THIS ARTICLE HAS BEEN CORRECTED. SEE LAST PAGE

Developmental Psychology

© 2018 American Psychological Association
0012-1649/18/$12.00

2018, Vol. 54, No. 7, 1317–1333
http://dx.doi.org/10.1037/dev0000514

A Cross-Language Study of Decontextualized Vocabulary Comprehension in Toddlerhood and Kindergarten Readiness

Margaret Friend
San Diego State University

Erin Smolak
San Diego State University and University of California, San Diego

Yushuang Liu
San Diego State University

Diane Poulin-Dubois
Concordia University

Pascal Zesiger
University of Geneva

Recent studies demonstrate that emerging literacy depends on earlier language achievement. Importantly, most extant work focuses on *parent-reported production* prior to 30 months of age. Of interest is whether and how *directly assessed vocabulary comprehension* in the 2nd year of life supports vocabulary and kindergarten readiness in the 4th year. We first contrasted orthogonal indices of parent-reported production and directly assessed vocabulary comprehension and found that comprehension was a stronger predictor of child outcomes. We then assessed prediction from vocabulary comprehension controlling for maternal education, preschool attendance, and child sex. In 3 studies early, decontextualized vocabulary comprehension emerged as a significant predictor of 4th year language and kindergarten readiness accounting for unique variance above demographic control variables. Further we found that the effect of early vocabulary on 4th year kindergarten readiness was not mediated by 4th year vocabulary. This pattern of results emerged in English monolingual children ($N = 48$) and replicated in French monolingual ($N = 58$) and French–English bilingual children ($N = 34$). Our findings suggest that early, decontextualized vocabulary may provide a platform for the establishment of a conceptual system that supports both later vocabulary and kindergarten readiness, including the acquisition of a wide range of concepts including print and number. Differences between parent-reported and directly assessed vocabulary and the mechanisms by which decontextualized vocabulary may contribute to conceptual development are discussed.

Keywords: decontextualized vocabulary, vocabulary size, kindergarten readiness, toddler, preschool

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

Understanding the origins of early literacy is a priority in psychological and educational research. The perspective that guides the present article is that emerging literacy is dependent upon earlier developing language achievement (e.g., Dickinson, Golinkoff, & Hirsh-Pasek, 2010; NICHD Early Child Care Research Network, 2005; Storch & Whitehurst, 2002). Of interest in the present article is the efficacy of *decontextualized vocabulary comprehension* in the second year of life for predicting kindergarten readiness. Decontextualized vocabulary consists of those word–referent relations that the child recognizes across contexts, contributing to a more stable lexicon and setting the stage for subsequent learning (e.g., Suanda, Mugwanya, & Namy, 2014). The vast majority of the work associating vocabulary with school readiness and reading focuses on children 3 years of age and older (Cristofaro & Tamis-LeMonda, 2011; Forget-Dubois et al., 2009; Kim, Im, & Kwon, 2015; NICHD Early Child Care Research Network, 2005) and the limited research conducted prior to age 3 is based primarily on *parent report of vocabulary production*

This article was published Online First April 5, 2018.

Margaret Friend, Department of Psychology, San Diego State University; Erin Smolak, School of Speech, Language, and Hearing Sciences, San Diego State University, and Doctoral Program in Language and Communicative Disorders, University of California, San Diego; Yushuang Liu, Department of Psychology, San Diego State University; Diane Poulin-Dubois, Department of Psychology, Concordia University; Pascal Zesiger, Department of Psychology and Psycholinguistics, University of Geneva.

This research was supported by NICHD HD468058, NIDCD DC007361, and the NSERC and does not necessarily represent the views of the National Institutes of Health or the Natural Sciences and Engineering Research Council of Canada. We gratefully acknowledge Bianka Enriquez, Tamara Patrucco, Laura Alaria, Monika Rodrigues, Katherine Gittins, and Olivia Kuzyk for assistance in data collection and coding and all of our participant families.

Correspondence concerning this article should be addressed to Margaret Friend, Department of Psychology, San Diego State University, 6505 Alvarado Road, Suite 101, San Diego, CA 92120. E-mail: mfriend@mail.sdsu.edu

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

(Duff, Reen, Plunkett, & Nation, 2015; Morgan, Farkas, Hillemeier, Hammer, & Maczuga, 2015).

In Study 1, we contrast decontextualized vocabulary comprehension with parent-reported vocabulary production in monolingual English-speaking children to determine whether decontextualized vocabulary accounts for unique variance in kindergarten readiness and assess the extent to which the effect of early vocabulary is mediated by concurrent vocabulary at preschool age. In Study 2, we assess the generalizability of our findings in an independent sample of monolingual French-speaking children who differ geographically, culturally, and in first language acquisition. In Study 3, we evaluate whether these findings hold in children who are simultaneously acquiring French and English in Montreal, Quebec. This extension to bilingualism is important as the population of children who learn more than one language from birth (bilingual first language acquisition or BFLA) is growing. In Quebec, Canada, 31.7% of the population 5 years or older can hold a conversation in either English or French (Statistics Canada, 2016). Similarly, in California, 43.6% of the population 5 years or older speak a language other than English at home (United States Census Bureau, 2015). Although there are some differences in monolingual and bilingual acquisition, in many ways the mechanisms are quite similar (De Houwer, 2009). In Study 3, we hold language constant with Studies 1 and 2 to assess generalizability across monolingual with bilingual acquisition.

We begin by considering how emergent literacy and kindergarten readiness are related. We then proceed to the current literature on the relation between early vocabulary and literacy. Finally, we discuss decontextualized vocabulary as precursor to deep word knowledge, setting the stage for conceptual development.

Kindergarten Readiness and Emergent Literacy

Emergent literacy is an approach that views literacy as existing on a continuum with preliteracy such that skills that develop early in life are the precursors on which literacy is based (Crain-Thoreson & Dale, 1992; Sulzby & Teale, 1985; Whitehurst & Lonigan, 1998). The focus of the present article is on vocabulary comprehension as a predictor of kindergarten readiness. Kindergarten readiness taps into components on the developmental continuum of emergent literacy (e.g., narrative and recognition of letters and numbers in print). Specifically, narrative skills mediate the relation between early language and emergent literacy in kindergarten (Gardner-Neblett & Iruka, 2015), letter naming contributes to preschool writing (Milburn et al., 2016), and number naming is a strong predictor of later numeracy (Koponen, Aunola, Ahonen, & Nurmi, 2007). The focus of kindergarten readiness is on a specific set of skills that children possess at the point in the continuum that they enter school.

Children embark on this continuum as early as the first 2 years of life. By age 2, children develop phonetic inventories that largely match adult forms (Stoel-Gammon, 1987) and phonological awareness is key to making the link later on between phonological representations and words (Whitehurst & Lonigan, 1998) such that early phonological awareness predicts reading ability (Lonigan, Burgess, Anthony, & Barker, 1998). In typically developing children, parent report of vocabulary production at 24 months predicts language and nonverbal intelligence at 4 years (Marchman & Fernald, 2008; Reilly et al., 2010). Vocabulary production across the second and third year (Forget-Dubois et al., 2009), and comprehension alone at 36 months (Cristofaro & Tamis-LeMonda, 2011), are associated with school readiness. Finally, there is evidence for a direct link between oral language skills at 3 years of age and first grade reading (NICHD Early Child Care Research Network, 2005). Recent findings suggest further that composite vocabulary (comprehension and production) at preschool age is concurrently associated with an array of decoding skills related to reading (Kim et al., 2015). This, in conjunction with previous research showing that reading comprehension is critically dependent on vocabulary comprehension (Cain & Oakhill, 2011; Ouellette, 2006; Quinn, Wagner, Petscher, & Lopez, 2015), suggests that early vocabulary may set the stage for later reading.

Such a general relation between early language and later cognitive development should hold across languages and monolingual and bilingual acquisition. What is less clear is how early in life vocabulary size predicts preschool outcomes. However, few instruments assess vocabulary size prior to third year of life. Two primary approaches, parent-reported vocabulary and directly assessed vocabulary, are discussed in the remainder of this review. Parent report is easily administered and provides a reliable assessment of child vocabulary size relative to their peers. For comparison, directly assessed vocabulary is portable, can be administered with minimal training in a variety of settings (e.g., preschools and well-baby visits) in about 10 min, and provides unique information about children's knowledge of word–world relations outside of the context(s) in which they were learned and are used in daily life. Further, direct assessment can overcome the need for multiple reporters in the bilingual case, in which it is important to obtain caregiver-reported vocabulary from the interlocutor most familiar with the child's use of each of their languages (De Houwer, Bornstein, & Putnick, 2014).

Early Vocabulary and Literacy

Recently, in a study of 300 British infants, Duff, Reen, Plunkett, and Nation (2015) found that vocabulary between 16 and 24 months of age significantly predicted language and reading skills between 4 and 9 years of age. Both parent-reported *comprehension and production* on the Oxford Communicative Development Inventory (OCDI: Hamilton, Plunkett, & Schafer, 2000) contributed to a single latent predictor. From this, Duff et al. (2015) modeled longitudinal relations between early vocabulary and several measures of language and literacy. Early vocabulary accounted for 16% of the variance in school-age vocabulary, 11% of the variance in reading accuracy, and 18% of the variance in reading comprehension. Increases in vocabulary size are thought to lead to more efficient written word identification (Perfetti & Hart, 2001; Perfetti & Stafura, 2014), supporting reading through the ability to infer spelling–sound relations (Mitchell & Brady, 2013). These findings suggest that vocabulary as early as the toddler period predicts language and reading outcomes into the early school years.

Population studies support this interpretation. A recent study of 8,650 children found that parent-reported vocabulary *production* on a modified version of the MacArthur Communicative Development Inventories (Fenson et al., 2007) at age 2 predicted academic achievement (in reading and math) and behavioral performance at kindergarten entry (Morgan et al., 2015). Standardized effect sizes for reading and math were .22 and .27, respectively.

Similarly, in a sample of 6,941 children followed from 5 to 34 years of age, vocabulary *comprehension* at age 5 was a significant predictor of adult literacy when controlling for a broad set of risk factors (including, e.g., maternal education, preschool attendance, and parent–child reading; Law, Rush, Parsons, & Schoon, 2013).

Critically, the Morgan et al. (2015) and Duff et al. (2015) findings support the view that early vocabulary contributes to a positive manifold that increases educational and social opportunities. However, in each case, parent-reported vocabulary predicted a modest proportion of outcome variance (Duff et al., 2015; Morgan et al., 2015). As Law, Rush, Parsons, and Schoon (2013) point out, this leaves two issues unaddressed. First, the practical significance of these findings is uncertain. Relatedly, whereas parent report has dominated much of the work on early vocabulary (with the notable exception of work on speed of word processing; e.g., Marchman & Fernald, 2008), other measures are crucial to replicating and extending these findings (Law & Roy, 2008). For the purposes of this article, we begin to tackle these issues by asking whether decontextualized vocabulary as early as the second year accounts for unique variance in children's kindergarten readiness.

Decontextualized Vocabulary

When parents report on early vocabulary, it is not clear that they discriminate between words that are context-dependent and words that are decontextualized. When parents tell us that their child produces the word "milk," they may mean that the child spontaneously says "milk" in breakfast or snack rituals that are richly contextualized and in which many potential referents are present. They may have associated "milk" with the rituals themselves rather than with the referent in adult usage. Alternatively, the parent may be able to elicit the work "milk" from the child when comprehension of the word–referent relationship is not strong enough to guide spontaneous production. In contrast, Bates, Bretherton, Carlson, Carpen, and Rosser (1979, p. 273) described decontextualized language as "occurring in a broader range of situations with decreasing perceptual support."

Words are decontextualized when the word–referent relation is recognized in the *absence of* the supportive context in which it was learned (e.g., correctly mapping "milk" to a glass of milk rather than to a cookie in an unfamiliar context). The only extant measure for assessing children's decontextualized vocabulary *size* prior to the third year of life is the computerized comprehension task (CCT; Friend & Keplinger, 2008). Other measures designed for this age range (e.g., Fernald, Perfors, & Marchman, 2006; Zimmerman, Steiner, & Pond, 2011), assess processing efficiency for familiar words or attention to sound, respectively. Vocabulary size on the CCT is operationalized as the number of discrete haptic responses to a referent (Friend & Keplinger, 2003, 2008). The task captures the size of the lexicon that is decontextualized and stable: haptic responses are nonrandom and tend to be elicited only when children's understanding of the word–world relation in any particular trial is stable (Friend & Keplinger, 2008; Hendrickson, Mitsven, Poulin-Dubois, Zesiger, & Friend, 2015).

