

Supplementary Materials to manuscript

**What's in a word? Cross-linguistic influences on Spanish-English and Chinese-English
bilingual children's word reading development**

Supplement 1

Bilingual Language Background and Use Questionnaire

The questionnaire is attached to the next page.

Participant ID: _____

Date: _____

Background Questionnaire

*The following questionnaire will take you about 1-hour to complete. We ask a lot of questions in order to get a full understanding of your child's development up to today's date. We appreciate any feedback and additional comments you may have as you're filling it out and afterwards. If you have any questions, please don't hesitate to ask any of the research assistants. Please feel free to mark and make notes on the side, especially if any of the suggested responses do not fit your answer. **You may skip any questions you do not wish to answer, and this information will be completely confidential and only used in conjunction with this study.***

We appreciate your participation, as your help will help us understand more about children's language development. Thank you for your time!

Identifying Information

Child's First Name: _____ Child's Last Name: _____

_____ Parent's/Guardian's Name

Child's Date of Birth (MM/DD/YY): ____ / ____ / ____

Child's Gender (please circle): Male Female

School: _____ Current Grade: ____ Highest grade completed: ____

Child's race/ethnicity (check all that apply):

- | | |
|--------------------------------------------------------------|--------------------------------------------------------------------|
| <input type="checkbox"/> White | <input type="checkbox"/> American Indian or Alaska Native |
| <input type="checkbox"/> Hispanic, Latino, or Spanish origin | <input type="checkbox"/> Native Hawaiian or Other Pacific Islander |
| <input type="checkbox"/> Asian | <input type="checkbox"/> Some other race, ethnicity, or origin |
| <input type="checkbox"/> Black or African American | (please specify) _____ |
| <input type="checkbox"/> Middle Eastern or North African | |

Child Developmental History

1. Was your child carried to full-term or born prematurely? _____

If premature, at how many weeks was the child born? _____

2. Has your child been **held back** one (or more) year(s) in school? YES NO

Has your child **skipped** one (or more) year(s) in school? YES NO

If yes to either question, in what grade and for how many years? _____

3. Has your child ever obtained special services in school (e.g. special education, speech therapy, occupational therapy, social work, etc.)? If yes, please describe: _____

4. What hand does your child use when...

	Always left	Mostly left	No preference	Mostly right	Always
right Writing?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Holding a toothbrush?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Holding a spoon?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

5. List any family members who are left handed and their relationship to the child:

Neurological Impairments & Medicine Use

Please place a check mark (✓) in the box next to any of the following conditions for which your child has a history (check all that apply):

- | | |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| <input type="checkbox"/> birth related injuries | <input type="checkbox"/> Attention Deficit/Hyperactivity Disorder (ADHD) |
| <input type="checkbox"/> developmental delay / developmental disorder | <input type="checkbox"/> Autism, Asperger’s, or Pervasive Developmental Disorder |
| <input type="checkbox"/> speech/language impairment | <input type="checkbox"/> Depression |
| <input type="checkbox"/> head injury with loss of consciousness (e.g. concussion) | <input type="checkbox"/> Anxiety |
| - at what age? _____ | <input type="checkbox"/> Conduct Disorder/Oppositional Defiant Disorder |
| <input type="checkbox"/> seizure disorder / epilepsy | <input type="checkbox"/> other neurological or mental health condition |
| <input type="checkbox"/> hearing impairment or some difficulty hearing | |
| <input type="checkbox"/> color blindness | (please specify): _____ |

6. Does your child have a reading impairment or dyslexia? YES NO

7. Does your child...

	Never	Rarely	Sometimes	Frequently	Always
1. Have difficulty with spelling	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Have/had difficulty learning names	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Have/had difficulty learning phonics (sounding out words)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Read slowly	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Read below grade level	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

8. Are there any family members with a history of dyslexia or reading difficulties? Please describe.

9. Is your child currently prescribed with medication? (circle) YES NO

If yes, please name the medications and for what they are prescribed for:

Medication

Condition

Parental Background

Parent / Guardian #1: Mother Father Other (please describe):

10. Please specify how you would describe **parent/guardian #1** (check as many as apply):

- White
- Hispanic, Latino, or Spanish origin
- Asian
- Black or African American
- Middle Eastern or North African
- American Indian or Alaska Native
- Native Hawaiian or Other Pacific Islander
- Some other race, ethnicity, or origin
(please specify) _____

11. Where was **parent/guardian #1** born?

- In the United States or another English-speaking country (e.g. Canada, Australia)
- Outside the United States (please specify): _____

12. If **parent/guardian #1** was NOT born in the U.S. (e.g., in Mexico), at what age did **parent/guardian #1** come to the U.S. or another English-speaking country?

