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Massachusetts Institute of Technology

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Running head: COVID-19 LITERACY IN BILINGUAL AND MONOLINGUAL

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Abstract

Children who speak one language at home and a different language at school may be at higher risk of falling behind in their academic achievement when schooling is disrupted. The present study examined the effects of COVID-19-related school disruptions on English language and literacy development among monolingual and bilingual children in the US. All children attended English-only schools that implemented varied forms of virtual and hybrid schooling during the pandemic. Pre-COVID-19 and during-COVID-19 examinations were conducted with 237 children ($M(SD)_{age}$ = 7.78 (1.54) at Time 1) from relatively high SES homes, including 95 monolinguals, 75 Spanish-English and 67 Chinese-English bilinguals. The findings revealed different impacts of COVID-19 school disruptions on the present bilingual and monolingual participants. Specifically, between Time 1 and Time 2, monolingual children made age-appropriate improvements in all literacy measurements. Relative to monolinguals, both bilingual groups showed greater gains in vocabulary but lower gains in reading comprehension. Moreover, across groups, children's independent reading practices during COVID-19 were positively associated with children's literacy growth during the pandemic-related schooling disruptions. Taken together, these findings inform theoretical perspectives on learning to read in linguistically diverse children experiencing COVID-19-related schooling disruptions.

Keywords: COVID-19, language and reading development, home literacy environment, bilingual children

Impacts of the COVID-19 disruption on the language and literacy development of monolingual and heritage bilingual children in the United States

The COVID-19 pandemic led to widespread school closures across the globe. In the state of Michigan, U.S.A., where the current study took place, half of the students across different school districts started their 2020 fall semester remotely, and one-third of students spent their whole academic year online (Hopkins et al., 2021; Kilbride et al., 2021a). Long-lasting school disruptions may lead to slower increases in children's language and literacy development (Allington & McGill-Franzen, 2018; Kilbride et al., 2021a, 2021b). In particular, children who speak a home language different from the language at school are thought to be at a higher risk for slower learning gains due to lack of communication and instruction typically received at school (Cooper et al., 1996; Kilbride et al., 2021b; Kim & Guryan, 2010). Moreover, home literacy practices are thought to play a protective role in helping children maintain and/or advance their literacy skills during school breaks (Dunn et al., 2022; Read et al., 2021; Sun et al., 2021; Wheeler & Hill, 2021). The present study thus examined the effects of pandemic-related schooling disruption and home literacy practices on learning to read in linguistically diverse learners in the US. To capture different aspects of language and literacy development, the present study included phonological and vocabulary measures of spoken and written language skills.

Impacts of COVID-19 on language and reading development among monolingual and bilingual children

Developing language and literacy skills require substantial practice and instruction (Allington & McGill-Franzen, 2018). School plays an essential role in building up these skills by providing various communication opportunities and explicit reading instruction. As such, long-term school disruptions such as COVID-19 remove students from their regular exposure to these

educational opportunities and can lead to serious alterations to children's language and reading growth trajectories (Charney et al., 2021; Engzell et al., 2021; Kilbride et al., 2021a, 2021b; Poletti, 2020). A simulation study based on prior summer learning loss data predicted a 66% decrease in kindergarten children's language and reading growth (assessed with a battery of language and literacy tests including vocabulary, word reading and reading comprehension) due to COVID-19 compared to in-person education between January 2020 and September 2020 (Bao et al., 2020). Studies of children also found that they experienced heightened depression and anxiety symptoms, decreased motivation to read, as well as less-than-expected reading progress during COVID-19 compared to pre-COVID-19 times (Baschenis et al., 2021; Soriano-Ferrer et al., 2021).

Indeed, studies that assessed language and reading outcomes generally revealed slower learning progress or even a decrease. For example, a study measured word decoding and reading comprehension among South African 2nd and 4th graders and revealed significant decreases in these skills during the 2020-2021 academic year compared to pre-pandemic students (Ardington et al., 2021). Engzell et al. (2021) analyzed the national achievement data among Dutch 8-11-year-olds collected in February and June 2020, and the results showed a reading comprehension decrease of 3.27 percentile points on average. A meta-analysis with 18 studies across a wide range of grades (e.g., K-12) and school subjects (e.g., mathematics, reading, and science) showed a small but significant decrease in achievement between pre- and during-COVID-19 student cohorts (König & Frey, 2022). In the state of Michigan where the present study took place, the department of education conducted analysis on K-8 students' NWEA assessment results during the 2020-2021 academic year. The reading composite assessment included phonological, vocabulary, word decoding and comprehension tests. Results showed that students identified as

"significantly behind grade level" increased from 25.2% to 32.8% during this pandemic year, showing slower progress compared to a typical pre-COVID-19 year (Kilbride et al., 2021a, 2021b).

While many studies revealed slower language and literacy development due to COVID-19, some studies also found mixed results regarding the impacts of COVID-19. For example, Kartushina et al. (2022) assessed toddler-age children during the major COVID-19 lockdown (2020 March-September) and found that children gained more words than expected compared to pre-pandemic norms. Georgiou (2021) found that, while English-speaking Canadian 2nd and 3rd graders had decreases in their reading fluency and comprehension skills, 4th-9th graders maintained adequate reading progress compared to the cohorts in pre-pandemic years. Kuhfeld et al. (2022) analyzed reading achievement data on 5 million US students and found that 3rd-8th graders had no significant change in their reading performance by the 2020 fall semester (i.e., the first semester after the major school disruption).

Academic success is often tied to children's proficiency and performance in the official language of the country. In the context of the US, for children from immigrant families who speak a non-English home language, school provides a rich environment to develop English spoken language and reading skills. These dual-language speakers are thus found to be particularly vulnerable to school disruptions in their English literacy and other aspects of academic development (Castañeda et al., 2018; Hur & Suh, 2010; Lawrence, 2012). Experts have thus suggested that pandemic-related disruptions in schooling may be especially detrimental to bilingual speakers from immigrant families, noting that the pandemic limits both schooling access and also exacerbates other adversity factors such as the socioeconomic stability of immigrant families (e.g., Bao et al., 2020).

Home literacy factors on language and reading development

According to the Home Literacy Model (HLM; Sénéchal & LeFevre, 2002), the home literacy environment can effectively facilitate children's language and reading competencies. These literacy practices may manifest in different forms. Informal home literacy practices are often performed through parent-children interactions and access to literacy resources, such as shared reading and the number of books at home. These practices mainly support oral language development such as vocabulary. Formal home literacy practices focus on directly engaging children with printed texts, such as teaching children about the alphabet and letter-sound correspondences. These practices mainly support letter knowledge, word decoding, and reading comprehension development (Sénéchal & LeFevre, 2002, 2014). In support of the HLM, cross-sectional and longitudinal studies have shown that home literacy factors are predictive of children's language and reading skills and growth (Chen et al., 2010; Georgiou et al., 2021; Hood et al., 2008; Inoue et al., 2018; Sénéchal & LeFevre, 2002, 2014; Silinskas et al., 2020).