Recent research suggests that children may make use of statistical regularities in the repeated pairing of the word and its referent(s) to reach this level of word knowledge (e.g., cross-situational learning; McMurray, Horst, & Samuelson, 2012; Smith & Yu, 2008). Decontextualized word knowledge may reflect domain-general learning processes that support vocabulary acquisition and other kinds of learning (Suanda et al., 2014). For example, both associative learning and hypothesis testing are thought to play a role in the acquisition of new words from infancy through adulthood (Yu & Smith, 2012). Decontextualized vocabulary reflects well-established concepts that are the product of these processes across many pairings of words and referents. This level of word comprehension is essential before children can begin to develop the semantic networks that support what Hadley, Dickinson, Hirsh-Pasek, Golinkoff, and Nesbitt (2015) refer to as "deep word knowledge" (p. 182). Hadley, Dickinson et al. (2015) argue, based on Perfetti's (2007) lexical quality hypothesis, that high-quality word knowledge is crucial to both reading speed and comprehension. High-quality or deep word knowledge can be difficult to define and measure: It can refer to mastery in production, or mastery of word meaning, and most importantly, the extent to which the word is part of a larger network of semantic associations (Schmitt, 2014). In the present article, we consider children's word recognition in the *absence of* the supportive context in which the relation was learned, as measured on the CCT, as evidence of decontextualized word knowledge, an early step on the road to deep word knowledge.

To summarize, extant evidence suggests a link between early language and later language and academic performance, raising the possibility that early vocabulary size is an indicator of learning mechanisms that are crucial to subsequent success in school. Only two large-scale studies connect vocabulary as early as the second year of life to these outcomes (Duff et al., 2015; Morgan et al., 2015) and the practical significance of these findings is unknown. Further, there has been no work on the role of *decontextualized vocabulary* as early as the second year in supporting subsequent development. The broad implications of academic achievement for development across the life course make exploring early prediction of kindergarten readiness imperative since remedying early deficits could have longstanding implications for success in school and beyond.

The Present Research

In three studies, the present article assesses the relation between directly assessed and parent-reported vocabulary in the second-year and kindergarten readiness in the fourth year. In addition, we assess whether vocabulary size in the fourth year mediates this effect. The article expands upon extant literature on the relation between early vocabulary and early literacy by assessing the relation between a direct measure of vocabulary size in the second year of life and subsequent kindergarten readiness. By doing so, it clarifies the contribution of *decontextualized* vocabulary for developmental outcomes.

In Study 1, we assessed the contribution of early vocabulary in the second year to kindergarten readiness using both parent-reported production and directly assessed comprehension. Our choice of measures was predicated on the fact that there are no other measures of vocabulary size for children in the second year and because parent-reported production has been used broadly in the previous literature. Evaluating the relative importance of parent-reported and directly assessed vocabulary allows us to extend the literature by evaluating the relative contribution of these approaches to predicting preschool outcomes.

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

We expected directly assessed (or *decontextualized*) vocabulary in the second year to yield stronger prediction than parent-reported vocabulary for both kindergarten readiness and concurrent vocabulary comprehension in the fourth year. However, it is important to consider why early vocabulary should predict kindergarten readiness. One possibility is that decontextualized vocabulary is foundational to the establishment of a conceptual system and, as such, it provides the scaffolding that directly supports both later vocabulary and kindergarten readiness. An alternate view is that early vocabulary directly contributes to later vocabulary and only indirectly to the concepts and skills that underlie kindergarten readiness. From this second view, it is later vocabulary that should best reflect the lexicon of concepts related to kindergarten readiness. To test these competing hypotheses, we conducted mediation analyses to determine whether decontextualized vocabulary in the second year predicts kindergarten readiness in the fourth year and whether this effect is mediated by concurrent vocabulary.

This research was conducted under the project, The Path from Language to Literacy. Authors were supported by the NICHD and NIDCD, in the United States, and the Natural Sciences and Engineering Research Council, in Canada. The project was approved by the Institutional Review Boards at San Diego State University under protocol #603057, Concordia University under protocol #UH2003-058–6, and the University of Geneva.

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

Study 1

Method

Participants. Participants were part of a larger longitudinal study and were recruited through parenting magazines, community-based Internet resources, newspapers, daycare, nutrition centers, and state birth records in a large city in the United States. Sixty-eight monolingual English children (35 girls) and their primary caregivers participated when children were 22 months of age (M = 22;28 months, range = 21;6 to 25;12). An additional 10 children were tested but were excluded due to fussiness (N = 1), being a twin (N = 1), or for missing data at one of the waves (N = 9). Forty-nine children returned for a second wave of testing at 48 months of age. Attrition over the 2-year period from first to second testing was 28% (N = 19; 10 of whom had moved out of state). To assess whether the children who did not return were different in any way from the final sample, we calculated mean scores for all demographic variables and predictors. In every case, mean differences between groups were small with overlapping confidence intervals indicating no differences on these measures. The final longitudinal sample was comprised of 48 children (29 girls; M age = 49;15, range = 47;0 to 53;0 months). Of these, 29 had begun attending preschool. Full demographic information on the final sample is presented in Table 1.

Table 1
Distribution of Selected Demographic Characteristics of Participants in Study 1

Number (%) of participants	Female	Male	Total
Maternal education			
High school or less	3 (6.3)	5 (10.4)	8 (16.7)
Some college	9 (18.8)	2 (4.2)	11 (22.9)
College graduate	7 (14.6)	5 (10.4)	12 (25.0)
Post-baccalaureate	10 (20.8)	7 (14.6)	17 (35.4)
Approximate income			
$18,000–$40,000	5 (10.4)	2 (4.2)	7 (14.6)
$41,000–$60,000	1 (2.1)	5 (10.4)	6 (12.5)
$61,000–$80,000	5 (10.4)	0 (.0)	5 (10.4)
$81,000–$100,000	11 (22.9)	7 (14.6)	18 (37.5)
>$100,000	7 (14.6)	5 (10.4)	12 (25.0)
Ethnicity			
Asian	0 (.0)	1 (2.1)	1 (2.1)
Black/not Hispanic	2 (4.2)	0 (.0)	2 (4.2)
Hispanic	8 (16.7)	1 (2.1)	9 (18.8)
White/not Hispanic	14 (29.2)	16 (33.3)	30 (62.4)
Mixed race	5 (10.4)	1 (2.1)	6 (12.5)

Note. Income reported in U.S. dollars.

Measures.

Language exposure assessment tool (LEAT). Participants' relative exposure to language was assessed via the Language Exposure Assessment Tool (DeAnda, Bosch, Poulin-Dubois, Zesiger, & Friend, 2016). The LEAT is a parent-report measure that takes the form of a systematic interview. The LEAT gathers information on each of the individuals who regularly interact with the child, the languages they speak, whether they are a native speaker, and the number of hours spent talking to/being overheard by the child in each language per day. The LEAT yields the following four quantitative measures of relative exposure for each language to which the child is exposed: hours per day, hours per week, percent exposure, and a parent estimate. Percent exposure to each language is determined by weighting hours of exposure by duration of exposure across the child's life for each interlocutor. As a check, parents provide an independent estimate the percent exposure to each language. Internal consistency for the four estimates of relative exposure on the LEAT is excellent (Cronbach's alpha = .96). Further, LEAT percent relative exposure significantly predicts concurrent vocabulary size in each of bilingual toddlers' languages as measured by parent report (R^2 = .36) and direct experimental measures (R^2 = .22) above and beyond maternal education, age, and parent estimates (DeAnda et al., 2016). Participants were included in the English monolingual sample if their relative exposure to English was 80% or greater at 22 months (M = .98, range = .80 to 1).

MacArthur-Bates communicative development inventory: Words and sentences (MCDI). The MCDI (Fenson et al., 2007) is a well-established checklist of 680 items that allows parents to indicate the words that their child currently produces. Vocabulary production on this measure exhibits excellent short-term test–retest reliability (r = .95) and is highly correlated with sentence complexity (r = .80) and grammar (r = .91; Fenson et al., 1994). Vocabulary production was estimated from the MCDI: Words and Sentences Form.

Computerized comprehension task (CCT, Friend & Keplinger, 2003; Friend, Schmitt, & Simpson, 2012). The CCT consists of four training trials, 41 test trials, and 13 reliability trials in opposite left-right orientation. All trials are forced-choice and there are two forms of the task such that each target on one form serves as a foil on the other and vice versa. The assessment is experimenter-controlled with a maximum duration of 7 s per trial and assesses comprehension of nouns, verbs, and adjectives. There are equal numbers of easy (comprehension ≥66%), moderately difficult (comprehension = 33%–66%), and difficult words (comprehension <33%) based on normative data at 16 months of age (Dale & Fenson, 1996). All image pairs presented during training, testing,

and reliability were matched for word difficulty (easy, moderately difficult, difficult), part of speech (noun, adjective, verb), category (animal, human, artifact, activity, color, or size), and visual salience (color, size, luminance). For each trial, exemplars are prototypical photographic images of the referent and foil. Finally, inclusion of difficult items from the MCDI results in a high ceiling enabling the CCT to be productively extended to 24 months of age.

The CCT yields test–retest reliability ($r = .70$) and convergent validity ($r = .64$) with parent report and responses on the CCT are nonrandom (Friend & Keplinger, 2008; Hendrickson, Mitsven, Poulin-Dubois, Zesiger, & Friend, 2015). This finding has been replicated across languages (Friend & Zesiger, 2011) and in bilinguals (Poulin-Dubois, Bialystok, Blaye, Polonia, & Yott, 2013).

The task was administered in a dimly lit testing room with the toddler seated in a low, cushioned chair or on the parent's lap. Static images were presented in a forced-choice format on a touch sensitive screen positioned 30 cm from the child and 16 cm above the floor at a 60-degree angle. Infants were prompted to touch the named image (e.g., Where's the dog?, Who is running?, Which one is blue?). The member of the forced-choice pair that constituted the target was counterbalanced across participants resulting in two forms of the assessment. The primary experimenter sat next to the child, delivered the prompts, and advanced the assessment. A coder observed the task through a one-way glass and coded responses as correct if the first touch/point was to the target image. A second, reliability coder then coded the videotape for each participant independently. Interrater agreement on CCT responses was 95%. Decontextualized vocabulary comprehension at 22 months was estimated from the CCT.

Peabody picture vocabulary test-III (PPVT; Dunn & Dunn, 1997). The PPVT is a direct measure of vocabulary appropriate for individuals from 30 months of age through adulthood. The test is standardized on a large and representative sample and widely used in the field with reliability and validity coefficients in the .90s. Like the CCT, participants are prompted to identify the pictorial referent associated with a target word. Decontextualized vocabulary comprehension at 48 months was estimated from the PPVT.

The lollipop test: A diagnostic test of school readiness III (Chew, 2007). The lollipop test is a brief, validated measure of kindergarten readiness that assesses knowledge of shapes, numbers, letters, and spatial concepts (Chew & Morris, 1984, 1987; Eno & Woehlke, 1995) and has been used in previous research on predictors of school readiness (Forget-Dubois et al., 2009; Lemelin et al., 2007). Prekindergarten scores are correlated with the developmental indicator for the assessment of learning in prekindergarten children ($r = .71$, $p < .001$; Chew & Morris, 1987) and with the metropolitan readiness test in kindergarten ($r = .76$, $p < .001$; Chew & Morris, 1984). Kindergarten scores explain significant variance in word reading, sentence reading, and math in the first grade (R^2s = .75, .63, .72, ps $< .001$) as well as reading and math in the third grade (R^2s = .58 and .55, ps $< .001$; Chew, 2007). Scores for those children entering kindergarten predict performance on the California Achievement Test at the end of kindergarten and successfully identify those children not prepared to proceed to a regular first-grade program (Eno & Woehlke, 1995).

Procedure. At the 22-month visit, participants completed the CCT while seated in their parents' laps. Parents wore blackout glasses and headphones playing music to reduce the possibility of interference and were instructed to allow their children to respond without assistance. During the same visit, parents completed the MCDI:WS. At the 48-month visit, participants completed the PPVT and the lollipop test as part of a battery of tests that included assessment of executive functioning, narrative ability, and general language abilities.

Data analytic strategy. We first conduct a relative weight analysis to determine the relative importance of parent-reported and decontextualized vocabulary to predicting language and kindergarten readiness. It is possible that the correlation between these two approaches obscures their orthogonal importance to prediction. To assess the hypothesis that decontextualized vocabulary in the second year is a stronger predictor of subsequent kindergarten readiness and concurrent vocabulary comprehension in the fourth year, we conduct two relative importance analyses (Johnson, 2000). In relative importance analysis, orthogonal variables are created to determine how much unique variance in the dependent measure is explained by each predictor. Multiple regression weights may fail to accurately capture this when predictors are correlated.