- Not applicable
- Ages 0-10
- Ages 11-18
- After the age of 18

13. What is the first language that **parent/guardian #1** learned to speak as a child?

- English only
- Another language only (**What language?** _____)
- English and another language (_____) equally

14. What is the highest level of education that **parent/guardian #1** has completed at this time?

- Some primary education
- Completed primary education
- Some high school
- High school diploma or equivalent (GED)
- Some college or trade school
- Received associate or trade certification
- Some bachelor's degree
- Received bachelor's degree
- Some graduate study
- Received master's degree
- Received professional/doctorate degree (e.g., MD, JD, PhD.)

Participant ID: _____

Date: _____

Questions 16 through 20 are about the child's **other** parent or primary caregiver. If this is not applicable to you, please skip this page and jump to question 21.

Parent / Guardian #2: Mother Father Other (please describe):

15. Please specify how you would describe **parent/guardian #2** (check as many as apply):

- | | |
|--------------------------------------------------------------|--------------------------------------------------------------------|
| <input type="checkbox"/> White | <input type="checkbox"/> American Indian or Alaska Native |
| <input type="checkbox"/> Hispanic, Latino, or Spanish origin | <input type="checkbox"/> Native Hawaiian or Other Pacific Islander |
| <input type="checkbox"/> Asian | <input type="checkbox"/> Some other race, ethnicity, or origin |
| <input type="checkbox"/> Black or African American | (please specify) _____ |
| <input type="checkbox"/> Middle Eastern or North African | |

16. Where was **parent/guardian #2** born?

- In the United States or another English-speaking country (e.g. Canada, Australia)
- Outside the United States (please specify): _____

17. If parent/guardian #2 was NOT born in the U.S. (e.g., in Mexico), at what age did **parent/guardian #2** come to the U.S. or another English-speaking country?

- Not applicable
- Ages 0-10
- Ages 11-18
- After the age of 18

18. What is the first language that **parent/guardian #2** learned to speak as a child?

- English only
- Another language only (*What language?* _____)
- English and another language (_____) equally

19. What is the highest level of education that **parent/guardian #2** has completed at this time?

- | | |
|----------------------------------------------------------------------|-----------------------------------------------------------------|
| <input type="checkbox"/> Some primary education | <input type="checkbox"/> Some bachelor's degree |
| <input type="checkbox"/> Completed primary education | <input type="checkbox"/> Received bachelor's degree |
| <input type="checkbox"/> Some high school | <input type="checkbox"/> Some graduate study |
| <input type="checkbox"/> High school diploma or equivalent (GED) | <input type="checkbox"/> Received master's degree |
| <input type="checkbox"/> Some college or trade school | <input type="checkbox"/> Received professional/doctorate degree |
| <input type="checkbox"/> Received associate's or trade certification | (e.g., MD, JD, PhD.) |

20. Which category below best represents your total household income over the past year **before taxes**?

**Please include from all family members living in your household and from all sources such as wages, salaries, commissions, pensions, family allowances, government assistance, child support, etc.*

- | | |
|----------------------------------------------------|------------------------------------------------------|
| <input type="checkbox"/> Less than \$10,000 | <input type="checkbox"/> \$80,000 through \$99,999 |
| <input type="checkbox"/> \$10,000 through \$14,999 | <input type="checkbox"/> \$100,000 through \$149,999 |
| <input type="checkbox"/> \$15,000 through \$19,999 | <input type="checkbox"/> \$150,000 through \$199,999 |
| <input type="checkbox"/> \$20,000 through \$29,999 | <input type="checkbox"/> \$200,000 through \$249,999 |
| <input type="checkbox"/> \$30,000 through \$34,999 | <input type="checkbox"/> \$250,000 through \$299,999 |
| <input type="checkbox"/> \$40,000 through \$49,999 | <input type="checkbox"/> \$300,000 through \$349,999 |
| <input type="checkbox"/> \$50,000 through \$59,999 | <input type="checkbox"/> \$400,000 through \$499,999 |
| <input type="checkbox"/> \$60,000 through \$69,999 | <input type="checkbox"/> over \$500,000 |
| <input type="checkbox"/> \$70,000 through \$79,999 | |

