Spanish-speaking ELL children. More detailed data on home literacy practices as well as preschool experiences can provide additional insight. Continuing to investigate ELL children's progress in lexical development is imperative for designing effective interventions for ELL children.

References

Adams, M. J. (1990). *Learning to read: Thinking and learning about print*. Cambridge, MA: MIT Press.

Anderson, R. C. & Freebody, P. (1981). Vocabulary knowledge. In J. T. Guthrie (ed.), *Comprehension and teaching: Research reviews*, pp. 77–116. Newark, DE: International Reading Association.

Anglin, J. (1993). Vocabulary development: A morphological analysis. *Monographs of the Society for Research in Child Development*, 58 (10, Serial No. 238), 1–166.

Bornstien, M. H., Hynes, O. M. & Painter, K. M. (1998). Sources of child vocabulary competence: A multivariate model. *Journal of Child Language*, 25, 367–393.

Boyle, J. (1987). Sex differences in listening vocabulary. *Language Learning*, 37, 273–284.

Caswell, L. (2002). The development of Spanish/English biliteracy: An individual growth modeling approach. *Dissertation Abstracts International*, 63(6). (UMI No. 3055841.)

Cummins, J., Swain, M. K., Nakajima, K., Handscombe, J., Green, D. & Tran, C. (1984). Linguistic interdependence among Japanese and Vietnamese immigrant students. In C. Rivera (ed.), *Communicative competence approaches to language proficiency assessment: Research and application*, pp. 60–81. Clevedon, England: Multilingual Matters.

De Groot, G. (1994). Psychologists explain "Barney's" power. *APA Monitor*, 4.

De Houwer, A. (1995). Bilingual language acquisition. In. P. Fletcher & B. MacWhinney (eds.), *The handbook of child language*, pp. 219–250. Oxford: Blackwell.

DeTemple, J. (2001). Parents and children reading books together. In D. Dickinson & P. Tabors (eds.), *Beginning literacy with language*, pp. 31–52. Baltimore, MD: Brookes Publishing.

Dunn, L. M. & Dunn, L. M. (1997). *Peabody Picture Vocabulary Test* (3rd ed.). Circle Pines, MN: American Guidance Service.

Dunn, L. M., Padilla, E. R., Lugo, D. E. & Dunn, L. M. (1986). *Test de Vocabulario en Imágenes Peabody*. Circle Pines, MN: American Guidance Service.

Galdwell, M. (2000). *The tipping point: How little things can make a big difference*. Boston, MA: Little, Brown & Co.

Hart, B. & Risley, T. (1995). *Meaningful differences in the everyday experience of young American children*. Baltimore, MD: Brookes Publishing.

Hill-Scott, K. (2001). Industry standards and practices. In D. G. Singer & J. L. Singer (eds.), *Handbook of children and the media*, pp. 605–620. Thousand Oaks, CA: Sage Publications.

Hoff-Ginsberg, E. (1986). Function and structure in maternal speech: Their relation to the child's development of syntax. *Developmental Psychology*, 22, 155–163.

Hubbs-Tait, L., Culp, L., McDonald, A., Huey, E., Culp, R., Starost, H. & Hare, C. (2002). Relation of head start attendance to children's cognitive and social outcomes: Moderation by family risk. *Early Childhood Research Quarterly*, 17, 539–558.

Huttenlocher, J., Haight, W., Bryk, A., Seltzer, M. & Lyons, T. (1991). Early vocabulary growth: Relation to language input and gender. *Developmental Psychology*, 27, 236–248.

Karmiloff, K. & Karmiloff-Smith, A. (2001). *Pathways to language: From fetus to adolescent*. Cambridge, MA: Harvard University Press.

Koolstra, C. M. & Beentjes, J. W. J. (1999). Children's vocabulary acquisition in a foreign language through watching subtitled television programs at home. *Educational Technology Research and Development*, 47, 51–60.

Lanauze, M. & Snow, C. E. (1989). The relation between first- and second-language writing skills: Evidence from Puerto Rican elementary school children in bilingual programs. *Linguistics and Education*, 1, 323–340.

Lemish, D. & Rice, M. (1986). Television as a talking picture book: A prop for language acquisition. *Journal of Child Language*, 13, 251–274.

Littell, R. C., Milliken, G. A., Stroup, W. W. & Wolfinger, R. D. (1996). *SAS system for mixed models*. Cary, NC: SAS Institute.

Nagy, W., Anderson, R. C. & Herman, P. (1987). Learning word meaning meanings from context during normal reading. *American Educational Research Journal*, 24, 238–270.

Nagy, W., Garcia, G. E., Durgunoglu, A. Y. & Hancin-Bhatt, B. (1993). Spanish–English bilingual students' use of cognates in English reading. *Journal of Reading Behavior*, 25, 241–259.

Ordóñez, C., Carlo, M., Snow, C. & McLaughlin, B. (2002). Depth and breadth of vocabulary in two languages: Which vocabulary skills transfer: *Journal of Educational Psychology*, 94, 719–728.

Patterson, J. (2002). Relationships of expressive vocabulary to frequency of reading and television experience among bilingual toddlers. *Applied Psycholinguistics*, 23, 493–508.