Next, in order to determine whether the relation between second-year vocabulary and fourth-year kindergarten readiness is mediated by concurrent vocabulary, we test each of the causal steps to establish mediation (Judd & Kenny, 1981; MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002). These steps constitute three regression models that test the three necessary conditions for mediation: (a) the independent variable (second-year vocabulary) affects the outcome variable (kindergarten readiness); (b) the independent variable affects the mediator variable (fourth-year vocabulary) and the mediator variable affects the outcome variable controlling for the effect of the independent variable; and (c) the independent variable does not affect the outcome variable when controlling for the mediator variable. As a further check on mediation, we employ Sobel's test, which is a t test of the significance of the indirect effect (Sobel, 1982).

Results

22 months. Average relative exposure to English according to the LEAT was .99 (range = .89 to 1.0). MCDI production vocabulary ranged from five to 633 words ($M = 256.94$, $SD = 168.18$), corresponding to the first to the 99th percentile. Sample-specific internal consistency was $\alpha = .99$. Two children had expressive vocabulary scores at the first percentile whereas their CCT comprehension scores corresponded to the 20th to 30th deciles for the sample suggesting that they knew more words than they were producing. Visual inspection of the scatterplot of MCDI and CCT scores suggested that, although they performed more poorly than their peers, they were not outliers. CCT comprehension vocabulary ranged from 10 to 39 words ($M = 27.44$, $SD = 6.95$). Sample-specific internal consistency was excellent across forms (Cronbach's alpha = .86 and .93, respectively). Immediate test–retest reliability was good, $r(42) = .65$, $p < .001$, and CCT scores correlated significantly with concurrent MCDI production, $r(47) = .44$, $p = .002$.

48 months. Comprehension vocabulary on the PPVT ranged from 31 to 106 words ($M = 72.23$, $SD = 15.48$), reflecting a range from the 13th to the 99th percentile. Sample-specific internal consistency was $\alpha = .94$. Lollipop test scores ranged from 14 to 65 ($M = 50.54$, $SD = 10.87$), corresponding to roughly the seventh to the 99th percentile for children entering kindergarten (Chew &

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

Morris, 1987) and sample-specific internal consistency was moderate ($\alpha = .69$).

Zero-order correlations revealed significant longitudinal relations between vocabulary at 22 months and later vocabulary and kindergarten readiness scores ($r(46) = .41$, $p = .004$) and $r(46) = .51$, $p < .001$, respectively). Parent-reported vocabulary was correlated with kindergarten readiness at 48 months ($r(46) = .37$, $p = .011$) but not with vocabulary at 48 months ($p = .253$). Maternal education was significantly associated with decontextualized vocabulary at 22 months, $r(46) = .37$, $p = .010$, and marginally associated with kindergarten readiness at 48 months, $r(46) = .27$, $p = .063$, but not with any other variable (all ps $> .18$). Sex was marginally correlated with decontextualized vocabulary at 22 months, $r(46) = .25$, $p = .087$, and kindergarten readiness at 48 months, $r(46) = .27$, $p = .064$, but not with any other variable (all ps $> .15$). Finally, number of hours in preschool was not associated with either predictor or outcome variables (all ps $> .6$).

Relative weights analysis. Each relative importance analysis included the decontextualized and parent-reported vocabulary as predictors and child sex and maternal education as control variables. All relative importance analyses were conducted in R (R Development Core Team, 2008) using the script provided by Tonidandel and LeBreton (2014). First, orthogonal raw correlations and 95% confidence intervals were computed for sex, maternal education, decontextualized vocabulary, and parent-reported vocabulary. These reflect the raw correlations between a set of orthogonal predictors (that are maximally similar to the original predictors) and the outcome. Following this, rescaled weights representing the proportion of total variance accounted for by each predictor were calculated. Each weight was then statistically tested using a bootstrap procedure of 10,000 iterations with replacement (Tonidandel, LeBreton, & Johnson, 2009). Finally, we tested whether the weights for decontextualized and parent-reported vocabulary were significantly different. Nominal alpha was set at .05, however, it is important to note that the relative weights procedure is overly conservative with regard to Type I error rates (Tonidandel et al., 2009). For this reason, application of a family wise correction would be inappropriate in conjunction with this procedure.

The first analysis examined the relative contribution of each independent variable in predicting kindergarten readiness scores at 48 months. Table 2 displays the raw and rescaled relative weights for each independent variable in predicting kindergarten readiness with 95% confidence intervals. In total, the predictors and control variables accounted for 19% of the variance in kindergarten readiness. The largest (and only statistically significant) weight was for decontextualized vocabulary, which explained 13% of the variance in kindergarten readiness and 69% of the total variance explained by all four predictors. However, the confidence intervals for decontextualized and parent-reported vocabulary overlap, indicating that their relative weights are not significantly different.

Table 2
Relative Importance Analysis Predicting Fourth Year Kindergarten Readiness for Study 1

Variables	Relative weights		95% Confidence interval	
	Raw	Rescaled	Lower bound	Upper bound
Child sex	.029	15.284	<.001	.156
Maternal education	.003	1.333	<.001	.017
Second-year CCT comprehension	.132*	69.360	.018	.323
Second-year MCDI production	.027	14.023	.002	.121

* Significant at $\alpha < .05$ (95% CI).

This analysis was repeated using vocabulary at 48 months as the outcome. Table 3 displays raw and rescaled weights for each independent variable with 95% confidence intervals. In total, the predictors and control variables accounted for 22% of the variance in vocabulary at 48 months. Similarly to the results for kindergarten readiness, the largest (and only statistically significant) weight was for the decontextualized vocabulary at 22 months, which explained 16% of the variance in vocabulary at 48 months and 71% of the total variance explained by all four predictors. As in the previous analysis, the confidence intervals for the predictors overlap, indicating that their relative weights are not significantly different. In summary, decontextualized vocabulary at 22 months was the largest and the only statistically significant relative weight in predicting both vocabulary and kindergarten readiness at 48 months, however, due to the large confidence intervals for both predictors, these weights were not significantly different.

These relative importance analyses identify decontextualized vocabulary as a stronger predictor, relative to parent-reported vocabulary, of both kindergarten readiness and subsequent vocabulary size at 48 months. We now turn our attention to how decontextualized vocabulary is related over time and to kindergarten readiness. Specifically, does decontextualized vocabulary as early as the second year predict decontextualized vocabulary in the fourth year, and how does vocabulary, in turn, support kindergarten readiness?

Early vocabulary and kindergarten readiness. To test the hypothesis that decontextualized vocabulary comprehension in the second year would predict kindergarten readiness in the fourth year, we conducted a hierarchical regression with the effects of sex and maternal education controlled on the first step with decontextualized vocabulary at 22 months entered on the second step and kindergarten readiness scores as the dependent measure. Nominal alpha was set at .05 and a sequential Bonferroni procedure was applied to control family wise false discovery rate (Benjamini & Hochberg, 1995). The first model revealed that maternal education and sex were not significant predictors. The inclusion of decontextualized vocabulary led to a significant increment in R^2 and accounted for significant unique variance in children's kindergarten readiness scores ($\eta^2 = .29$). As expected, decontextualized vocabulary predicted subsequent kindergarten readiness above variance accounted for by control variables. Regression parameters for the models described above are presented in Table 4.

To test the hypothesis that decontextualized vocabulary in the second year predicts vocabulary in the fourth year, we conducted a second hierarchical regression in which sex and maternal education were entered as control variables on the first step and second-year decontextualized vocabulary was entered on the second step with fourth-year vocabulary as the dependent measure. Only the second model was significant indicating the expected prediction from the second- to the fourth-year vocabulary ($\eta^2 = .22$; see Table 5 for full regression parameters).

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

Table 3
Relative Importance Analysis Predicting Fourth Year Vocabulary for Study 1

Variables	Relative weights		95% Confidence interval	
	Raw	Rescaled	Lower bound	Upper bound
Child sex	.036	15.835	.002	.156
Maternal education	.006	2.642	<.001	.015
Second-year CCT comprehension	.161*	71.306	.037	.374
Second-year MCDI production	.023	10.216	.002	.121

* Significant at $\alpha < .05$ (95% CI).

To complete testing of the causal requirements for mediation, we conducted a final hierarchical regression. On the first step, we controlled for maternal education and sex. We entered fourth-year vocabulary scores on the second step and second-year vocabulary scores on the third step with kindergarten readiness scores as the dependent measure. If the relation between the second-year vocabulary and kindergarten readiness is mediated by fourth-year vocabulary, we would expect fourth-year, but not second-year, vocabulary to be significant in the final model. The first model was significant and neither maternal education nor sex emerged as significant predictors. The inclusion of fourth-year vocabulary scores on the second step led to a significant increment in R^2 ($\eta^2 = .31$); however, when CCT scores were included on the third step, no single predictor reached significance although the model itself was significant ($\eta^2 = .36$). Observed power for the final model was estimated using G* Power (Faul, Erdfelder, Buchner, & Lang, 2009) at .90. In all models, collinearity was assessed using SPSS diagnostics. Tolerance was consistently high across predictors indicating low, acceptable levels of shared variance. Regression parameters are presented in Table 6.

As a final test for mediation, we entered the parameters in the second (second-year vocabulary predicting fourth-year vocabulary) and third (fourth-year vocabulary predicting kindergarten readiness, controlling for second-year vocabulary) regressions into a Sobel test (Sobel, 1982). The result was not significant ($z' = 1.87$, $SE = .13$, $p = .062$), consistent with the prior regression test for mediation: fourth-year vocabulary did not significantly predict kindergarten readiness when controlling for demographic variables and second-year vocabulary. These findings suggest that the effect of early, decontextualized vocabulary on kindergarten readiness is not mediated by concurrent vocabulary.

In sum, these models indicate that decontextualized vocabulary in the second year is a significant predictor of both vocabulary and kindergarten readiness in the fourth year. Further, the effect of early vocabulary on kindergarten readiness was not mediated by concurrent vocabulary comprehension.

Table 4
Regression Parameters for Models Predicting Fourth Year Kindergarten Readiness From Second Year Vocabulary for Study 1 (N = 48)

Full model	Model 1				Model 2			
	R^2	*SE*	β	*p*	R^2	*SE*	β	*p*
	.10			.035	**.24**			**.002**
Measure								
Maternal education		.69	.26	.073		.68	.10	.460
Child sex		3.05	.26	.071		2.89	.16	.238
Second-year CCT comprehension						.22	.43	**.004**

Note. R^2 is adjusted. Significant *p* values after family-wise error correction are bolded.

Table 5
Regression Parameters for Models Predicting Fourth Year Vocabulary From Second Year Vocabulary for Study 1 (N = 48)

Full model	Model 1				Model 2			
	R^2	*SE*	β	*p*	R^2	*SE*	β	*p*
	−.02			.567	.17			**.010**
Measure								
Maternal education		1.05	.10	.496		1.01	−.07	.608
Child sex		4.62	−.13	.393		4.30	−.24	.087
Second-year CCT comprehension						.33	.49	**.002**

Note. R^2 is adjusted. Significant *p* values after family-wise error correction are bolded.

Discussion

Parent-reported vocabulary in the second year was significantly correlated with kindergarten readiness consistent with Duff et al. (2015) and Morgan, Farkas, Hillemeier, Hammer, and Maczuga (2015). Importantly, however, decontextualized vocabulary emerged as the only significant predictor of both kindergarten readiness and concurrent vocabulary in the fourth year in the relative importance analyses. These results support previous findings indicating that vocabulary knowledge in the toddler period is associated with later school-related outcomes but extending Duff et al. (2015) we find in the relative importance analyses that decontextualized vocabulary is a stronger predictor of kindergarten readiness than is parent-reported vocabulary.

Table 6
Regression Parameters for Models Predicting Fourth-Year Kindergarten Readiness From Second- and Fourth-Year Vocabulary for Study 1 (N = 48)

Full model	Model 2				Model 3			
	R^2	*SE*	β	*p*	R^2	*SE*	β	*p*
	.28			**.001**	.30			.001
Measure								
Maternal education		.62	.21	.099		.65	.13	.347
Child sex		2.77	.31	.018		2.86	.23	.082
Fourth-year PPVT comprehension		.09	.42	**.002**		.10	.31	.030
Second-year CCT comprehension						.24	.28	.073

Note. R^2 is adjusted. Significant *p* values after family-wise error correction are bolded.