21. How many people depend on this income? _____

Language and Reading Development

22. What language(s) is/are spoken at home?

- English only
- Another language only (*What language?* _____)
- English and another language (_____) equally

23. What is/are the language(s) that each family member can **speak**? (*at the level to hold a conversation*)

Languages	Child	Parent/guardian #1	Parent/guardian #2
Primary language			
Other primary language (If this language is as good as the first primary language)			
Second language			
Third language			

24. To the best of your knowledge, at what age did your child **say** his/her **first English**...

	Between 9-11 months old	1 year – 1 year 5 months	1 year 6 months – 1 year 11 months	2 years – 2 years 5 months	2 year 6 months – 2 year 11 months	If later than 3 years old, please specify:
Word?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Two word phrase?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sentence?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

25. At what age did you begin reading **English** books to your child?

- 0-2 years
- 3-4 years
- 5-7 years
- after the age of 7

26. To the best of your knowledge, at what age did your child begin to **read** by themselves (silently or out loud) in **English**?

- 3 years or earlier
- 4 years
- 5 years
- 6 years
- 7 years or later

27. On an **average day**, how much...

	Less than 15 mins	15 – 30 mins	30 – 45 mins	45 – 60 mins	More than 1 hour
Do you read English books to your child?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you tell stories and share rhymes or jokes to your child in English ?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Does your child read to him/herself in English ?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

28. Does your child partake in any form of after-school tutoring programs that provide extra help with reading in English? If yes, how many hours per week?

- No tutoring
- less than 1 hour
- 1-2 hours
- 2-3 hours
- 3-4 hours
- 4-5 hours
- 5 hours or more

29. Is there anything else we should know about your child’s English language or reading development?

30. Is your child 100% English monolingual? YES NO

- **If YES: This was the last section for you. Thank you very much for completing this form!**
- If NO: Please proceed to the next section.

Questions 31 through 38 are about your child's other language development. If this is not applicable to your child, this was the last section for you. Thank you very much for completing this form!

**Spanish / Chinese Language and Reading
(Bilingual Children ONLY)**

31. What is your child's other language? (circle one) SPANISH CHINESE

32. To the best of your knowledge, at what age did your child **say** his/her **first other language**...

	Between 9-11 months old	1 year – 1 year 5 months	1 year 6 months – 1 year 11 months	2 years – 2 years 5 months	2 year 6 months – 2 year 11 months	If later than 3 years old, please specify:
Word?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> _____
Two word phrase?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> _____
Sentence?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> _____

33. At what age did you begin reading **other language** books to your child?

- 0-2 years
- 3-4 years
- 5-7 years
- after the age of 7

34. To the best of your knowledge, at what age did your child begin to **read** by themselves (silently or out loud) in their **other language**?

- 3 years or earlier
- 4 years
- 5 years
- 6 years
- 7 years or later

35. On an **average day**, how much...

	Less than 15 mins	15 – 30 mins	30 – 45 mins	45 – 60 mins	More than 1 hour
Do you read other language books to your child?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you tell stories and share rhymes or jokes to your child in their other language ?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Does your child read to him/herself in their other language ?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

36. At what age did your child begin attending an English-speaking school?

- Pre-school
- Kindergarten
- 1st grade
- 2nd grade
- 3rd grade or later

37. Is your child currently learning how to read in his/her other language (_____)? (Please read all answers through first, then check all that apply.)

- No, my child is not learning how to read in Spanish / Chinese.

My child is learning to read in their other language...

- At home
- At school (How many hours per week? _____)
- In an after-school program (e.g. at church, parent groups) (How many hours per week? _____)
- El Nuestra Lengua
- Ann-Hua
- Other: _____ (How many hours per week? _____)

38. We would like to know a little bit more about your child's background involving the language(s) they speak. Please provide us with information on your child's language-learning experiences (e.g. regular visits to non-English speaking countries, experience living in other countries; nanny; siblings, family members, peers; etc.)