Under the COVID-19 lockdown, home literacy practices may offer unique compensatory influences on children's language and reading maintenance and progress (Dunn et al., 2022; Read et al., 2021; Sun et al., 2021; Wheeler & Hill, 2021). Survey studies with US preschooler samples showed that parents used more adaptive literacy practices during COVID-19, such as increased parent-child shared reading time (Wheeler & Hill, 2021) and more screen-based reading practices (Read et al., 2021). A Singaporean study with bilingual children found that, compared to pre-COVID-19 times, children showed increased time and enjoyment of English reading during COVID-19 compared to their heritage languages (i.e., Chinese, Tamil, or Malay; Sun et al., 2021). Shared reading practices were also found to be associated with spoken language outcomes. Kartushina et al. (2022) conducted a multi-site longitudinal study across 15

Running head: COVID-19 LITERACY IN BILINGUAL AND MONOLINGUAL

countries, surveying 1,742 parents of toddler-age children beginning in March 2020. Results

showed that children's vocabulary size over the first 1-2 months of lockdown increased at a

faster speed than the age norm, and importantly, their vocabulary growth was positively

associated with parents' shared reading time during COVID-19, controlling for demographics

such as socioeconomic status. Together, home literacy factors may play a critical role in

alleviating the potential decreases in language and literacy skills during the COVID-19

disruptions.

In sum, several studies have estimated how COVID-19 school disruptions and home

literacy factors are associated with children's language and literacy development. However, to

our knowledge, very few have traced the same children from pre-COVID-19 to post-outbreak

times. The study from Kartushina et al. (2022) demonstrated a meaningful vocabulary increase

and a positive association with parental shared reading time. However, this study focused on

toddler-age children over a short period of time (41 days between tests on average), which lacks

generalizability to older children and their reading development. It also remains a question as to

how COVID-19 school disruptions and home literacy routines may differentially impact dual

language speakers. The present study therefore aimed to address these issues by providing two-

time-point measurements of children's language and literacy development before and during

pandemic-related school disruptions.

The present study

The goal of the present study was to examine the influence of COVID-19-related school

closures on the English language and reading development among US-raised school-age children

from diverse home language backgrounds. We measured English language and literacy skills

pre-COVID-19 (Time 1, May - October 2019), and approximately one year into the COVID-19

Running head: COVID-19 LITERACY IN BILINGUAL AND MONOLINGUAL

pandemic (Time 2, December 2020 - July 2021). To capture different aspects of language and literacy, we assessed phonological and vocabulary skills as indicators of spoken language skills, as well as word decoding and reading comprehension as indicators of written language skills. At Time 2, we also conducted a parental questionnaire to probe children's home literacy environment and schooling experiences since the first major outbreak of COVID-19 in the US (i.e., March 2020).

This study addressed two questions. 1) how much progress did bilingual and monolingual children make in their English language and literacy development during the COVID-19 school disruption? As most COVID-19 related studies showed slower learning gains (e.g., Kilbride et al., 2021a, 2021b; Kuhfeld et al., 2022), we predicted that across groups, children may show slower-than-expected progress in comparison to prior age-related norms. In particular, bilingual children were expected to be especially susceptible to having slower learning gains in both spoken and written English language skills.

2) how do home literacy practices during COVID-19 impact children's language and reading skills? We focused on word reading and reading comprehension as the target outcomes of individual reading skills as well as vocabulary as an index of spoken language development. Home literacy questions focused on literacy activities during COVID-19, and included informal practices such as shared reading and the number of books at home, as well as formal practices such as children's independent reading. Guided by the Home Literacy Model (Senechal & LeFevre, 2014), we predicted that these home literacy practices would be significantly associated with children's language and reading skills at Time 2.

Method

Participants and procedure

Running head: COVID-19 LITERACY IN BILINGUAL AND MONOLINGUAL

The final sample included in the analysis was a total of 237 children (46.6% girls) from schools and community centers in southeast Michigan, United States. The sample included 95 monolingual, 75 Spanish-English, and 67 Chinese-English bilingual children recruited as part of a larger study of bilingual literacy. Bilingual participants were recruited by community liaisons integrated within the local Chinese- and Spanish-speaking communities. Time 1 data collection was before the COVID-19 outbreak, between May and October 2019. Participants were tested during one in-person lab visit. The testing session for each language took approximately 1 hour. During the COVID-19 outbreak, participants completed Time 2 testing online via Zoom between December 2020 and July 2021. Testing sessions for each language took approximately 1.5 hours. The average Time 1 - Time 2 gap was 631 days (1.73 years). Note that the Time 1 - Time 2 discrepancies across groups are due to the order of Time 1 data collection, in which bilingual children were largely tested before monolingual children. At Time 2, monolinguals and bilinguals were tested during the same time period. There were additional 134 participants who completed Time 1 assessments but were not available at Time 2. For those who did not participate in Time 2, 46 were not invited because they did not meet the inclusion criteria for the larger bilingual literacy study. The remaining 88 were invited to Time 2 but either did not respond to the invitation ($n = 43$) or declined to participate ($n = 45$). These remaining 88 children did not differ in any Time 1 measure from the participants included in the current analysis (ps = .052-.769 across the four English tasks between the Time 2 participants and the remaining 88 children). Table 1 showed specific demographic information by language status. The study was approved by the Institutional Review Board.

Table 1.

Participant Demographics

	Full Sample		English Monolingual		Spanish Bilingual		Chinese Bilingual		*F*	*p*	Group Differences
N	237		95		75		67				
% Girl	46.6%		47.9%		48.0%		43.3%				
T1 Age (*M(SD)*)	7.78 (1.54)		8.18 (1.64)		7.86 (1.34)		7.11 (1.38)		10.46	<.001	E = S > C
T2 Age (*M(SD)*)	9.50 (1.56)		9.76 (1.65)		9.67 (1.45)		8.95 (1.45)		6.05	.003	E = S > C
T1-T2 gap (*M(SD)* days)	631 (99)		577 (96)		661 (93)		675 (73)		29.72	<.001	C = S > E
	n	%	*n*	%	*n*	%	*n*	%	χ^2	*p*	
T1 Grade distribution									20.03	<.001	E = S > C
Pre-K/K	58	24.5%	19	20.0%	11	14.7%	28	41.8%			
1	56	23.6%	17	17.9%	26	34.7%	13	19.4%			
2	39	16.5%	20	21.1%	8	10.7%	11	16.4%			
3	47	19.8%	18	19.0%	18	24.0%	11	16.4%			
4+	37	15.6%	21	22.1%	12	16.0%	4	9.0%			
T2 Grade distribution									18.41	.104	E = S = C
K	1	.4%	0	0%	0	0%	1	1.5%			
1	20	8.4%	7	7.4%	2	2.7%	11	16.4%			
2	60	25.3%	19	20.0%	20	26.7%	21	31.3%			
3	45	19.0%	19	20.0%	16	21.3%	10	14.9%			
4	49	20.7%	21	22.1%	14	18.7%	14	20.9%			
5	35	14.8%	16	16.8%	13	17.3%	6	9.0%			
6+	27	11.4%	13	13.7%	10	13.3%	4	6.0%			
Maternal Education									28.61	<.001	E = C > S
High school or lower	28	11.8%	9	9.5%	15	20.0%	4	6.0%			
Bachelor's degree	82	34.6%	29	30.5%	38	50.7%	15	22.4%			
Master's or higher	127	53.6%	57	60.0%	22	29.3%	48	71.7%			