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

The CCT and MCDI capture both unique and overlapping aspects of early vocabulary given shared variance but differential prediction to subsequent vocabulary and kindergarten readiness scores. Indeed, the measures differ in two important ways in the present study. First, we assessed vocabulary comprehension on the CCT whereas we assessed production on the MCDI. In the Morgan et al. (2015) population study, MCDI production was associated with subsequent reading and math achievement. Thus, we contrasted directly assessed vocabulary comprehension with parent-reported production, a known predictor of developmental outcomes. Nevertheless, only decontextualized vocabulary accounted for significant variance, which brings us to the second difference between the CCT and the MCDI.

The CCT assesses decontextualized word knowledge: Children must respond to a word–referent relation without the context in which the referent is usually encountered. One can think of children's decontextualized word knowledge as essential to building the "deep" knowledge that is crucial to conceptual development generally and to reading skill specifically (Hadley et al., 2015). As we argued earlier, parents likely report this decontextualized knowledge on the MCDI as well but also report words for which children show evidence of context-dependent, or partial knowledge. From this perspective, the CCT provides an estimate of early word knowledge based on those words for which children have a sufficiently robust representation to execute a response in a decontextualized setting whereas MCDI scores inform us about where children are, relative to same-age peers, in making a wide variety of word–world associations. Our findings suggest that early vocabulary is foundational to the establishment of a conceptual system and, as such, it provides the scaffolding that directly supports both later vocabulary and kindergarten readiness, including the acquisition of a wide range of concepts including print and number. To assess the generalizability of these findings, we tested two additional samples that differed geographically and linguistically from the sample in Study 1.

Study 2

Method

Participants. Participants were part of a larger longitudinal study and were recruited via birth records in a large French-speaking city in Switzerland. Sixty-three monolingual French children (31 girls) and their primary caregivers participated in data collection when children were 22 months of age (M = 21;29 months, range = 21 to 22;6 months). An additional three children were tested but excluded due to missing data at one of the waves. Fifty-eight children returned for a third wave of testing at 48 months of age (M = 47;25 months, range = 47;3 to 49;3 months). Seven of these children had begun attending preschool. Attrition between testing occasions was 8%. Additional demographic information is presented in Table 7.

Table 7
Distribution of Selected Demographic Characteristics of Participants in Study 2

Number (%) of participants	Male	Female	Total
Maternal education			
High school or less	6 (10.3)	8 (13.8)	14 (24.1)
Some college	9 (15.5)	4 (6.9)	13 (22.4)
College graduate	2 (3.4)	3 (5.2)	5 (8.6)
Post-baccalaureate	12 (20.7)	14 (24.1)	26 (44.8)
Approximate income			
$18,000–$40,000	0 (.0)	2 (5.9)	2 (5.9)
$41,000–$60,000	1 (3.0)	1 (3.0)	2 (5.9)
$61,000–$80,000	3 (8.8)	2 (5.9)	5 (14.7)
$81,000–$100,000	2 (5.9)	2 (5.9)	4 (11.8)
>$100,000	10 (29.4)	11 (32.3)	21 (61.7)
Ethnicity			
Black/not Hispanic	1 (1.7)	1 (1.7)	2 (3.4)
Hispanic	0 (0)	1 (1.7)	1 (1.7)
White/not Hispanic	28 (48.3)	27 (46.6)	55 (94.8)

Note. Income reported in Swiss Francs (CHF). Median family income at time of data collection was approximately 126,000 CHF. 24 participants declined to provide income information. Some percentages may not sum to 100 due to rounding error.

Measures.

Language exposure assessment tool (LEAT). Identical to Study 1. Participants were included in the French monolingual sample if their relative exposure to French was 80% or greater at 22 months (M = .96, range = .80 to 1).

L'inventaire français du développement communicatif (IFDC). The IFDC (Kern, 2007; Kern & Gayraud, 2010) is the European French adaptation of the MCDI. The IFDC has been shown to be sensitive to vocabulary development over time (Kern, 2010) and to have strong short-term test–retest reliability ($r > .90$; Kern & Gayraud, 2010). The IFDC: Mots et Phrases (Words and Sentences) consists of 698 vocabulary items and can be administered from 16 to 30 months of age. Vocabulary production was estimated from the IFDC Mots et Phrases Form.

CCT. The French CCT is an adaptation of the English CCT described in Study 1. The design and administration are the same with items on the French adaptation based on comprehension norms from the IFDC. The French adaptation evinces significant test–retest reliability (r = .42) and convergent validity (r = .54) with parent report on the IFDC (Friend & Zesiger, 2011). As many translation equivalents (words across languages with the same referential meaning) as possible were maintained in the adaptation from English to French with the restriction that the French, like the English, contained one third each easy, moderately difficult, and difficult items (based on parent-report norms from the IFDC). Similarly, the proportion of nouns, verbs, and adjectives was roughly equivalent. Images were prototypical exemplars in the region in which children were tested.

Échelle de vocabulaire en images Peabody (EVIP). The EVIP (Dunn, Dunn, & Thériault-Whalen, 1993) is the French adaptation of the English PPVT. Like the PPVT, it is a measure of receptive vocabulary from 30 months of age to adulthood. The EVIP was normed on a large representative sample of French speakers. It has satisfactory test–retest reliability (r = .72), as well as internal consistency (α = .81). Validity of the French version has also been established through high correlations with other vocabulary tests (r = .86) and with IQ measures (r = .62-.72; Dunn et al., 1993).

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

Lollipop test. The Lollipop test is identical to Study 1 and was administered in French.

Procedure and data analytic strategy. Identical to Study 1.

Results

22 months. Average relative exposure to French according to the LEAT was .95 (range = .80 to 1.0). IFDC production vocabulary ranged from 13 to 523 words ($M = 201.66$, $SD = 133.61$), corresponding to the fifth to the 90th percentile and sample-specific internal consistency was excellent ($\alpha = .99$). CCT comprehension vocabulary ranged from 14 to 40 words ($M = 29.67$, $SD = 5.58$). Sample-specific internal consistency was excellent across forms ($\alpha = .92$ and .91, respectively). Immediate test–retest reliability was significant, $r(51) = .67$, $p < .001$, and CCT scores correlated with concurrent IFDC production, $r(56) = .41$, $p = .001$.

48 months. Comprehension vocabulary on the EVIP ranged from 27 to 92 words ($M = 55.17$, $SD = 14.83$), reflecting a range from the 16th to the 99th percentile and sample-specific internal consistency was excellent ($\alpha = .97$). Lollipop test scores ranged from 14 to 67 ($M = 38.79$, $SD = 13.78$). This range is almost identical to that observed in the English sample in Study 1. Sample-specific internal consistency was good ($\alpha = .78$).

Early vocabulary and kindergarten readiness. Zero-order correlations revealed significant longitudinal relations between vocabulary at 22 months and later vocabulary and kindergarten readiness scores and kindergarten readiness scores at 48 months, $r(56) = .54$, $p < .001$, and $r(56) = .40$, $p = .002$, respectively. For Study 2, we used a dichotomous measure of preschool attendance because, unlike the English sample, all children who attended preschool attended for the same number of hours. Maternal education was associated with attendance at preschool, $r(58) = .31$, $p = .020$, but not with any other measure (all $ps > .27$). Sex was marginally correlated with attendance at preschool, $r(56) = .27$, $p = .045$, but not with any other measure (all $ps > .32$). In large part, these correlations mirror the pattern observed in the English sample in Study 1.

Relative weights analysis. Following the logic of Study 1, we first examined the relative contribution of decontextualized and parent-reported vocabulary in predicting fourth-year kindergarten readiness scores. Table 8 displays the raw and rescaled relative weights for each independent variable along with the 95% confidence intervals. In total, the predictors and control variables accounted for 30% of the variance in kindergarten readiness scores. The largest (and only statistically significant) weight was for the decontextualized vocabulary, which explained 13% of the variance in kindergarten readiness scores and 44% of the total variance explained by all four predictors. However, the confidence intervals for the predictors overlap, indicating that their relative weights are not significantly different.

Table 8
Relative Importance Analysis Predicting Fourth-Year Kindergarten Readiness for Study 2

Variables	Relative weights		95% Confidence interval	
	Raw	Rescaled	Lower bound	Upper bound
Child sex	.045	15.175	.002	.178
Maternal education	.040	13.384	.002	.157
Second-year CCT comprehension	.130*	44.012	.030	.278
Second-year MCDI production	.081	27.428	.009	.206

* Significant at $\alpha < .05$ (95% CI)

This analysis was repeated using fourth-year vocabulary as the outcome variable. Table 9 displays the raw and rescaled weights for each independent variable, along with the 95% confidence intervals. In total, the predictors and control variables accounted for 35% of the variance in fourth-year vocabulary. The largest (and only statistically significant) weight was for decontextualized vocabulary, which explained 31% of the variance in fourth-year vocabulary and 88% of the total variance explained by all four predictors. In contrast to the previous analysis, the confidence intervals for the predictors did not overlap, indicating that the relative weight of decontextualized vocabulary was significantly greater than the relative weight of the parent-reported vocabulary. In summary, decontextualized vocabulary was the largest and the only statistically significant relative weight in predicting both vocabulary and kindergarten readiness scores in the fourth year, however, due to the large confidence intervals for both predictors, these weights were only significantly different when predicting fourth-year vocabulary.

To test the mediation model put forward in Study 1, we conducted parallel hierarchical regressions on the French data. Nominal alpha was set at .05 and a sequential Bonferroni procedure was applied to control family wise false discovery rate (Benjamini & Hochberg, 1995). In all models, collinearity was assessed using SPSS diagnostics. Tolerance was consistently high across predictors indicating low, acceptable levels of shared variance. In the first regression, the effects of sex, maternal education, and attendance at preschool were controlled on the first step. Decontextualized vocabulary in the second year was entered on the second step with kindergarten readiness scores as the dependent measure. The first model was significant with attendance at preschool the only factor approaching significance and the inclusion of vocabulary in second year in the second step accounted for significant unique variance in the model ($\eta^2 = .26$). Observed power for the final model was estimated using G* Power (Faul et al., 2009) at .87. This provides further support for the hypothesis that decontextualized vocabulary predicts subsequent kindergarten readiness. Regression parameters for the models described above are presented in Table 10.

As in Study 1, we conducted a second hierarchical regression in which maternal education, sex, and preschool attendance were entered as control variables on the first step, Decontextualized vocabulary scores in the second year were entered on the second step, and vocabulary scores in the fourth year served as the dependent measure. Only the second model was significant ($\eta^2 = .32$) indicating the expected relation between vocabulary in the second and fourth years (see Table 11 for full regression parameters). Consistent with the English data, second-year vocabulary predicted both kindergarten readiness and fourth-year vocabulary.

To determine whether the relation between second-year vocabulary and fourth-year kindergarten readiness was mediated by concurrent vocabulary in the fourth year, we conducted a final hierarchical regression. On the first step, we controlled for mater-

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

Table 9
Relative Importance Analysis Predicting Fourth-Year Vocabulary for Study 2

Variables	Relative weights		95% Confidence interval	
	Raw	Rescaled	Lower bound	Upper bound
Child sex	.002	.446	<.001	.004
Maternal education	.024	6.814	<.001	.131
Second-year CCT comprehension	.306*[a]	88.207	.159	.477
Second-year MCDI production	.016[a]	4.533	.001	.041

[a] Indicates significant weight difference at the $\alpha < .05$ level.
* Significant at $\alpha < .05$ (95% CI).

nal education, sex, and preschool attendance. We entered fourth-year vocabulary scores on the second step and second-year vocabulary scores on the third step with kindergarten readiness scores as the dependent measure. If the relation between second-year vocabulary and kindergarten readiness is mediated by fourth-year vocabulary, we would expect the fourth-year, but not second-year, vocabulary to be significant in the final model. The first model was significant and preschool attendance was the only predictor to approach significance. The inclusion of fourth-year vocabulary on the second step lead to a marginally significant increment in R^2 ($\eta^2 = .23$) but when second-year vocabulary scores were included on the third step, neither fourth-year, nor second-year, vocabulary scores reached significance even though the model was significant ($\eta^2 = .28$). Regression parameters are presented in Table 12. Interestingly, preschool attendance contributed modestly to the models although it was not significant once the sequential Bonferroni correction was applied.

Finally, to further test our mediation model, we entered the appropriate parameters into a Sobel test. As in Study 1, the test was not significant ($z' = 1.14$, $SE = .20$, $p = .255$), suggesting the effect of decontextualized vocabulary on kindergarten readiness was not mediated by concurrent vocabulary.