Supplement 2

Heritage Language Reading Assessment

Spanish Word Reading Proficiency. Spanish single word reading was assessed by the Identificación de letras y palabras (word identification) subset from the Batería III Woodcock-Muñoz (Muñoz-Sandoval et al., 2005). It is the Spanish version of the English Woodcock-Johnson III word reading task (Woodcock, McGrew, & Mather, 2001).

Chinese character reading proficiency. Chinese character reading was assessed by a character recognition and a character reading task. There were two versions with the same set of characters but in different forms, one with simplified forms and the other with traditional forms. Children were tested with the version aligned with their reading instruction. They were self-developed on the basis of Liu and Chen's measures (2013). The characters were carefully selected to ensure that they are of similar complexities between the simplified and the traditional forms. For the character recognition task, children hear a character and are asked to pick the character from four choices. The incorrect answers include a semantic distractor, a phonological distractor, and one orthographic distractor. E.g., “qian1”, choices are “欠 (qian4, owe, phonological distractor), 千 (qian1, thousand, answer), 万 (wan4, ten thousand, semantic distractor), 干 (gan1, dry, orthographic distractor).” Children stop when they have eight incorrect responses in a row. There is a total of 30 items with very high reliability ($\alpha = .95$). For the character reading task, children are asked to read characters. The two tasks both progress from simpler (e.g., 口 kou3, mouth) items to harder ones (e.g., 笔 bi3, pen). The character reading measure has 60 items with very high reliability ($\alpha = .98$). Children stop when they have five incorrect responses in a row.

Supplement 3

Multiple correlation coefficients between covariates and English measures

For each language group, we calculated multiple correlations between all covariates (age, gender, working memory, and maternal education) and the four English measures. Figure 1 shows the multiple correlation coefficients by task and by the group.

Table S1. Multiple correlation coefficients between covariates and English measures

	English Monolingual	Spanish Bilingual	Chinese Bilingual
Vocabulary	.67	.72	.79
Word Reading	.69	.77	.74
Morphological Awareness	.72	.75	.78
Phonological Awareness	.53	.72	.67

Note. All correlations are significant at $p < .001$.

Supplement 4

Group statistics of the ANCOVA covariates

Table S2. Group statistics of the ANCOVA covariates

	Vocabulary		Word Reading		Morphological awareness		Phonological Awareness	
	<i>F</i>	<i>p</i>	<i>F</i>	<i>p</i>	<i>F</i>	<i>p</i>	<i>F</i>	<i>p</i>
Age	134.19	<.001	97.35	<.001	125.77	<.001	29.89	<.001
Gender	4.14	.043	.16	>.05	.14	>.05	.62	>.05
Digit Span	27.32	<.001	42.56	<.001	39.85	<.001	60.52	<.001
Maternal Education	5.39	.021	10.45	<.001	7.87	.005	24.59	<.001

Note. *df* = (1, 276).

Supplement 5

Bivariate correlations among English, heritage language tasks, and control variables

Table S3

Bivariate correlations among English, heritage language tasks, and controls by group

English Monolingual		2	3	4	5	6	7			
English	1.Vocabulary	.57	.65	.45	.63	.01	.38			
	2.Word Reading	-	.71	.76	.62	-.02	.48			
	3.Morphological Awareness		-	.65	.68	-.13	.47			
	4.Phonological Awareness			-	.47	-.01	.41			
Control	5.Age				-	-.28	.38			
	6.Maternal Education					-	-.05			
	7.Working Memory						-			
Spanish Bilingual		2	3	4	5	6	7	8	9	10
English	1.Vocabulary	.67	.72	.63	.65	.08	.63	.75	.65	.59
	2.Word Reading	-	.74	.86	.64	.19	.68	.70	.72	.82
	3.Morphological Awareness		-	.65	.64	.19	.65	.69	.72	.66
	4.Phonological Awareness			-	.54	.09	.70	.60	.68	.86
Control	5.Age				-	-.06	.61	.69	.55	.43
	6.Maternal Education					-	.03	.12	.19	.25
	7.Working Memory						-	.64	.59	.59
Spanish	8.Vocabulary							-	.79	.67
	9.Morphological Awareness								-	.74
	10.Phonological Awareness									-
Chinese Bilingual		2	3	4	5	6	7	11	12	13
English	1.Vocabulary	.81	.85	.66	.78	.08	.58	.21	.48	.62
	2.Word Reading	-	.83	.78	.71	.10	.59	.12	.45	.71
	3.Morphological Awareness		-	.71	.75	.11	.63	.25	.58	.68
	4.Phonological Awareness			-	.59	.05	.61	.23	.52	.75
Control	5.Age				-	.05	.61	.29	.52	.55
	6.Maternal Education					-	.05	.02	.14	.05
	7.Working Memory						-	.22	.49	.54
Chinese	11.Vocabulary							-	.63	.37
	12.Morphological Awareness								-	.62
	13.Phonological Awareness									-