Pearson, B., Fernández, S., Lewedeg, V. & Oller, D. K. (1997). The relation of input factors to lexical learning by bilingual infants. *Applied Psycholinguistics*, 18, 41–58.

Rath, L. (2000). *Between the Lions*: Using television to promote literacy. *Book Links*, 9, 41–45.

Reese, E. & Cox, A. (1999). Quality of adult book reading affects children's emergent literacy. *Developmental Psychology*, 35, 20–28.

Rice, M. (1983). The role of television in language acquisition. *Developmental Review*, 3, 211–224.

Rice, M. L. & Haught, P. (1986). "Motherese" of Mr. Rogers: A description of the dialogue of educational television programs. *Journal of Speech and Hearing Disorders*, 51, 282–287.

Rice, M. L., Huston, A. C., Truglio, R. & Wright, J. C. (1990). Words from "Sesame Street": Learning vocabulary while viewing. *Developmental Psychology*, 26, 421–428.

Rice, M. L. & Woodsmall, L. (1988). Lessons from television: Children's word learning when viewing. *Child Development*, 59, 420–429.

Robbins, C. & Ehri, L. (1994). Reading storybooks to kindergarteners helps them learn new vocabulary words. *Journal of Educational Psychology*, 86, 54–64.

Royer, J. & Carlo, M. (1991). Transfer of comprehension skills from native to second language. *Journal of Reading*, 34, 450–455.

Singer, J. D. (1998). Using SAS PROC MIXED to fit multilevel models, hierarchical models, and individual growth models. *Journal of Educational and Behavioral Statistics*, 24, 323–355.

Singer, J. D. & Willett, J. B. (2003). *Applied longitudinal data analysis: Modeling change and event occurrence*. Oxford: Oxford University Press.

Snow, C. E. (1984). Parent–child interactions and the development of communicative ability. In R. L. Schiefelbusch & J. Pickar (eds.), *Communicative competence: Acquisition and intervention*, pp. 69–108. Baltimore, MD: University Park Press.

Snow, C. E., Burns, M. S. & Griffin, P. (1998). *Preventing reading difficulties in young children*. Washington, DC: National Academy Press.

Snow, C. E. & Goldfield, B. A. (1983). Turn the page please: Situation-specific language acquisition. *Journal of Child Language*, 10, 551–569.

Tabors, P., Beals, D. & Weizman, Z. (2001). "You know what oxygen is?": Learning new words at home. In D. Dickinson & P. Tabors (eds.), *Beginning literacy with language*, pp. 93–110. Baltimore, MD: Brookes Publishing.

Tabors, P., Roach, K. & Snow, C. E. (2001). Home language and literacy environment: Final results. In D. Dickinson & P. Tabors (eds.), *Beginning Literacy with Language*, pp. 111–138. Baltimore, MD: Brookes Publishing.

Tabors, P., Snow, C. E. & Dickinson, D. (2001). Homes and schools together: Supporting language and literacy development. In D. Dickinson & P. Tabors (eds.), *Beginning literacy with language*, pp. 313–334. Baltimore, MD: Brookes Publishing.

Van Evra, J. (1998). *Television and child development*. Mahwah, NJ: Lawrence Erlbaum Associates.

Verhoeven, L. (1994). Transfer in bilingual development: The linguistic interdependence hypothesis revisited. *Language Learning*, 44, 381–415.

Vermeer, A. (2001). Breadth and depth of vocabulary in relation to L1/L2 acquisition and frequency of input. *Applied Psycholinguistics*, 22, 217–234.

Walker, D., Greenwood, C., Hart, B. & Carta, J. (1994). Prediction of school outcomes based on early language production and socioeconomic factors. *Child Development*, 65, 606–621.

Wells, G. (1985). *Language development in the pre-school years: Language at home and at school* (vol. 2). Cambridge: Cambridge University Press.

Whitehurst, G. J., Arnold, S. A., Epstein, J. N., Angell, A. L., Smith, M. & Fischel, J. E. (1994). A picture book reading intervention in day care and home for children from low-income families. *Developmental Psychology*, 30, 679–689.

Willett, J. (1994). Measuring change more effectively by modeling individual growth over time. In T. Husen & T. N. Postlethwaite (eds.), *The international encyclopedia of education* (2nd edn.), pp. 671–678. Oxford: Pergamon. Press.

Willet, J., Singer, J. D. & Martin, N. C. (1998). The design and analysis of longitudinal studies of development and psychopathology in context: Statistical models and methodological recommendations. *Development and Psychopathology*, 10, 395–426.

Woodcock, R. W. (1991). *Woodcock language proficiency battery-revised*. Itasca, IL: Riverside Publishing.

Wright, J. C., Huston, A. C., Murphy, K. C., St. Peters, M., Piñon, M. & Scantlin, R. (2001). The relations of early television viewing to school readiness and vocabulary of children from low-income families: The early window project. *Child Development*, 72, 1347–1366.

Zigler, E. & Styfco, S. (1994). Head start criticisms in a constructive context. *American Psychologist*, 49, 127–132.

Received June 7, 2004
Revision received October 7, 2004
Accepted February 1, 2005