Discussion

In contrast to Study 1, Duff et al. (2015), and Morgan et al. (2015), we did not find evidence that parent-reported vocabulary production was significantly correlated with kindergarten readiness. In addition, as in Study 1, decontextualized vocabulary was a stronger predictor, relative to parent-reported vocabulary, of both kindergarten readiness and subsequent vocabulary in our relative importance analyses. Thus, the general finding that decontextualized vocabulary is a stronger predictor of kindergarten readiness than is parent-reported vocabulary was replicated. It is not clear why parent-reported production in the French-speaking sample failed to predict kindergarten readiness but it is possible that parents in the U.S. and Switzerland have different expectations for what constitutes production and, consequently, complete the MCDI and IFDC forms differently. This illustrates the fact that language adaptations of instruments cannot necessarily be expected to capture vocabulary estimates in the same way due to the potential for cultural differences in reporting practices. Although these differences in prediction could result from differences in kindergarten readiness, the fact that directly assessed vocabulary was a strong predictor of readiness across languages and cultures argues against this interpretation.

Consistent across both English and French monolingual children is the fact that the relation between decontextualized vocabulary in the second year and children's kindergarten readiness in the fourth year is not mediated by fourth-year vocabulary comprehension.

Table 10
Regression Parameters for Models Predicting Fourth-Year Kindergarten Readiness From Second-Year Vocabulary for Study 2 (N = 58)

Full model	Model 1				Model 2			
	R^2	*SE*	β	*p*	R^2	*SE*	β	*p*
	.10			**.038**	.20			**.003**
Measure								
Maternal education		.65	−.04	.797		.62	−.01	.923
Child sex		3.60	.13	.335		3.40	.10	.444
Preschool		5.80	.33	.020		5.49	.28	.036
Second-year CCT comprehension						.30	.34	**.006**

Note. R^2 is adjusted. Significant *p* values after family-wise error correction are bolded.

Table 11
Regression Parameters for Models Predicting Fourth-Year Vocabulary From Second-Year Vocabulary for Study 2 (N = 60)

Full model	Model 1				Model 2			
	R^2	*SE*	β	*p*	R^2	*SE*	β	*p*
	−.02			.628	.27			**<.001**
Measure								
Maternal education		.75	.12	.401		.63	.16	.200
Child sex		4.12	.02	.876		3.50	−.03	.803
Preschool		6.63	.09	.527		5.65	.02	.898
Second-year CCT comprehension						.31	.55	**<.001**

Note. R^2 is adjusted. Significant *p* values after family-wise error correction are bolded.

Table 12
Regression Parameters for Models Predicting Fourth-Year Kindergarten Readiness From Second- and Fourth-Year Vocabulary for Study 2 (N = 60)

Full model	Model 1				Model 2			
	R^2	*SE*	β	*p*	R^2	*SE*	β	*p*
	.18			**.006**	.21			**.004**
Measure								
Maternal education		.63	−.07	.581		.62	−.04	.765
Child sex		3.44	.12	.338		3.39	.10	.420
Preschool		5.55	.30	.026		5.48	.28	.037
Fourth-year EVIP comprehension		.11	.31	.016		.13	.17	.247
Second-year CCT comprehension						.35	.25	.085

Note. R^2 is adjusted. Significant *p* values after family-wise error correction are bolded.

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

Thus, as we argued in Study 1, it appears that early, decontextualized vocabulary may scaffold both later vocabulary and kindergarten readiness. However, it should be noted that these findings are restricted to children learning only one language from birth when the majority of children in the world learn two or more languages. To better understand whether the observed relation between early vocabulary and subsequent kindergarten readiness holds for children exposed to more than one language, we conducted a study with children who acquired two languages from birth. To follow as directly as possible from Studies 1 and 2, we recruited children who acquired both French and English as their first languages.

Because we were interested in extending our findings from Studies 1 and 2 on the relation between early vocabulary and kindergarten readiness to BFLA children, we were particularly interested in how children's vocabulary in their dominant language in toddlerhood was related to their language and kindergarten readiness skills in the fourth year.

Study 3

Method

Participants. Participants were part of a larger longitudinal study and were recruited via birth records in a large bilingual French-English city in Québec, Canada. Forty-eight French-English bilingual children (19 girls) and their primary caregivers participated when children were 22 months of age (M = 23;24 months, range = 20;24 to 26;6 months for the English visit and M = 23;26 range = 20;27 to 26;6 for the French visit). An additional 24 children were tested but were excluded due to fussiness (N = 7) or missing data at one of the waves (N = 17). Attrition between testing occasions was 29% (N = 14, eight of whom had moved out of the area). Thirty-four children returned for a third wave of testing at 48 months of age (M = 48;26, range = 46;15 to 51;12 months for the English visit and M = 49, range = 47;15 to 52;3 for the French visit). Of these 34 children, all were enrolled in daycare. Additional demographic information is presented in Table 13.

Measures.

Language exposure assessment tool (LEAT). Identical to Studies 1 and 2. Participants who were included in the bilingual sample were exposed to French and English from birth and their exposure to each language was 80% or less and exposure to the least-exposed language was at least 20%.

Inventaire MacArthur du développement de la communication (IMDC). The IMDC (Frank, Poulin-Dubois, & Trudeau, 1997) is the Quebec French adaptation of the MCDI. In contrast to the IFDC, the items were normed on children acquiring Québécois French. Thus, there is overlap between the IFDC and the IMDC but the IMDC is more appropriately targeted to the present sample. The Mots et Énoncés (Words and Sentences) Form is designed for use for children from 16 to 30 months of age. Vocabulary production on IMDC exhibits excellent short-term test–retest reliability (r = .90) and is highly correlated with sentence complexity (r = .78) and grammar (r = .70; Trudeau, Aktouf, Boudreault, & Breault, 2008).

Results have confirmed the validity of the IMDC and a significant correlation between the IMDC and chronological age suggests the IMDC is sensitive to language growth (Boudreault, Cabirol, Trudeau, Poulin-Dubois, & Sutton, 2007).

MCDI. The MCDI is identical to Study 1.

CCT. The English CCT and the French adaptation were utilized. The instruments are identical to those described in Studies 1 and 2.

PPVT. The PPVT is identical to Study 1.

EVIP. The EVIP is identical to Study 2.

Lollipop test. The lollipop test is identical to Studies 1 and 2 and was administered in the child's dominant language.

Procedure. All children were assessed on two different days, once in English and once in French. The language of first and second visit was counterbalanced across children. During visits, the experimenter instructed the parent to speak only the language of that visit (i.e., English *or* French) and assessments were completed in that language to elicit optimal performance. The two appointments were scheduled approximately 2 weeks apart (M interval = 16 days, range = 6 to 43 days). Language of testing was counterbalanced across participants such that half of the children completed the first visit in their dominant language and the second in their non-dominant language. Otherwise the procedure was identical to Studies 1 and 2.

Data analytic strategy. The strategy is similar to Study 1 although a reduction in sample size required us to use a correlational approach instead of performing regressions. Due to this, in Study 3 we test mediation using only the causal steps tests (Judd & Kenny, 1981; MacKinnon et al., 2002).

Results

Language dominance. In BLFA, both languages are acquired simultaneously from birth. Here we refer to L1 and L2 as a function of relative exposure. Therefore, L1 refers to the language

Table 13
Distribution of Selected Demographic Characteristics of Participants in Study 3

Number (%) of participants	Male	Female	Total
Maternal education			
High school or less	1 (3.0)	2 (6.1)	3 (9.1)
Some college	4 (12.1)	2 (6.1)	6 (18.2)
College graduate	8 (24.2)	2 (6.1)	10 (30.3)
Post-baccalaureate	7 (21.2)	7 (21.2)	14 (42.4)
Approximate income			
$18,000–$40,000	2 (6.5)	4 (12.9)	6 (19.4)
$41,000–$60,000	3 (9.7)	0 (0)	3 (9.7)
$61,000–$80,000	5 (16.1)	2 (6.5)	7 (22.6)
$81,000–$100,000	2 (6.5)	3 (9.7)	5 (16.1)
>$100,000	7 (22.6)	3 (9.7)	10 (32.3)
Ethnicity			
Asian	1 (3.0)	0 (0)	1 (3.0)
Black/not Hispanic	1 (3.0)	3 (9.1)	4 (12.1)
Hispanic	0 (0)	1 (3.0)	1 (3.0)
White/not Hispanic	15 (45.5)	9 (27.3)	24 (72.8)
Mixed race	1 (3.0)	0 (0)	1 (3.0)
Other	1 (3.0)	1 (3.0)	2 (6.1)

Note. Income reported in Canadian dollars (CAN). Median income at the time of the study was approx. 74,000 CAN. One participant declined to provide demographic information and two participants declined to provide income information. Some percentages may not sum to 100 due to rounding error.

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

with the greatest relative exposure and L2 refers to the language with less exposure rather than to which language was acquired first or second. According to the LEAT, at 22 months of age, 24 children had greater exposure to English, and 24 had greater exposure to French. Average relative exposure to L1 was 65% (range = 42% to 79%), whereas relative exposure to L2 was 34% (range = 21% to 61%). Four children were also exposed to a third language (M exposure = .12, range = .02 to .26). In these cases, we collapsed across the two nondominant languages to obtain an estimate of nondominant exposure. The average L1/L2 exposure ratio was 2.04 (SD = .89), reflecting that children received roughly twice as much exposure to the dominant, relative to nondominant, languages. Parent-reported L1/L2 exposure was higher at 48 months (M L1/L2 = 3.08, SD = 5.43).

There was evidence of a change in relative exposure in some participants from 22 to 48 months: Five children who received greater French exposure at 22 months had greater exposure to English at 48 months, and six children who had greater English exposure at 22 months had greater exposure to French at 48 months. There was no change in relative language exposure for 23 children. Children whose relative exposure to French was higher than to English at 22 months also had a larger French vocabulary at 48 months. The same was true for children whose relative exposure was higher to English than to French. Of the 34 children who participated at 48 months, a majority (N = 19) had larger vocabularies in English than in French and the rest (N = 15) had larger vocabularies in French. Whereas exposure is a good predictor of vocabulary size in the toddler period, this relation did not hold at 48 months of age. Language exposure estimates at 48 months were uncorrelated with vocabulary size (ps $\geq$ .171) consistent with the literature on dominance as children approach school age (Bedore et al., 2012; Lust et al., 2016; Sheng, Lu, & Gollan, 2014, but cf. Brebner, McCormack, & Liow, 2016). All children were included in the analyses.

22 months. Parent-reported vocabulary production ranged from three to 446 words (M = 186.6, SD = 120.5) in French and from five to 643 words (M = 171.0, SD = 162.1) in English. Sample-specific internal consistency was α = .99 for both French and English parent-reported vocabulary. CCT vocabulary comprehension ranged from four to 36 words (M = 23.1, SD = 8.3) in French and from two to 37 words (M = 23.3, SD = 8.3) in English. Sample-specific internal consistency was excellent across forms (Cronbach's alpha = .89 and .90, respectively). Immediate test–retest reliability was significant, $r(29) = .610$, $p < .001$ and $r(23) = .508$, $p = .013$ in French and English, respectively; and CCT scores correlated with concurrent parent-reported production, $r(44) = .337$, $p = .024$ and $r(45) = .457$, $p = .001$, in French and English, respectively.

48 months. Comprehension vocabulary ranged from four to 72 words (M = 34.66, SD = 17.19) in French and 11 to 87 words (M = 52.47, SD = 17.70) in English. Vocabulary size in the dominant language ranged from 16 to 87 words (M = 52.9, SD = 17.85). Sample-specific internal consistency was α = .92 and .95, on the EVIP on the PPVT, respectively. Lollipop test scores ranged from 12 to 56 (M = 38.18, SD = 10). This range of scores was comparable with the monolingual samples in Studies 1 and 2. Sample-specific internal consistency was moderate (α = .68).

Below we present findings for the dominant language at 22 and 48 months. Zero-order correlations revealed significant longitudinal relations between decontextualized vocabulary at 22 months and L1 vocabulary and kindergarten readiness at 48 months, $r(33) = .35$ $p = .045$) and $r(33) = .47$, $p = .006$, respectively. In Study 3, all children attended preschool and varied only in how many days they attended per week so we used number of days per week in preschool as a control variable (M = 4.73, range = 3 to 5 days/week). Maternal education was associated with days/week in preschool, $r(33) = .43$, $p = .014$, but not with any other measure (all ps $>$ .11). Sex was significantly correlated with parent-reported language production and marginally correlated with CCT scores at 22 months, $r(30) = .37$, $p = .048$ and $r(33) = .31$, $p = .083$, respectively; and with kindergarten readiness scores at 48 months, $r(33) = .44$, $p = .01$, but not with other variables (ps $>$ .272). Finally, attendance at preschool was associated with maternal education (as described above) and with L1 vocabulary at 48 months, $r(32) = .39$, $p = .027$, but not with any other variables (all ps $>$ .275). Importantly, parent-reported L1 vocabulary production was related only to sex, $r(30) = .37$, $p = .048$, and not to any outcome variable (all ps $>$ .25).