Note. Degrees of freedom for all *F* tests were (2, 234), and for Chi-square tests were 8, 12, and 4, respectively. E = English monolingual; S = Spanish bilingual; C = Chinese bilingual

Language Background Screening

At Time 1, parents filled in an adapted version of the Bilingual Language Background and Use Questionnaire (see Sun et al., 2022a, for the full scale). The questionnaire asks about children's cognitive and language development, physical and mental health history, home and school language exposure and use, and parents' language background. Each participant was identified as either English monolingual, Spanish bilingual, or Chinese bilingual during targeted recruitment for a larger study of Spanish-English and Chinese-English bilingual literacy, and based on their parents' responses on one item about their language background ("Is your child 100% monolingual?" "Yes/No"; if "No", "What is your child's other language?").

All participants were living in the United States and were attending English-only schools and had age-appropriate proficiency in English vocabulary and word reading. Monolingual children were exposed to English from birth, and bilingual participants were systematically exposed to English (i.e., using English on a regular basis such as in daycare or preschool in the US) by two years of age. All bilingual participants were exposed to Chinese or Spanish at home from birth by at least one parent who was a native speaker of the language. Bilingual parents also completed an hour-by-hour language usage survey in which they reported children's language input and output throughout a typical week (Sun et al., 2022b). The survey showed that Spanish-English bilingual children on average used Spanish for 40% (SD = 11%) time of a typical week and the proportion of Chinese usage for Chinese-English bilingual children was 47% (SD = 11%). The remaining proportion represents time spent using English.

Time 2 Parent Questionnaire on Schooling Experiences, Home Literacy Practices, and Family Financial Status during COVID-19

At Time 2, parents were invited to complete a questionnaire on their children's home literacy experiences and school education from March 2020 until the time when the

questionnaire was administered (December 2020-July 2021). The questionnaire included

questions on children's schooling experiences during that period, children's home literacy

environment, and demographic questions including family income and employment status during

that period (see Tables 2 and 3). For children's schooling experiences, questions included 1) how

teachers communicated with parents, 2) how children attended school, and 3) how often teachers

checked children's homework. Parents answered each question twice, with regard to two

schooling periods, one during March-June 2020 (i.e., the first major outbreak of COVID-19,

which resulted in a rapid transition to remote schooling), and the other during the 2020-2021

school year. Table 2 displays the descriptive statistics for these questions.

We note that although the schooling experience variables were able to provide a general

picture of children's schooling a year into the pandemic, these variables are difficult to account

for in the current analyses. During the period of the study, the lockdown was only partially lifted

and virtual schooling persisted as local school districts implemented a gradual transition from all

virtual to hybrid, such that children slowly transitioned from 5 days a week of virtual school to

having an increasing number of days in-person. To maintain social distancing, the local school

district (where most participants attend school) invited half the class to attend in-person and half

the class stayed at home, alternating between days. This thus makes it difficult to quantify

specific amounts of in-person versus virtual schooling for each child, but only allows for an

overall documentation of schooling modes in general.

The home literacy questions were selected and adapted from the Home Literacy

Environment Questionnaire by Hood et al. (2008). We asked 1) how often parents read English

to children per week during COVID-19 (originally an 8-point scale, collapsed into 5 categories

for clarity in Table 3), 2) the number of English books the child has at home (originally a 13-

point scale), and 3) children's English independent reading time per week during COVID-19 (5-point scale). Family financial status during COVID-19 was assessed with two questions: 1) family income during 2019 (originally a 17-point scale), and 2) family financial status change since COVID-19 (originally a 7-point scale). Table 3 displays the descriptive statistics for these questions.

English standardized language and reading measures

Receptive vocabulary. Receptive vocabulary was measured by the Peabody Picture Vocabulary Test - 5 (PPVT-5, Dunn, 2019). Children heard a word and were asked to select the picture that best depicts the word from four picture choices. Each child started with their age-appropriate item and stopped when they made six consecutive mistakes. PPVT-5 has a total of 240 items and demonstrated overall reliability of .97, and test-retest reliability of .88 (Dunn, 2019). For the current study, the test-retest reliability was .83 for the raw score and .71 for the standard score. While still within the acceptable range, the relatively lower test-retest reliability is likely due to numerous contextual factors, such as the 1.5 year interval between tests, the change from in-person to remote testing, and the changing educational context that is the focus of the current study.

Phonological awareness. Phonological awareness was tested with the 34-item Elision subtest of the Comprehensive Test of Phonological Processing-2 (CTOPP-2; Wagner et al., 2013). Children heard a word and were asked to delete one of the sounds in the word and say what was left after deleting that sound. For example, "Say cup without saying /k/" [up]. The test started with simple items that ask children to omit a single syllable and became more difficult by omitting smaller parts (i.e., a phoneme) at different positions of the word, i.e., "Say fixed without saying /k/" [fist]. Children stopped when they made three mistakes in a sequence. CTOPP-2

demonstrated high internal consistency, Cronbach's α > .80 (Wagner et al., 1999). For the

current study, the test-retest reliability was .71 for the raw score and .72 for the standard score.

Word reading. Word reading was assessed by the letter-word identification subtest of the

Woodcock-Johnson IV (Schrank et al., 2014). Children were asked to read a list of words that

were arranged with increasing difficulty and the task was discontinued after 6 consecutive errors.

Children began the test from their age-appropriate item and stopped when they made six errors in

a row. There are 78 items in the task, and it demonstrated high test-retest reliability (> .80,

Canivez, 2017). For the current study, the test-retest reliability was .84 for the raw score and .82

for the standard score.

Passage Comprehension. Passage reading comprehension was assessed by the passage

comprehension subtest of the Woodcock-Johnson IV (Schrank et al., 2014). For each item,

children were asked to read a sentence or passage to themselves and completed the blank at the

end. The test started from single sentence items to longer and more complex passage items.

Children began the test from their age-appropriate item and stopped when they made six errors in

a row. There are 52 items in the task, and it demonstrated high test-retest reliability (> .83,

Villarreal, 2015). For the current study, the test-retest reliability was .78 for the raw score

and .71 for the standard score.

Statistical Analysis.

Pre- and during-COVID-19 language and reading scores were compared using linear

mixed-effects regression models with R package *lme4*. Omnibus χ^2 tests were calculated with

ANOVA models using Type III sums of squares. In all models, random effects were modeled for

each participant. Post hoc simple effects tests were computed with R package *emmeans*, *p*-values

were calculated with a Bonferroni correction for three comparisons (at *p* = .017), and Cohen's *d*

effect sizes were calculated. Next, multiple regression models were conducted to examine the

role of home literacy factors on language and reading outcomes at Time 2. The data analysis R

script is available on OSF:

https://osf.io/529vp/?view_only=8689e2fe66f843adb90622d765fdff77.