Note. $r < .15, p > .05$; $r < .22, p < .10$; $r < .25, p < .05$; $r < .30, p < .01$; all else, $p < .001$.

Supplement 6

Unstandardized coefficients, standard errors, and confidence intervals of the path models

Table S4. Research question 1 model unstandardized coefficients

		Unstandardized β	SE	95% CI
English Monolingual	MA – Word Reading	.64	.14	(.36, .91)
	PA – Word Reading	.73	.16	(.42, 1.00)
	Vocabulary – Word Reading	.00	.05	(-.11, .09)
	MA – Vocabulary	.80	.26	(.30, 1.31)
	PA – Vocabulary	.09	.30	(-.49, .67)
Spanish Bilingual	MA – Word Reading	.31	.11	(.10, .52)
	PA – Word Reading	1.15	.13	(.90, 1.41)
	Vocabulary – Word Reading	.01	.04	(-.06, .07)
	MA – Vocabulary	1.16	.29	(.60, 1.72)
Chinese Bilingual	PA – Vocabulary	.66	.36	(-.05, 1.38)
	MA – Word Reading	.30	.13	(.05, .55)
	PA – Word Reading	.79	.16	(.48, 1.10)
	Vocabulary – Word Reading	.15	.05	(.06, .24)
	MA – Vocabulary	1.63	.25	(1.14, 2.11)
	PA – Vocabulary	.46	.35	(-.23, 1.14)

Note. MA - morphological awareness, PA - phonological awareness.

Table S5. Research question 2 model unstandardized coefficients

		Unstandardized β	SE	95% CI
Spanish Bilingual	English MA – Word Reading	.26	.11	(.04, .48)
	English PA – Word Reading	.80	.20	(.42, 1.19)
	Spanish MA – Word Reading	-.02	.11	(-.23, .20)
	Spanish PA – Word Reading	.53	.26	(.02, 1.05)
	Spanish MA – English MA	.30	.08	(.14, .45)
	Spanish PA – English PA	.99	.08	(.83, 1.15)
Chinese Bilingual	English MA – Word Reading	.30	.13	(.04, .57)
	English PA – Word Reading	.57	.19	(.20, .93)
	Chinese MA – Word Reading	-.11	.19	(-.49, .27)
	Chinese PA – Word Reading	.28	.13	(.02, .54)
	Chinese MA – English MA	.39	.14	(.12, .67)
	Chinese PA – English PA	.33	.07	(.20, .46)

Note. MA - morphological awareness, PA - phonological awareness.

References

- Liu, M., & Chen, S.Y. (2013) *Development of Chinese Character Orthography Awareness of Taiwanese Children*. [Master's Thesis, University of Taipei] National digital library of theses and dissertations in Taiwan. [https://ndltd.ncl.edu.tw/cgi-bin/gs32/gswweb.cgi/login?o=dnclcdr&s=id=%22101TMTC5096008%22.&searchmode=bas
ic](https://ndltd.ncl.edu.tw/cgi-bin/gs32/gswweb.cgi/login?o=dnclcdr&s=id=%22101TMTC5096008%22.&searchmode=basic)
- Muñoz-Sandoval, A. F., Woodcock, R. W., McGrew, K. S., & Mather, N. (2005). *Batería III Woodcock-Muñoz*. Itasca, IL: Riverside Publishing.
- Woodcock, R. W., McGrew, K. S., & Mather, N. (2001). *Woodcock-Johnson III*. Itasca, IL: Riverside Publishing.