To test whether the mediation model in Studies 1 and 2 applies to BFLA, we conducted a set of partial correlations to parallel the hierarchical regressions on the English and French samples. This change in analytic procedure was undertaken due to the smaller sample in Study 3. The first partial correlation assessed the relation between CCT comprehension at 22 months and kindergarten readiness at 48 months controlling for sex, maternal education, and days/week at preschool. CCT comprehension was significantly associated with subsequent kindergarten readiness scores, $r(27) = .43$, $p = .02$.

We then tested the relation between CCT at 22 months and L1 vocabulary comprehension at 48 months again controlling for the effects of sex, maternal education, and days/week at preschool. This relation was marginal, $r(27) = .39$, $p = .039$, when controlling for false discovery rate (Bonferroni α = .033). Early L1 vocabulary predicted kindergarten readiness scores and marginally predicted subsequent vocabulary at 48 months.

Finally, to assess whether the relation between CCT scores and kindergarten readiness on the kindergarten readiness were mediated by fourth-year vocabulary, we tested the relation between the CCT and kindergarten readiness controlling for sex, maternal education, days/week at preschool, and fourth-year L1 vocabulary comprehension. This correlation was not significant (p = .094). Similarly, the relation between L1 vocabulary at 48 months and kindergarten readiness was not significant (p = .133) when controlling for sex, maternal education, days/week at preschool, and second-year vocabulary. Together, these findings suggest, consistent with Studies 1 and 2, that vocabulary in the fourth year does not mediate the relation between vocabulary in the second year and kindergarten readiness. Instead, the size of early, decontextualized vocabulary in the second year of life predicts both subsequent vocabulary (although this was marginal when controlling for false detection rate) and kindergarten readiness. Post hoc analyses to assess prediction from L2 revealed no association between early L2 vocabulary comprehension and fourth-year vocabulary in L1 (p = .30) or fourth-year L2 ($r(27) = .34$, $p = .08$) and no relation between early L2 vocabulary and kindergarten readiness (p = .40). This suggests that early L1 vocabulary provides stronger support for subsequent language acquisition and kindergarten readiness in bilingual children.

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

Discussion

The purpose of Study 3 was to extend a model in which early vocabulary was associated with subsequent vocabulary and kindergarten readiness to BFLA children. Consistent with Studies 1 and 2, children's decontextualized vocabulary comprehension in the second year predicted kindergarten readiness outcomes and vocabulary comprehension in their dominant language at 48 months of age. Given the small sample size, these findings are preliminary but are important for guiding future research.

Interestingly, the dominant language of exposure at 22 months marginally predicted the language with the largest vocabulary at 48 months even though children's relative exposure changed over time. Some children who received greater exposure to French at 48 months of age had larger vocabularies in English and vice versa. This sheds light on two important facts. First, language exposure is fluid and depends upon environmental influences. Importantly, all of these children had begun preschool, which likely contributed to changing language exposure. Second, children's vocabulary in their dominant language at 22 months marginally predicts vocabulary in their dominant, but not their nondominant, language at 48 months even when relative exposure to these languages has changed. The present research suggests that, in monolingual children and their BFLA peers, early vocabulary is a key longitudinal predictor of language and kindergarten readiness.

General Discussion

Early Vocabulary and Kindergarten Readiness

In Study 1, second-year decontextualized vocabulary explained unique variance in both fourth-year vocabulary and kindergarten readiness after controlling for demographic variables. Second-year decontextualized vocabulary (measured by the CCT) and parent-reported vocabulary (measured by the MCDI) were both related to children's kindergarten readiness although a relative importance analysis that allowed us to assess the independent contributions of these instruments revealed that only CCT comprehension accounted for significant unique variance.

It is important to note that the CCT and MCDI were moderately correlated. This, in conjunction with differential prediction to developmental outcomes, reveals that these measures capture unique as well as overlapping aspects of early vocabulary. Whereas the MCDI yields a reliable estimate of the lexicon inclusive of context-dependent and decontextualized items, the CCT yields a more circumscribed estimate focused on word-world relations that are sufficiently stable to elicit an accurate haptic response. Thus, the two instruments may serve different but complementary purposes. In the present study directly assessed vocabulary yielded effect sizes that were similar to or larger than those obtained in large-scale studies of parent-reported vocabulary. We discuss this point in more detail at the end of this section.

Consistent with previous work finding a relation between comprehension at 18 months and a language sample at 30 months (Friend, Schmitt, & Simpson, 2012), early decontextualized vocabulary was also a predictor of fourth-year vocabulary. These findings, consistent with larger scale studies (Duff et al., 2015; Morgan et al., 2015), suggest that kindergarten readiness and, by extension, emergent literacy is subserved in part by vocabulary size as early as the second year of life.

Study 2 confirmed and extended this finding in a sample of French-speaking children in Switzerland. Decontextualized vocabulary at 22 months of age was the only significant predictor of kindergarten readiness at 48 months. There was a notable difference in parent-reported vocabulary size across our monolingual samples. Parents of English-speaking monolingual children reported that children produced, on average, 259 words whereas parents of French-speaking monolingual children reported that their children produced 198 words on average. This finding is consistent with previous cross-language comparisons using the MCDI (Bleses et al., 2008) and an earlier version of the MCDI (Bornstein et al., 2004). In both reports, there is variability across languages in parent-reported vocabulary for children of the same age and reported vocabulary in French is lower than in English. The same pattern emerged for parent-reported production in the present French and English monolingual samples. However, children's directly assessed vocabulary *comprehension* was similar across monolingual samples: English monolingual children correctly identified the referent for an average of 27 words whereas French children did so for 29 words.

These findings are consistent with Bornstein et al.'s (2004) previous report specific to French and with reports by Bleses et al. (2008) and Eriksson et al. (2012) revealing language group differences in parent-reported vocabulary. Whether these differences reflect real differences in acquisition across languages, differences in reporting practices, or differences in predictive validity is indeterminate. To the last concern, it is important to note three sources of evidence that speak to the reliability and validity of the IFDC. First, Kern and Gayraud (2010) report reliability estimates for the IFDC similar to those reported for the MCDI. Second, sample-specific internal consistency on this measure was excellent and similar to the estimates for the other parent-report instruments in the study and finally, the IFDC converges with directly assessed vocabulary estimates.

In both Studies 1 and 2, decontextualized vocabulary in the second year predicted both vocabulary and kindergarten readiness in the fourth year. In Study 3, we demonstrated that this model holds for children who acquire two languages from birth and importantly, the effect is robust to changes in language status suggesting that general language ability drives later language achievement and readiness for school. This is an important, if preliminary, extension of the mechanisms underlying cognitive development from the toddler to the preschool period to the majority of children in the world who grow up learning more than one language.

In the present study, we calculate eta-squared to estimate effect size to contrast our effects with those in the extant literature. This estimate can be interpreted similarly to R^2. The present study yielded similar or larger effect sizes to those obtained by Duff et al. (2015) and Morgan et al. (2015) for both monolingual samples. For example, whereas Duff et al. (2015) found that parent-reported second-year vocabulary accounted for about 16% of the variance in school age vocabulary, in the present study, directly assessed second-year vocabulary accounted for between 22% and 32% of the variance. Similarly, whereas Morgan et al. (2015) found that parent-reported second-year vocabulary accounted for 22% of the variance in school age reading and 27% of the variance in math, directly assessed second-year vocabulary accounts for between 26% and 29% of the variance in kindergarten readiness. The

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

estimates for the bilingual sample, which are somewhat smaller, should be interpreted with caution given the small sample size and preliminary nature of this investigation. Nevertheless, these findings extend previous research by showing that decontextualized vocabulary may be effective for predicting downstream developmental outcomes across language (English and French) and language status (monolingual and bilingual).

The Role of Decontextualized Vocabulary

One of the difficulties that novice word learners have in generalizing across referents for a word is that they must dissociate, to some extent, the word–referent relation from the context in which it was learned. Otherwise, children's early vocabulary is "context-bound:" children can only show recognition of the word–referent relation in its original supporting context. We emphasize decontextualized vocabulary because this level of knowledge reflects stable word–referent relations across contexts, the ability to generalize relations to other exemplars, and the ability to extract the relevant properties of the referent class (McMurray et al., 2012; Smith & Yu, 2008). This is an essential precursor to what Hadley et al. (2015) refer to as "deep word knowledge:" lexical knowledge that sets the stage for acquiring new concepts and for later literacy.

From this view, early, decontextualized knowledge supports the development of stable conceptual networks. Children must first form word–referent relations that are consistent across multiple contexts. These stable word–referent relations can, in turn, support stable conceptual networks. Finally, these networks become a platform from which the concepts and skills necessary for beginning kindergarten are built. For example, knowing number words facilitates the development of numeric skills (Barner & Bachrach, 2010; Mix, 2009) and knowing letter names facilitates recognition of letters in print (Justice & Ezell, 2004). Although our findings indicate that early, decontextualized vocabulary is related to kindergarten readiness, this is not to say that it is *causal* in and of itself. It is possible that children who have large, stable lexicons at the end of the second year may be "good learners" relative to their peers such that, when they reach preschool age, they are also better prepared for kindergarten. That is, the same general learning mechanisms that support the acquisition of a stable lexicon may also support conceptual development and kindergarten readiness. For example, working memory may scaffold both early vocabulary and a broad range of nonlinguistic skills (e.g., understanding of numbers and shapes).

Previous work focused on processing *efficiency* illustrates this point (Marchman & Fernald, 2008). Processing efficiency and parent-reported production at 25 months each account for unique variance (16% and 17%, respectively) in linguistic and cognitive skills at age 8 and these predictors are correlated. In fact, processing efficiency is related to *both* parent-reported (Hurtado, Marchman, & Fernald, 2007; Marchman, Fernald, & Hurtado, 2010) and directly assessed vocabulary (Hendrickson, Mitsven, Poulin-Dubois, Zesiger, & Friend, 2015; Legacy, Zesiger, Friend, & Poulin-Dubois, 2018). Further, vocabulary size and processing efficiency are associated with later working memory. Marchman and Fernald (2008) argue that vocabulary growth is driven by the same learning principles that support the development of an array of skills and concepts. Evaluating a causal model that takes into account the relative contributions of vocabulary, processing efficiency, and general learning to children's kindergarten readiness is beyond the scope of the present article and an important direction for future research.

Limitations

The samples in the present research are somewhat small relative to some of the large-scale studies that we have cited (e.g., Duff et al., 2015; Forget-Dubois et al., 2009; Morgan et al., 2015). Nevertheless, the samples are within range of several related studies (e.g., Cristofaro & Tamis-LeMonda, 2011; Fernald & Marchman, 2012; Marchman & Fernald, 2008) and, in particular, of previous work using the CCT, an individually administered, lab-based assessment (Friend & Keplinger, 2003, 2008; Hendrickson et al., 2015; Legacy et al., 2016; Legacy, Zesiger, Friend, & Poulin-Dubois, 2018; Poulin-Dubois et al., 2013). Our findings are in line with, and extend, previous work with both large and small samples. An important focus of the present article was to determine whether decontextualized vocabulary in the second year was sufficiently robust to account for unique variance in preschool outcomes. The fact that the same pattern of effects emerged across language and geographic/cultural differences with effect sizes in the range of previous reports or larger, suggests that these effects are robust. We are involved currently in collaborative research scaling this assessment to environments outside the laboratory to facilitate testing of larger samples.

In addition, more work is required to test monolingual findings in bilingual samples. The pattern of effects reported here must be tested in larger samples and across languages. For example, it is not clear whether these effects would hold for children who are learning languages from different language families (e.g., Chinese and English). Finally, that we find the same pattern of effects in bilinguals as in monolinguals tells us little with regard to how bilingual children make the transition to proficiency in the language of schooling that is critical for academic success. That is, when a child's dominant language does not match the language of schooling, it is possible that whereas dominant language vocabulary size predicts kindergarten readiness, it may not predict academic achievement.