Results

Schooling and home literacy environment during COVID-19

According to parental reports (also displayed in Table 2), during the semester of the

initial COVID-19 outbreak (March-June 2020), most children (84%) attended school fully

virtually with only a few children hybrid (3%), in-person (6%), or other (7%, including no

schooling or home schooling). At this time, the most frequent means for teachers to contact

parents were via emails or messages (78%). Most of the children's teachers checked homework

at least "some of the time" (64%). Overall, these numbers did not differ between monolingual

and bilingual groups (all ps > .118, see Table 2). During the 2020-2021 school year, the number

of children who attended school virtually decreased to around 52%, and more children went to

school in hybrid or in-person formats (46%). At this time, the most frequent way for teachers to

contact parents was still via individual emails or messages, as reported by more than 91% of

parents. About half of children's teachers checked homework at least "some of the time." Again,

these numbers did not differ between monolingual and bilingual groups (all ps > .140, see Table

2).

Table 3 displays the frequencies and percentages for the COVID-19 family financial and

home literacy questions. The current sample was mostly from middle-to-high socioeconomic

families: only 17% of families earned less than $70,000 in one year, whereas the national median

household income was $69,560 in 2019 (U.S. Census Bureau, 2021). Note that the monolingual

group on average had a higher annual income compared to the two bilingual groups (see Table 3). Moreover, COVID-19 did not impact income for most families (i.e., 73% of children's family income was either unaffected or increased). This was not statistically different among the three groups (see Table 3). An additional important socioeconomic variable is the maternal education level as shown in Table 1. In the current sample, mothers generally had high educational attainment: 87.7% held at least a bachelor's degree (80%-94% across groups). Monolingual and Chinese-English bilingual mothers had higher educational attainment compared to Spanish-English bilingual mothers ($p < .001$, Table 1). Despite some group differences in income and maternal education, all groups can be considered having relatively high socioeconomic status.

As for the home literacy questions, parents of monolingual children read English books more often during a typical week to their children compared to the two bilingual groups, and monolingual children also had more English books at home (ps $< .001$, Table 3). However, the three groups were reported to spend equivalent amounts of time reading English books independently in a typical week during COVID-19 ($p = .347$, Table 3).

Table 2.

Descriptive statistics for children's schooling during COVID-19

	Full Sample		English Monolingual		Spanish Bilingual		Chinese Bilingual		$\chi^2(6)$	p
	n	%	n	%	n	%	n	%		
Children's schooling during March - June 2020										
1. How did your child currently attend school?									9.87	.130
Virtual	150	83.8%	69	87.3%	40	85.1%	41	77.4%		
Hybrid	5	2.8%	1	1.3%	2	4.3%	2	3.8%		
In person	11	6.1%	3	3.8%	5	10.6%	3	5.7%		
Other (no schooling, home schooling)	13	7.3%	6	7.6%	0	0%	7	13.2%		
2. How did your child's current primary teacher communicate with you? Select all that apply.[a]									N/A	N/A
Individual email/message	144	77.8%	53	66.3%	44	89.8%	47	83.9%		
Individual phone/video call	91	49.5%	32	40.0%	30	62.5%	29	51.8%		
Group email/message	168	90.3%	75	92.6%	43	89.6%	50	87.7%		
Group phone/video call	84	45.4%	33	40.7%	29	60.4%	22	38.6%		
3. How often did your child's primary teacher check his or her homework?									10.15	.118
All the time	22	12.3%	13	16.0%	4	8.5%	5	10.2%		
Most of the time	35	19.6%	16	19.8%	5	10.6%	14	28.6%		
Some of the time	46	25.7%	16	19.8%	16	34.0%	14	28.6%		
Does not check at all or no homework	76	42.5%	36	44.4%	22	46.8%	16	32.7%		
Children's schooling during the 2020-2021 school year										
1. How does your child currently attend school?									9.65	.140
Virtual	97	51.6%	40	50.0%	20	40.0%	37	63.8%		
Hybrid	38	20.2%	16	20.0%	12	24.0%	10	17.2%		
In person	49	26.1%	22	27.5%	18	36.0%	9	15.5%		
Other (no schooling, home schooling)	4	2.1%	2	2.5%	0	0%	2	3.4%		
2. How does your child's current primary teacher communicate with you? Select all that apply.[a]									N/A	N/A
Individual email/message	173	94.0%	70	89.7%	49	100%	54	94.7%		

Individual phone/video call	122	66.3%	53	67.9%	32	65.3%	37	64.9%	
Group email/message	167	90.8%	68	89.5%	46	92.0%	53	91.4%	
Group phone/video call	90	48.9%	35	46.1%	24	48.0%	31	53.4%	
3. How often does your child's primary teacher check his or her homework?								9.17	.164
All the time	7	3.7%	2	2.5%	1	2.0%	4	7.0%	
Most of the time	28	14.9%	14	17.3%	4	8.0%	10	17.5%	
Some of the time	44	23.4%	17	21.0%	10	42.0%	17	29.8%	
Does not check at all or no homework	109	58.0%	48	59.3%	35	70.0%	26	45.6%	

Note. [a] For this question, parents may select multiple choices. Percentage values represent the number of participants selecting each choice out of the total number of participants, and therefore do not add up to 100%. Chi-square difference tests are not appropriate for this type of question, and so group differences have not been calculated.

Table 3.

Descriptive statistics for the family socio-economic factors and home literacy environments during COVID-19

	Full Sample		English Monolingual		Spanish Bilingual		Chinese Bilingual		Group Differences		
	n	%	n	%	n	%	n	%	χ^2	p	
Family socio-economic factors											
1. Family income in 2019 (USD)									19.09	.014	E > S = C
< 70k	32	17.2%	12	15.2%	7	14.3%	13	22.4%			
70k-100k	42	22.6%	16	20.3%	16	32.4%	10	17.2%			
100k-150k	54	29.0%	23	29.1%	18	36.7%	13	22.4%			
150k-200k	25	13.4%	7	8.9%	5	10.2%	13	22.4%			
> 200k	33	17.7%	21	26.6%	3	6.1%	9	15.5%			
2. Family income change since COVID-19									6.24	.397	E = S = C
Increased	29	15.5%	16	20.0%	5	10.2%	8	13.8%			
Remained the same	108	57.8%	43	53.8%	28	57.1%	37	63.8%			
Decreased by < 20%	37	19.8%	14	17.5%	14	28.6%	9	15.5%			
Decreased by > 20%	13	7.0%	7	8.8%	2	4.1%	4	6.9%			
Home literacy environment questions											
3. In a typical week, how often do you or other family members read to your child at bedtime?									23.40	<.001	E > S = C
Once	61	33.0%	17	21.0%	18	37.5%	26	46.4%			
Two to three times	41	22.2%	16	19.8%	13	27.1%	12	21.4%			
Four to five times	32	17.3%	15	18.5%	8	16.7%	9	16.1%			
Six to seven times	22	11.9%	11	13.6%	5	10.4%	6	10.7%			
More than seven times	29	15.7%	22	27.2%	4	8.3%	3	5.4%			
4. How many English books does your child have (including purchased, rented, and borrowed books)?									39.75	<.001	E > S = C
<40	53	28.8%	6	7.4%	27	57.4%	20	35.7%			
40-90	46	25.0%	23	28.4%	9	19.1%	14	25.0%			
>90	85	46.2%	52	64.2%	11	23.4%	22	39.3%			
5. How much time does your child spend reading per week?									8.194	.347	E = S = C
Less than 1 hour	14	7.6%	7	8.6%	3	6.3%	4	7.1%			