Finally, our findings differ from previous research in that, whereas zero order correlations revealed maternal education was associated with some measures in Study 1, it was not associated with parent-reported vocabulary production in the second year or with vocabulary in the fourth year and it was not a significant predictor in our regression models. Further, maternal education did not emerge as significantly associated with either predictors or outcome measures in Studies 2 and 3. In contrast, Forget-Dubois et al. (2009) reported a significant effect of socioeconomic status (SES; i.e., parent education and household income) with an effect size of $R^2 = .10$. Our models in Study 1 yielded an identical effect size for control variables (child sex and maternal education) suggesting that larger samples may be required to detect this effect. Because maternal education has been shown to exert an effect in previous work (Hoff, 2013) and in the interest of providing better-adjusted estimates of the relation of early vocabulary to later outcomes, we controlled for it in all of our analyses. Scaling up testing to larger samples would facilitate more comprehensive models of the role of decontextualized vocabulary vis-à-vis vari-

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

ables with smaller effect sizes (e.g., demographic factors) in contributing to children's preparedness for school.

To conclude, this research contributes to the literatures on language development and emergent literacy by providing evidence that vocabulary comprehension as early as 22 months of age is associated with subsequent vocabulary and kindergarten readiness. In conjunction with recent evidence that early vocabulary predicts later literacy (Duff et al., 2015; Law et al., 2013; Morgan et al., 2015), this article emphasizes the significance of early language comprehension for broad developmental outcomes and, of particular importance, we have extended these findings across two languages and across monolingual and bilingual children. Of interest for future research are the mechanisms that underlie this continuity. We have suggested that early, decontextualized vocabulary supports later vocabulary and broader conceptual learning. However, an alternative is that vocabulary knowledge is the product of an efficient cognitive system and it is this cognitive efficiency that underlies both vocabulary acquisition and school readiness. Both language-based and general cognitive accounts are consonant with these findings. Distinguishing between these accounts is a direction for future research that may have implications for preschool interventions.

References

Barner, D., & Bachrach, A. (2010). Inference and exact numerical representation in early language development. *Cognitive Psychology, 60,* 40–62. http://dx.doi.org/10.1016/j.cogpsych.2009.06.002

Bates, E., Bretherton, I., Carlson, V., Carpen, K., & Rosser, M. (1979). Next steps: A follow-up study and some pilot research. In E. Bates, L. Benigni, I. Bretherton, L. Camaioni, & V. Volterra (Eds.), *The emergence of symbols: Cognition and communication in infancy* (pp. 271–311). Waltham, MA: Academic Press. http://dx.doi.org/10.1016/B978-0-12-081540-1.50012-0

Bedore, L. M., Peña, E. D., Summers, C. L., Boerger, K. M., Resendiz, M. D., Greene, K., . . . Gillam, R. B. (2012). The measure matters: Language dominance profiles across measures in Spanish-English bilingual children. *Bilingualism: Language and Cognition, 15,* 616–629. http://dx.doi.org/10.1017/S1366728912000090

Benjamini, Y., & Hochberg, Y. (1995). Controlling the false discovery rate: A practical and powerful approach to multiple testing. *Journal of the Royal Statistical Society: Series B, Methodological, 57,* 289–300.

Bleses, D., Vach, W., Slott, M., Wehberg, S., Thomsen, P., Madsen, T. O., & Basbøll, H. (2008). Early vocabulary development in Danish and other languages: A CDI-based comparison. *Journal of Child Language, 35,* 619–650. http://dx.doi.org/10.1017/S0305000908008714

Bornstein, M. H., Cote, L. R., Maital, S., Painter, K., Park, S. Y., Pascual, L., . . . Vyt, A. (2004). Cross-linguistic analysis of vocabulary in young children: Spanish, Dutch, French, Hebrew, Italian, Korean, and American English. *Child Development, 75,* 1115–1139. http://dx.doi.org/10.1111/j.1467-8624.2004.00729.x

Boudreault, M.-C., Cabirol, É.-A., Trudeau, N., Poulin-Dubois, D., & Sutton, A. (2007). Les Inventaires Macarthur du Développement de la Communication: Validité et données normatives préliminaires [The MacArthur Communicative Development Inventories: Preliminary validity and normative data]. *Journal of Speech-Language Pathology and Audiology, 31,* 27–37.

Brebner, C., McCormack, P., & Liow, S. R. (2016). Marking of verb tense in the English of preschool English–Mandarin bilingual children: Evidence from language development profiles within subgroups on the Singapore English Action Picture Test. *International Journal of Language & Communication Disorders, 51,* 31–43. http://dx.doi.org/10.1111/1460-6984.12181

Cain, K., & Oakhill, J. (2011). Matthew effects in young readers: Reading comprehension and reading experience aid vocabulary development. *Journal of Learning Disabilities, 44,* 431–443. http://dx.doi.org/10.1177/0022219411410042

Chew, A. L. (2007). *Developmental and interpretive manual for the Lollipop Test: A Diagnostic Screening Test of School Readiness-III*. Atlanta, GA: Humanics Learning.

Chew, A. L., & Morris, J. D. (1984). Validation of the lollipop test: A diagnostic screening test of school readiness. *Educational and Psychological Measurement, 44,* 987–991. http://dx.doi.org/10.1177/0013164484444022

Chew, A. L., & Morris, J. D. (1987). Investigation of the lollipop test as a pre-kindergarten screening instrument. *Educational and Psychological Measurement, 47,* 467–471. http://dx.doi.org/10.1177/0013164487472019

Crain-Thoreson, C., & Dale, P. S. (1992). Do early talkers become early readers? Linguistic precocity, preschool language, and emergent literacy. *Developmental Psychology, 28,* 421–429. http://dx.doi.org/10.1037/0012-1649.28.3.421

Cristofaro, T. N., & Tamis-LeMonda, C. S. (2011). Mother–child conversations at 36 months and at pre-kindergarten: Relations to children's school readiness. *Journal of Early Childhood Literacy, 12,* 68–97. http://dx.doi.org/10.1177/1468798411416879

Dale, P. S., & Fenson, L. (1996). Lexical development norms for young children. *Behavior Research Methods, Instruments, & Computers, 28,* 125–127. http://dx.doi.org/10.3758/BF03203646

DeAnda, S., Bosch, L., Poulin-Dubois, D., Zesiger, P., & Friend, M. (2016). The language exposure assessment tool: Quantifying language exposure in infants and children. *Journal of Speech, Language, and Hearing Research, 59,* 1346–1356. http://dx.doi.org/10.1044/2016_JSLHR-L-15-0234

De Houwer, A. (2009). *An introduction to bilingual development*. Bristol, UK: Multilingual Matters. Retrieved from https://books.google.com/books?hl=en&lr=&id=R0-SY0ryj0oC&oi

De Houwer, A., Bornstein, M. H., & Putnick, D. L. (2014). A bilingual–monolingual comparison of young children's vocabulary size: Evidence from comprehension and production. *Applied Psycholinguistics, 35,* 1189–1211. http://dx.doi.org/10.1017/S0142716412000744

Dickinson, D. K., Golinkoff, R. M., & Hirsh-Pasek, K. (2010). Speaking out for language: Why language is central to reading development. *Educational Researcher, 39,* 305–310. http://dx.doi.org/10.3102/0013189X10370204

Duff, F. J., Reen, G., Plunkett, K., & Nation, K. (2015). Do infant vocabulary skills predict school-age language and literacy outcomes? *Journal of Child Psychology and Psychiatry, 56,* 848–856. http://dx.doi.org/10.1111/jcpp.12378

Dunn, L. M., & Dunn, L. M. (1997). *PPVT-III: Peabody picture vocabulary test*. Circle pines, MN: American Guidance Service.

Dunn, L. M., Dunn, L. M., & Thériault-Whalen, C. M. (1993). *Échelle de Vocabulaire en Images Peabody: Série de Planches* [Peabody Picture Vocabulary Scale: Series of Stages]. Toronto, Ontario, Canada: Psychcorp.

Eno, L., & Woehlke, P. (1995). Use of the Lollipop Test as a predictor of California achievement test scores in kindergarten and transitional first-grade status. *Psychological Reports, 76,* 145–146. http://dx.doi.org/10.2466/pr0.1995.76.1.145

Eriksson, M., Marschik, P. B., Tulviste, T., Almgren, M., Pérez Pereira, M., Wehberg, S., . . . Gallego, C. (2012). Differences between girls and boys in emerging language skills: Evidence from 10 language communities. *British Journal of Developmental Psychology, 30,* 326–343. http://dx.doi.org/10.1111/j.2044-835X.2011.02042.x

Faul, F., Erdfelder, E., Buchner, A., & Lang, A. G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods, 41,* 1149–1160. http://dx.doi.org/10.3758/BRM.41.4.1149

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

Fenson, L., Dale, P. S., Reznick, J. S., Bates, E., Thal, D. J., Pethick, S. J., & Stiles, J. (1994). Variability in early communicative development. *Monographs of the Society for Research in Child Development, 59,* 1–185. http://dx.doi.org/10.2307/1166093

Fenson, L., & Dale, P. S., Reznick, J. S., Thal, D., Bates, E., Hartung, J., Reilly, J. (2007). *MacArthur communicative development inventories: User's guide and technical manual*. San Diego, CA: Singular Publishing Group.

Fernald, A., & Marchman, V. A. (2012). Individual differences in lexical processing at 18 months predict vocabulary growth in typically developing and late-talking toddlers. *Child Development, 83,* 203–222. http://dx.doi.org/10.1111/j.1467-8624.2011.01692.x

Fernald, A., Perfors, A., & Marchman, V. A. (2006). Picking up speed in understanding: Speech processing efficiency and vocabulary growth across the 2nd year. *Developmental Psychology, 42,* 98–116. http://dx.doi.org/10.1037/0012-1649.42.1.98

Forget-Dubois, N., Dionne, G., Lemelin, J. P., Pérusse, D., Tremblay, R. E., & Boivin, M. (2009). Early child language mediates the relation between home environment and school readiness. *Child Development, 80,* 736–749. http://dx.doi.org/10.1111/j.1467-8624.2009.01294.x

Frank, I., Poulin-Dubois, D., & Trudeau, N. (1997). *Inventaires MacArthur du Développement de la Communication: Mots et Énoncés*. Montreal, Quebec, Canada: Concordia University.

Friend, M., & Keplinger, M. (2003). An infant-based assessment of early lexicon acquisition. *Behavior Research Methods, Instruments, & Computers, 35,* 302–309. http://dx.doi.org/10.3758/BF03202556

Friend, M., & Keplinger, M. (2008). Reliability and validity of the computerized comprehension task (CCT): Data from American English and Mexican Spanish infants. *Journal of Child Language, 35,* 77–98. http://dx.doi.org/10.1017/S0305000907008264

Friend, M., Schmitt, S. A., & Simpson, A. M. (2012). Evaluating the predictive validity of the computerized comprehension task: Comprehension predicts production. *Developmental Psychology, 48,* 136–148. http://dx.doi.org/10.1037/a0025511

Friend, M., & Zesiger, P. (2011). A systematic replication of the psychometric properties of the CCT in three languages: English, Spanish, and French. *Enfance, 3,* 329–344. http://dx.doi.org/10.4074/S0013754511003053

Gardner-Neblett, N., & Iruka, I. U. (2015). Oral narrative skills: Explaining the language-emergent literacy link by race/ethnicity and SES. *Developmental Psychology, 51,* 889–904. http://dx.doi.org/10.1037/a0039274

Hadley, E. B., Dickinson, D. K., Hirsh-Pasek, K., Golinkoff, R. M., & Nesbitt, K. T. (2015). Examining the acquisition of vocabulary knowledge depth among preschool students. *Reading Research Quarterly, 51,* 181–198. http://dx.doi.org/10.1002/rrq.130

Hamilton, A., Plunkett, K., & Schafer, G. (2000). Infant vocabulary development assessed with a British communicative development inventory. *Journal of Child Language, 27,* 689–705. http://dx.doi.org/10.1017/S0305000900004414

Hendrickson, K., Mitsven, S., Poulin-Dubois, D., Zesiger, P., & Friend, M. (2015). Looking and touching: What extant approaches reveal about the structure of early word knowledge. *Developmental Science, 18,* 723–735. http://dx.doi.org/10.1111/desc.12250

Hoff, E. (2013). Interpreting the early language trajectories of children from low-SES and language minority homes: Implications for closing achievement gaps. *Developmental Psychology, 49,* 4–14. http://dx.doi.org/10.1037/a0027238

Hurtado, N., Marchman, V. A., & Fernald, A. (2007). Spoken word recognition by Latino children learning Spanish as their first language. *Journal of Child Language, 34,* 227–249. http://dx.doi.org/10.1017/S0305000906007896

Johnson, J. W. (2000). A heuristic method for estimating the relative weight of predictor variables in multiple regression. *Multivariate Behavioral Research, 35,* 1–19. http://dx.doi.org/10.1207/S15327906MBR3501_1

Judd, C. M., & Kenny, D. A. (1981). Process analysis: Estimating mediation in treatment evaluations. *Evaluation Review, 5,* 602–619. http://dx.doi.org/10.1177/0193841X8100500502

Justice, L. M., & Ezell, H. K. (2004). Print referencing: An emergent literacy enhancement strategy and its clinical applications. *Language, Speech, and Hearing Services in Schools, 35,* 185–193. http://dx.doi.org/10.1044/0161-1461(2004/018)

Kern, S. (2007). Lexicon development in French-speaking infants. *First Language, 27,* 227–250. http://dx.doi.org/10.1177/0142723706075789

Kern, S. (2010). Les premiers mots du jeune enfant français: Analyse quantitative et qualitative du vocabulaire réceptif et productif des deux premières années de vie [The first words of the young French child: Quantitative and qualitative analysis of the receptive and productive vocabulary of the first two years of life]. *Rééducation orthophonique, 244,* 149–165.