1-3 hours	55	29.7%	20	24.7%	20	41.7%	15	26.8%
3-5 hours	40	21.6%	15	18.5%	13	27.1%	12	21.4%
5-10 hours	49	26.5%	24	29.6%	8	16.7%	17	30.4%
More than 10 hours	27	14.6%	15	18.5%	4	8.3%	8	14.3%

Note. E = English monolingual; S = Spanish bilingual; C = Chinese bilingual. Degrees of freedom are 8, 6, 8, 4, 8, respectively.

Table 4. *M(SD)* of Standard Language and Literacy Scores by Group by Time Point

		Vocabulary					Phonological Awareness				
		M(SD)	*t*	*df*	*p*	*d*	*M(SD)*	*t*	*df*	*p*	*d*
Full sample	T1	106.85(18.66)	5.38	227	<.001	.51	10.69(2.91)	1.59	231	.11	-.15
	T2	111.77(17.78)					10.46(3.04)				
English Monolingual	T1	114.13(15.51)	.69	226	.494	.06	10.05(2.80)	-2.05	230	.042	-.19
	T2	115.10(14.55)					9.59(3.00)				
Spanish Bilingual	T1	100.15(19.18)	4.09	226	<.001	.39	10.82(3.20)	-.78	231	.439	-.07
	T2	106.69(18.98)					10.62(3.06)				
Chinese Bilingual	T1	104.02(18.86)	5.21	226	<.001	.49	11.43(2.55)	.28	230	.783	.03
	T2	112.65(19.44)					11.51(2.74)				
		Word Reading					Passage Comprehension				
Full sample	T1	108.17(17.33)	2.22	228	.027	.21	102.17(14.62)	-2.07	210	.040	-.20
	T2	109.69(17.19)					100.58(14.58)				
English Monolingual	T1	104.17(16.86)	1.06	227	.292	.10	100.00(15.64)	.49	209	.622	.05
	T2	105.32(17.93)					100.59(13.65)				
Spanish Bilingual	T1	108.58(18.95)	.24	227	.811	.02	100.13(14.26)	-2.83	209	.005	-.28
	T2	108.88(17.43)					96.21(15.04)				
Chinese Bilingual	T1	113.38(14.70)	2.66	227	.008	.25	107.14(12.37)	-1.58	209	.115	-.16
	T2	116.80(13.36)					104.95(14.24)				

Note. T1: Time 1; T2: Time 2; *p* values indicated the paired simple effects between T1 and T2 task performance for each group based on respective linear mixed-effects regressions. The statistics split by language group should be thresholded under Bonferroni correction at .017 for three multiple comparisons (the full sample statistics do not apply).

Age-normed change in language and reading skills

Means and standard deviations of the age-normed scaled/standard scores by group by task are shown in Table 4. To examine how participants' age-normed performance changed during COVID-19, we conducted four linear mixed-effects regression models using time (2 time points, within-subject variable) and bilingual status (3 groups, between-subject variable) to statistically predict language and reading standard scores (i.e., the four English tasks), respectively. To account for the fact that children may vary in the amount of schooling experience, Time 1 grade was entered as covariate. Maternal education was also entered to partially account for differences in socioeconomic backgrounds. Because we were interested in each group's progress between the two time points, for each task, we then conducted simple effects contrasts between Time 1 and Time 2 for the three language groups (Bonferroni correction was used for 3 comparisons, $p = .017$). The results of these pairwise contrasts are shown in Table 4. Note that Table 4 also displays score changes between the two time points for the full sample.

For vocabulary, all predictors were significant except for Time 1 grade and time interval: the main effect of time, $\chi^2_{Time}(1) = 27.11$, $p < .001$; main effect of group, $\chi^2_{Group}(2) = 22.22$, $p < .001$; time*group interaction, $\chi^2_{Time*Group}(1) = 13.87$, $p < .001$; maternal education, $\chi^2_{Maternal\ Education}(1) = 9.47$, $p = .002$; Time 1 grade, $\chi^2_{Time\ 1\ Grade}(1) = .54$, $p = .463$; and time interval, $\chi^2_{Time\ Interval}(1) = 1.90$, $p = .168$. Therefore, the three groups made significantly different amounts of progress in vocabulary between the two time points. Follow-up pairwise contrasts between the two time points showed that the bilingual groups made significant progress at Time 2 compared to Time 1, but the monolingual group did not yield significance: $M(SE)_{Spanish\ Bilingual\_T2-T1} =$

6.54(1.60), $t(225) = 4.09$, $p < .001$, $d = .39$; $M(SE)_{\text{Chinese Bilingual\_T2-T1}} = 8.64(1.66)$, $t(225) = 5.21$,

$p < .001$, $d = .49$; $M(SE)_{\text{Monolingual\_T2-T1}} = .97(1.41)$, $t(225) = .69$, $p = .494$, $d = .06$.

For phonological awareness, only the group main effect as well as the maternal education

and grade covariates were significant: the main effect of group, $\chi^2_{\text{Group}}(2) = 6.25$, $p = .044$; the

main effect of time, $\chi^2_{\text{Time}}(1) = .08$, $p = .783$; time*group interaction, $\chi^2_{\text{Time*Group}}(1) = 2.35$, p

$= .309$; maternal education, $\chi^2_{\text{Maternal Education}}(1) = 10.98$, $p < .001$; Time 1 grade, $\chi^2_{\text{Time 1 Grade}}(1) =$

3.91, $p = .048$; and time interval, $\chi^2_{\text{Time Interval}}(1) < .01$, $p = .991$. Specifically, pairwise contrasts

between the two time points showed that all groups maintained age-appropriate progress between

Time 1 and 2, and did not differ significantly from one another: $M(SE)_{\text{Spanish Bilingual\_T2-T1}} =$

$-.21(.26)$, $t(229) = -.78$, $p = .434$, $d = -.07$; $M(SE)_{\text{Chinese Bilingual\_T2-T1}} = .07(.27)$, $t(229) = .28$, p

$= .784$, $d = .03$; $M(SE)_{\text{Monolingual\_T2-T1}} = -.47(.23)$, $t(229) = -2.04$, $p = .042$, $d = -.19$.