Kern, S., & Gayraud, F. (2010). *L'inventaire français du développement communicatif* [French inventories of communicative development]. Grenoble, France: Editions La Cigale.

Kim, S., Im, H., & Kwon, K. A. (2015). The role of home literacy environment in toddlerhood in development of vocabulary and decoding skills. *Child and Youth Care Forum, 44,* 835–852. http://dx.doi.org/10.1007/s10566-015-9309-y

Koponen, T., Aunola, K., Ahonen, T., & Nurmi, J. E. (2007). Cognitive predictors of single-digit and procedural calculation skills and their covariation with reading skill. *Journal of Experimental Child Psychology, 97,* 220–241. http://dx.doi.org/10.1016/j.jecp.2007.03.001

Law, J., & Roy, P. (2008). Parental report of infant language skills: A review of the development and application of the Communicative Development Inventories. *Child and Adolescent Mental Health, 13,* 198–206. http://dx.doi.org/10.1111/j.1475-3588.2008.00503.x

Law, J., Rush, R., Parsons, S., & Schoon, I. (2013). The relationship between gender, receptive vocabulary, and literacy from school entry through to adulthood. *International Journal of Speech-Language Pathology, 15,* 407–415. http://dx.doi.org/10.3109/17549507.2012.721897

Legacy, J., Zesiger, P., Friend, M., & Poulin-Dubois, D. (2016). Vocabulary size, translation equivalents, and efficiency in word recognition in very young bilinguals. *Journal of Child Language, 43,* 760–783. http://dx.doi.org/10.1017/S0305000915000252

Legacy, J., Zesiger, P., Friend, M., & Poulin-Dubois, D. (2018). Vocabulary size and speed of word recognition in very young French-English bilinguals: A longitudinal study. *Bilingualism: Language and Cognition, 21,* 137–149. http://dx.doi.org/10.1017/S1366728916000833

Lemelin, J.-P., Boivin, M., Forget-Dubois, N., Dionne, G., Séguin, J. R., Brendgen, M., . . . Pérusse, D. (2007). The genetic-environmental etiology of cognitive school readiness and later academic achievement in early childhood. *Child Development, 78,* 1855–1869. http://dx.doi.org/10.1111/j.1467-8624.2007.01103.x

Lonigan, C. J., Burgess, S. R., Anthony, J. L., & Barker, T. A. (1998). Development of phonological sensitivity in 2-to 5-year-old children. *Journal of Educational Psychology, 90,* 294–311. http://dx.doi.org/10.1037/0022-0663.90.2.294

Lust, B., Flynn, S., Blume, M., Park, S. W., Kang, C., Yang, S., & Kim, A. Y. (2016). Assessing child bilingualism: Direct assessment of bilingual syntax amends caretaker report. *The International Journal of Bilingualism, 20,* 153–172. http://dx.doi.org/10.1177/1367006914547661

MacKinnon, D. P., Lockwood, C. M., Hoffman, J. M., West, S. G., & Sheets, V. (2002). A comparison of methods to test mediation and other intervening variable effects. *Psychological Methods, 7,* 83–104. http://dx.doi.org/10.1037/1082-989X.7.1.83

Marchman, V. A., & Fernald, A. (2008). Speed of word recognition and vocabulary knowledge in infancy predict cognitive and language outcomes in later childhood. *Developmental Science, 11,* F9–F16. http://dx.doi.org/10.1111/j.1467-7687.2008.00671.x

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

Marchman, V. A., Fernald, A., & Hurtado, N. (2010). How vocabulary size in two languages relates to efficiency in spoken word recognition by young Spanish-English bilinguals. *Journal of Child Language, 37,* 817–840. http://dx.doi.org/10.1017/S0305000909990055

McMurray, B., Horst, J. S., & Samuelson, L. K. (2012). Word learning emerges from the interaction of online referent selection and slow associative learning. *Psychological Review, 119,* 831–877. http://dx.doi.org/10.1037/a0029872

Milburn, T. F., Hipfner-Boucher, K., Weitzman, E., Greenberg, J., Pelletier, J., & Girolametto, L. (2016). Cognitive, linguistic and print-related predictors of preschool children's word spelling and name writing. *Journal of Early Childhood Literacy, 17,* 111–136. http://dx.doi.org/10.1177/1468798415624482

Mitchell, A. M., & Brady, S. A. (2013). The effect of vocabulary knowledge on novel word identification. *Annals of Dyslexia, 63,* 201–216. http://dx.doi.org/10.1007/s11881-013-0080-1

Mix, K. S. (2009). How Spencer made number: First uses of the number words. *Journal of Experimental Child Psychology, 102,* 427–444. http://dx.doi.org/10.1016/j.jecp.2008.11.003

Morgan, P. L., Farkas, G., Hillemeier, M. M., Hammer, C. S., & Maczuga, S. (2015). 24-month-old children with larger oral vocabularies display greater academic and behavioral functioning at kindergarten entry. *Child Development, 86,* 1351–1370. http://dx.doi.org/10.1111/cdev.12398

NICHD Early Child Care Research Network. (2005). Pathways to reading: The role of oral language in the transition to reading. *Developmental Psychology, 41,* 428–442. http://dx.doi.org/10.1037/0012-1649.41.2.428

Ouellette, G. P. (2006). What's meaning got to do with it: The role of vocabulary in word reading and reading comprehension. *Journal of Educational Psychology, 98,* 554–556. http://dx.doi.org/10.1037/0022-0663.98.3.554

Perfetti, C. (2007). Reading ability: Lexical quality to comprehension. *Scientific Studies of Reading, 11,* 357–383. http://dx.doi.org/10.1080/10888430701530730

Perfetti, C. A., & Hart, L. (2001). The lexical bases of comprehension skill. In D. S. Gorfien (Ed.), *On the consequences of meaning selection: Perspectives on resolving lexical ambiguity* (pp. 67–86). Washington, DC: American Psychological Association. http://dx.doi.org/10.1037/10459-004

Perfetti, C., & Stafura, J. (2014). Word knowledge in a theory of reading comprehension. *Scientific Studies of Reading, 18,* 22–37. http://dx.doi.org/10.1080/10888438.2013.827687

Poulin-Dubois, D., Bialystok, E., Blaye, A., Polonia, A., & Yott, J. (2013). Lexical access and vocabulary development in very young bilinguals. *The International Journal of Bilingualism, 17,* 57–70. http://dx.doi.org/10.1177/1367006911431198

Quinn, J. M., Wagner, R. K., Petscher, Y., & Lopez, D. (2015). Developmental relations between vocabulary knowledge and reading comprehension: A latent change score modeling study. *Child Development, 86,* 159–175. http://dx.doi.org/10.1111/cdev.12292

R Development Core Team. (2008). *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing.

Reilly, S., Wake, M., Ukoumunne, O. C., Bavin, E., Prior, M., Cini, E., . . . Bretherton, L. (2010). Predicting language outcomes at 4 years of age: Findings from early language in Victoria Study. *Pediatrics, 126,* e1530–e1537. http://dx.doi.org/10.1542/peds.2010-0254

Schmitt, N. (2014). Size and depth of vocabulary knowledge: What the research shows. *Language Learning, 64,* 913–951. http://dx.doi.org/10.1111/lang.12077

Sheng, L., Lu, Y., & Gollan, T. H. (2014). Assessing language dominance in Mandarin–English bilinguals: Convergence and divergence between subjective and objective measures. *Bilingualism: Language and Cognition, 17,* 364–383.

Smith, L., & Yu, C. (2008). Infants rapidly learn word-referent mappings via cross-situational statistics. *Cognition, 106,* 1558–1568. http://dx.doi.org/10.1016/j.cognition.2007.06.010

Sobel, M. E. (1982). Asymptotic confidence intervals for indirect effects in structural equation models. *Sociological Methodology, 13,* 290–312. http://dx.doi.org/10.2307/270723

Statistics Canada. (2016). *Language highlights tables, 2016 Census*. Retrieved from http://www12.statcan.gc.ca/census-recensement/2016/dp-pd/hlt-fst/lang/Table.cfm?Lang=E&T=21&Geo=00&SP=1&view=1&age=4

Stoel-Gammon, C. (1987). Phonological skills of 2-year-olds. *Language, Speech, and Hearing Services in Schools, 18,* 323–329. http://dx.doi.org/10.1044/0161-1461.1804.323

Storch, S. A., & Whitehurst, G. J. (2002). Oral language and code-related precursors to reading: Evidence from a longitudinal structural model. *Developmental Psychology, 38,* 934–947. http://dx.doi.org/10.1037/0012-1649.38.6.934

Suanda, S. H., Mugwanya, N., & Namy, L. L. (2014). Cross-situational statistical word learning in young children. *Journal of Experimental Child Psychology, 126,* 395–411. http://dx.doi.org/10.1016/j.jecp.2014.06.003

Sulzby, E., & Teale, W. H. (1985). Writing development in early childhood. *Educational Horizons, 64,* 8–12.

Tonidandel, S., & LeBreton, J. M. (2014). RWA-Web—A free, comprehensive, web-based, and user-friendly tool for relative weight analysis. *Journal of Business and Psychology, 30,* 207–216. http://dx.doi.org/10.1007/s10869-014-9351-z

Tonidandel, S., Lebreton, J. M., & Johnson, J. W. (2009). Determining the statistical significance of relative weights. *Psychological Methods, 14,* 387–399. http://dx.doi.org/10.1037/a0017735

Trudeau, N., Aktouf, K., Boudreault, M., & Breault, C. (2008). *Les Inventaires MacArthur du développement de la communication: Mots et gestes* [MacArthur Inventories of the Development of communication: words and gestures]. Unpublished Manual, School of Speech Therapy and Audiology, University of Montreal, Montréal, Québec, Canada.

United States Census Bureau. (2015). *Detailed languages spoken at home and ability to speak English for the population 5 years and over: 2009–2013*. Retrieved from http://www.census.gov/data/tables/2013/demo/2009-2013-lang-tables.html

Whitehurst, G. J., & Lonigan, C. J. (1998). Child development and emergent literacy. *Child Development, 69,* 848–872. http://dx.doi.org/10.1111/j.1467-8624.1998.tb06247.x

Yu, C., & Smith, L. B. (2012). Modeling cross-situational word-referent learning: Prior questions. *Psychological Review, 119,* 21–39. http://dx.doi.org/10.1037/a0026182

Zimmerman, I. L., Steiner, V. G., & Pond, R. E. (2011). *PLS-5: Preschool Language Scale-5*. San Antonio, TX: Psychological Corporation.

Received February 6, 2017
Revision received October 30, 2017
Accepted December 31, 2017 ■

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

This document is copyrighted by the American Psychological Association or one of its allied publishers.
This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

Correction to Friend et al. (2018)

In the article "A Cross-Language Study of Decontextualized Vocabulary Comprehension in Toddlerhood and Kindergarten Readiness," by Margaret Friend, Erin Smolak, Yushuang Liu, Diane Poulin-Duboisand, and Pascal Zesiger (*Developmental Psychology*, Advance online publication. April 5, 2018. http://dx.doi.org/10.1037/dev0000514), the reference for Legacy, Zesiger, Friend, & Poulin-Dubois (2016) should be Legacy, Zesiger, Friend, & Poulin-Dubois (2018). The correct reference for the article is listed below:

Legacy, J., Zesiger, P., Friend, M., & Poulin-Dubois, D. (2018). Vocabulary size and speed of word recognition in very young French-English bilinguals: A longitudinal study. *Bilingualism: Language and Cognition, 21*, 137–149. https://doi.org/10.1017/S1366728916000833.

All versions of this article have been corrected.

http://dx.doi.org/10.1037/dev0000590