For word reading, there were significant main effects of time, $\chi^2_{\text{Time}}(1) = 7.11$, $p = .008$,

group, $\chi^2_{\text{Group}}(2) = 9.64$, $p = .008$, maternal education, $\chi^2_{\text{Maternal Education}}(1) = 21.79$, $p < .001$, but

not Time 1 grade, $\chi^2_{\text{Time 1 Grade}}(1) = .36$, $p = .552$, as well as time interval, $\chi^2_{\text{Time Interval}}(1) < .01$, p

$= .985$. The time by group interaction effect was not significant, $\chi^2_{\text{Time*Group}}(2) = 3.33$, $p = .189$.

Specifically, pairwise contrasts between the two time points showed that all groups maintained at

least age-appropriate progress between Time 1 and 2, and did not differ significantly from one

another: $M(SE)_{\text{Spanish Bilingual\_T2-T1}} = .29(1.22)$, $t = .24$, $p(226) = .811$, $d = .02$; $M(SE)_{\text{Chinese}}$

$_{\text{Bilingual\_T2-T1}} = 3.42(1.28)$, $t(226) = 2.67$, $p = .008$, $d = .25$; $M(SE)_{\text{Monolingual\_T2-T1}} = 1.14(1.08)$,

$t(226) = 1.06$, $p = .290$, $d = .10$.

For passage reading comprehension, there were significant effects of time*group

interaction, $\chi^2_{\text{Time*Group}}(2) = 6.33$, $p = .042$, maternal education, $\chi^2_{\text{Maternal Education}}(1) = 19.00$, p

$< .001$, and Time 1 grade, $\chi^2_{\text{Time 1 Grade}}(1) = 10.15$, $p = .001$. The time and group main effects

were not significant, $\chi^2_{Time}(1) = 2.49$, $p = .114$; $\chi^2_{Group}(2) = 2.77$, $p = .251$, as well as time interval, $\chi^2_{Time\ Interval}(1) = .21$, $p = .650$. Therefore, the three groups made significantly different amounts of progress in reading comprehension between the two time points. Follow-up pairwise contrasts between the two time points showed that the bilingual groups showed score decreases at Time 2 compared to Time 1, but the monolingual group showed a slight (but non-significant) increase: $M(SE)_{Spanish\ Bilingual\_T2-T1} = -3.92(1.38)$, $t = -2.83$, $p(208) = .005$, $d = -.28$; $M(SE)_{Chinese\ Bilingual\_T2-T1} = -2.19(1.38)$, $t(208) = -1.58$, $p = .116$, $d = -.16$; $M(SE)_{Monolingual\_T2-T1} = .59(1.19)$, $t(208) = .49$, $p = .623$, $d = .05$.

Home literacy and language and literacy outcomes at Time 2

Table 5 shows the bivariate correlations between age-normed standard scores of all language and literacy measures at both times and the home literacy factors across all participants. The same correlation table for each language group is provided in Supplement 1. Across all participants, children's independent reading practices during COVID-19 were reliably associated with Time 2 language and reading scores, rs = .20-.44, all ps < .01. However, parent's bedtime reading practices during COVID-19 only showed null-to-small-sized associations with Time 2 scores, rs = -.10-.16, ps > .031. Similarly, the number of books at home showed non-significant associations with Time 2 word reading ($r = .03$, $p = .661$) and phonological awareness ($r = -.06$, $p = .385$), and small-to-mid-sized associations with Time 2 vocabulary ($r = .31$, $p < .001$) and reading comprehension ($r = .31$, $p < .001$). These associations were similar across the three language groups (see Supplement 1).

To examine the influence of home literacy practices on children's Time 2 performance, we performed hierarchical regression models using home literacy factors to predict Time 2 language (vocabulary) and literacy (word reading and reading comprehension). At step 1,

bilingualism status (coded as two dummy variables for each bilingual group, in which 0 = monolingual and 1 = either Spanish or Chinese), maternal education, family income in 2019, income change during COVID-19, as well as respective Time 1 score were entered. Time 1 grade as well as time intervals (in days) between two time points were also entered to control for children's varied amounts of formal schooling experiences. At step 2, we entered in the regression equation the home literacy factors as predictors, including the number of books at home, parent's weekly bedtime reading frequency during COVID-19, and children's weekly independent reading time during COVID-19. Table 6 shows the results of this analysis. Specifically, results showed that children's weekly independent reading time during COVID-19 was the only significant predictor on Time 2 vocabulary and reading comprehension, above and beyond Time 1 scores (for the vocabulary model: β = .22, p < .001, bivariate r = .40, p < .001; for the reading comprehension model: β = .26, p = .001, bivariate r = .44, p < .001, Table 6). However, none of the home literacy factors was a significant predictor of Time 2 word reading (βs = -.01-.05, ps = .313 - .793).

Table 5. Bivariate Correlation between Standardized Behavioral Scores, Home Literacy Factors, and Socioeconomic Factors

	M	*SD*	1	2	3	4	5	6	7	8	9	10	11	12
1. Family income 2019	8.66	2.55												
2. Family income change	1.24	0.94	-.19**											
3. Parent bedtime reading	2.65	2.6	.11	.00										
4. Number of books at home	9.74	3.64	.19**	-.06	.24**									
5. Child independent reading	3.11	1.2	.26***	-.04	.17*	.39***								
6. T1 vocabulary [a]	106.85	18.66	.17*	.00	.12	.31***	.26***							
7. T2 vocabulary [a]	111.77	17.78	.14	-.01	.16*	.31***	.40***	.71***						
8. T1 phonological awareness [b]	10.69	2.91	.18*	-.12*	-.07	-.01	.30***	.24***	.30***					
9. T2 phonological awareness [b]	10.46	3.04	.09	-.12*	-.10	-.06	.20**	.22**	.33***	.72***				
10. T1 word reading [a]	108.17	17.33	.17*	-.16*	-.12	.06	.28***	.35***	.44***	.65***	.61***			
11. T2 word reading [a]	109.69	17.19	.18*	-.14	-.09	.03	.27***	.31***	.43***	.60***	.65***	.82***		
12. T1 reading comprehension [a]	102.17	14.62	.25***	-.17*	-.01	.17*	.27***	.34***	.47***	.57***	.54***	.74***	.66***	
13. T2 reading comprehension [a]	100.58	14.58	.21**	-.19**	.07	.24**	.44***	.46***	.61***	.47***	.49***	.67***	.70***	.71***

Note. T1: Time 1; T2: Time 2; The scale for the language and literacy assessments refers to the mean and standard deviation for the standard scores of each measure; significance levels may vary due to different sample sizes; [a] Age-normed mean = 100, standard deviation = 15; [b] Age-normed mean = 10, typical range: 8-12. *$p < .05$, **$p < .01$, ***$p < .001$.

Table 6.

Hierarchical Regression predicting Time 2 vocabulary (Model 1), word reading (Model 2), and reading comprehension (Model 3)

Variable	Model 1: Time 2 Vocabulary			Model 2: Time 2 Word Reading			Model 3: Time 2 Reading Comprehension		
Step 1	β	t	p	β	t	p	β	t	p
Time 1 – Time 2 interval	.05	.77	.442	.08	1.72	.087	.11	1.67	.097
Time 1 grade	-.13	-2.20	.029	-.09	-1.94	.054	.08	1.32	.188
Bilingual status (Spanish)	.01	.21	.910	-.02	-.38	.703	-.11	-1.67	.097
Bilingual status (Chinese)	.09	1.18	.213	.04	.78	.436	-.04	-.59	.558
Maternal education	>-.01	.07	.952	.07	1.42	.157	.07	1.09	.279
Family income 2019	<.01	.05	.911	<.01	.02	.981	.02	.24	.810
Family income change during COVID	.01	.20	.800	-.02	-.50	.616	-.06	-.97	.335
Time 1 vocabulary	.71	11.73	<.001	/	/	/	/	/	/
Time 1 word reading	/	/	/	.78	16.84	<.001	/	/	/
Time 1 reading comprehension	/	/	/	/	/	/	.66	10.32	<.001
	$R^2_{adjusted} = .47$			$R^2_{adjusted} = .69$			$R^2_{adjusted} = .48$		
Step 2									
Number of books at home	.05	.81	.420	-.01	-.26	.793	<.01	.01	.996
Parent bedtime reading during COVID	.07	1.19	.234	.05	.55	.580	.05	.92	.361
Child independent reading during COVID	.22	3.47	<.001	.03	1.01	.313	.26	3.91	.001
	$R^2_{adjusted} = .52$			$R^2_{adjusted} = .69$			$R^2_{adjusted} = .53$		
	$\Delta R^2 = .050$			$\Delta R^2 = -.003$			$\Delta R^2 = .052$		
	$F (3, 160) = 6.72$			$F (3, 163) = .50$			$F (3, 152) = 6.75$		
	$p < .001$			$p = .683$			$p < .001$		

Discussion

The outbreak of COVID-19 greatly changed children's school and family routines. The present study examined the effects of COVID-19-related school disruptions on language and literacy development among bilingual and monolingual children in the US. The bilingual groups included children who attended English-only schools and were heritage speakers of either Chinese or Spanish in first-generation immigrant families. English language and reading measurements were conducted at a pre-pandemic Time 1 (Summer-Fall 2019) and about one year into the COVID-19 pandemic, Time 2 (Winter 2020 - Spring 2021). Results revealed that the monolinguals maintained age-appropriate progress among all tasks, and bilingual groups maintained age-appropriate progress in phonological awareness and word reading tasks. Yet, both bilingual groups showed significant age-adjusted improvements in vocabulary but slower progress in reading comprehension (note that only Spanish-English bilinguals reached significance). The findings suggest that prolonged school disruptions may differently impact children who have a home language different from the language of schooling. Further analysis across all participants showed that children's independent reading at home during the COVID-19 study period was a significant predictor of both vocabulary and reading comprehension performance at Time 2. The results also highlight the critical role of child-initiated home literacy practices on reading development during COVID-19. Together, the current study yields implications for research on language and literacy development in linguistically diverse learners experiencing disruptions in regular schooling.

Changes in Language and Literacy Skills

Our first research question asked about children's language and reading progress between the two testing points (i.e., before and around one year into the pandemic). To address this

question, we compared children's age-normed performance in vocabulary, phonological

awareness, word reading, and reading comprehension between Time 1 (Summer-Fall 2019) and

Time 2 (Winter 2020 - Spring 2021).

Age-normed Spoken Language Growth

The three groups demonstrated at least age-appropriate progress in phonological

awareness and vocabulary. These results suggest that school disruptions are less likely to affect

spoken language skills (Cooper et al., 1996; Pagan & Sénéchal, 2014). Prior meta-analytic

research has shown that, after the summer vacation, children on average demonstrated a score

decrease equivalent to 2-month in reading comprehension, but an increase equivalent to 2-month

in vocabulary (Cooper et al., 1996). Longitudinal studies have also revealed age-adjusted

vocabulary increases among toddler-age monolingual children (Kartushina et al., 2022, across 15

countries, tested in March 2020 and June 2020) and school-age Spanish-English bilingual

children (Martinez & Ronderos, 2021, both English and Spanish vocabulary, tested in 2019 and

2020). Therefore, the current results added to the evidence that among school-age children,

spoken language skills (vocabulary and phonological awareness) were generally unharmed by

COVID-19 lockdown.

Compared to monolinguals, both bilingual groups demonstrated significantly steeper

growth in English vocabulary. At Time 1 (pre-pandemic), vocabulary knowledge among our

bilingual sample was within the typical developmental range, but still significantly lower than

monolinguals' vocabulary (see Table 4). This initial vocabulary difference is often found in

comparisons of monolingual and bilingual child samples (e.g., Hoff, 2003). For instance,

children speaking a non-English home language had a smaller English vocabulary size compared

to their monolingual peers before formal schooling (Auer & Wei, 2008). As these children

entered formal English-only education, they made faster progress in their English vocabulary and achieved equivalent vocabulary in the mid-elementary years (Paradis & Jia, 2017). Indeed, at our Time 2 follow-up, which took place around a year into the pandemic, bilinguals in the current study had closed their vocabulary gap with monolinguals.

Similar to the participants in Paradis and Jia's (2017) study, children in the current study showed accelerated English vocabulary growth that was unaffected by remote schooling a year into the COVID-19 pandemic. Even in the absence of consistent, in-person schooling, most children were still attending school remotely. Furthermore, the participants in the current study likely still had access to rich English language input as a function of their community make-up and high socioeconomic status, despite more limited exposure to English at home. First, Michigan is a culturally and linguistically homogeneous state with only 3.4% Asian and 5.3% Hispanic population (according to the 2020 US census). The current sample may thus be able to demonstrate English vocabulary progress because of their English-rich neighborhoods and the broader community. Furthermore, the mothers of 89.5% of the monolingual and 86.3% of the bilingual participants had at least a bachelor's degree, and under 20% of families had an annual income below the national median. Socioeconomic status (SES) in bilingual children has been positively related to vocabulary in the language of schooling (i.e., non-heritage language, Prevoo et al., 2014). These factors may have made it possible for children to demonstrate accelerated English vocabulary growth.

Age-normed Reading Growth

As for reading skills, all groups showed age-appropriate progress in single-word reading. Monolinguals also made age-appropriate progress in reading comprehension, likely related to family SES backgrounds that offered educational privileges that their literacy was virtually

unaffected despite school disruptions. In contrast, Spanish-English bilinguals demonstrated statistically slower progress in reading comprehension by an average of 3.92 standard points, and Chinese-English bilinguals also showed slower (but not statistically significant) progress by an average of 2.19 standard points. Note that despite the slower increases, the bilingual children on average still maintained reading performance in the typical developmental range.

These findings are intriguing to consider through the lens of the Simple View of Reading (Hoover & Gough, 1990), which posits that reading comprehension is the product of language comprehension and decoding ability. Since bilingual participants showed age-appropriate growth in phonological awareness and word reading (foundational decoding skills) and *accelerated* growth in vocabulary (a key component of language comprehension), we might expect that reading comprehension skills should remain intact. However, more recent theoretical perspectives, such as the Active View of Reading (Duke & Cartwright, 2021), point to numerous other linguistic and cognitive skills that support reading comprehension but were not assessed in the current study. These factors may include executive functions, especially attention and inhibitory control, which may be particularly affected by the remote test setting. Moreover, motivational factors may drive children to engage in more reading practices, leading to their reading progress. Indeed, while children's independent reading practice largely indicate their actual literacy practices, it may also reflect individual differences in reading attitudes and motivation, and the current results suggest meaningful associations with reading comprehension at Time 2. Moreover, as the pandemic likely imposed psychological burdens, this may impact students' learning motivation and outcomes. Indeed, students were found to show heightened anxiety symptoms and reduced reading motivation during COVID-19 (Baschenis et al., 2021;

Soriano-Ferrer et al., 2021). To sum up, these additional linguistic, cognitive, and psychological factors are all important issues for future research on the developmental trajectory of reading.

While the current study as well as some others reveal that children overall maintained language and reading progress during COVID-19 (e.g., Georgiou et al., 2021; Kartushina et al., 2022), we note that these results do not converge with the recently published report from a national scale in the U.S., which revealed score decreases in both reading and math (National Assessment of Education Progress, NAEP, 2022). This is likely largely due to the high SES of the current sample. Although this sample is not representative of the U.S. population, it is informative in helping to dissociate the effects of environmental influences on learning from the specific effects of bilingualism. Bilingual children are often seen as having heightened risk for maintaining skills in both of their languages. However, current findings suggest that bilingualism itself is not inherently a risk factor during periods of school closures.

Home Literacy Environment

Our second research question asked whether home literacy factors were associated with children's reading progress during COVID-19. We conducted hierarchical regression analyses using home literacy factors to predict vocabulary, word reading, and reading comprehension performance at Time 2, respectively. The results showed that children's independent reading at home during the study period uniquely predicted both vocabulary and reading comprehension at Time 2, above and beyond Time 1 performance, maternal education, Time 1 grade, time intervals between tests, and family income status. These results were consistent with literature showing the importance of home literacy environments on children's language and reading development (Dunn et al., 2022; Hood et al., 2008; Sénéchal & LeFevre, 2002, 2014).

The results advance Home Literacy Model (HLM; Sénéchal, 2006; Sénéchal & LeFevre, 2014) to include evidence for the effects of home literacy factors during the periods of schooling disruption. HLM identifies home literacy practices as formal and informal practices. Formal activities are often "code-focused" which directly engage children with print such as teaching children print knowledge or asking children to practice reading. In the current study, we used children's independent reading as an indicator of formal home literacy practices. We acknowledge that this may reflect not only formal literacy practices at home, but also other factors such as children's motivation to read. However, it stems from the notion of the HLM framework and serves as a more common practice for children at older ages (Inoue et al., 2020; Silinskas et al., 2020). Indeed, in the present study, children's independent reading practices during COVID-19 explained the most variance in vocabulary and reading comprehension at Time 2. Our results are consistent with prior HLM meta-analytic research which found a moderate effect size for the association between emergent literacy skills and the amount of child reading practices listened by parents (Sénéchal & Young, 2008). The current results offer empirical support for a robust association between formal home literacy activities and children's reading achievement. Importantly, these results also highlight the importance of home reading practices in potentially alleviating the COVID-19 decrease in reading scores. As school reading instruction was heavily influenced due to COVID-19, an effective strategy for parents and teachers to maintain and improve children's reading skills is to encourage them to practice reading at home, and this can also play a critical complementary role in children's reading development, especially in face of sudden schooling interruptions.

Unlike formal literacy practices, the current findings for the informal literacy factors (i.e., number of books at home, parent-led reading) were mixed. Informal literacy activities often do

not directly offer print instructions but simply expose children to print such as through parent-child interactions and by providing book resources. According to HLM, informal practices are often associated with oral language skills such as vocabulary (Sénéchal & LeFevre, 2014). In the current study, access to books (i.e., number of books at home) was significantly associated with vocabulary and reading comprehension. Indeed, the number of books has been consistently shown as predictive of child literacy across countries (Park, 2008; Allington et al., 2021). Studies also found that providing book resources (i.e., bringing home books, offering library access) can compensate for summer reading losses among disadvantaged children (Bell et al., 2020; Fälth et al., 2019). However, parent-led reading (i.e., parent reading to the child) was only weakly associated with vocabulary but not with reading outcomes. One potential explanation is that parent-child reading likely plays a more substantial role at earlier stages of vocabulary accumulation and learning to read. For example, a recent study found that access to literacy resources, but not parent-led reading was associated with children's language and literacy outcomes among first- and second-graders across four cultures (Inoue et al., 2020). An alternative possibility is that, as this variable is measured by self-report measures, parents may report in a socially desirable way that may not reflect their actual practices at home (Manolitsis et al., 2013).

Limitations

There are several limitations to the current study. First, children from the current study were mostly from middle- and high-SES families, and therefore the results may not generalize to lower-SES children. In particular, as the current results yielded a score decrease in reading comprehension in the bilingual samples (especially the Spanish-speaking bilinguals), bilingual children from lower-SES backgrounds may have experienced a greater negative impact from

COVID-19 school closures. Studies are needed to unpack the COVID-19 impacts on these children and seek effective strategies to make up for the potential reading decrease. Second, the study used a retrospective questionnaire to identify home literacy factors, thus it may be susceptible to subjectivity such as social desirability bias and inaccurate estimation. Third, during Time 1, many of the children were measured during or immediately after the summer break known to be associated with the 'summer slump'. Finally, the testing settings were not consistent between Time 1 (in-person) and Time 2 (via Zoom), which may affect some children. Despite this, children's performance was generally consistent between the two time points (as suggested by the test-retest reliability across times).

Conclusions

The current investigation revealed different patterns in which pandemic-related disruptions in regular schooling were associated with learning to read in bilingual and monolingual children in the US. English monolingual children exhibited age-appropriate progress during the disruption period of Spring 2020 - Spring 2021. Both Spanish-English and Chinese-English bilingual participants exhibited faster age-adjusted progress in English vocabulary, age-appropriate phonological and decoding skills, but relatively slower progress in learning to read connected text, the ultimate goal of learning to read. Importantly, across all children, their independent reading practices during the pandemic-related schooling disruptions were uniquely predictive of vocabulary and reading comprehension skills above and beyond pre-pandemic skill proficiency and socioeconomic factors. In sum, these findings add to our understanding of language and reading development under the influences of pandemic-related schooling disruptions among children from linguistically diverse backgrounds.

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Impacts of the COVID-19 disruption on the language and literacy development of monolingual and heritage bilingual children in the United States

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