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Biliteracy acquisition in Kannada and English: A developmental study

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This study investigated the contribution of decoding and language comprehension sub-skills to Kannada and English biliteracy development over three years in multilingual students in urban low-income communities in one large city in India. Syllabic awareness, phonemic awareness and decoding skills were measured in Grades 3–5 (Time 1), and participants were followed to Grades 6–8 (Time 2), when their oral language comprehension and reading comprehension skills were tested. Hierarchical regression results revealed that: (1) both syllabic and phonemic awareness predicted Kannada decoding scores; however, only phonemic awareness predicted English decoding scores; (2) decoding ability from Time 1 and language comprehension skills from Time 2 made unique contributions to reading comprehension skills at Time 2 in both languages; (3) there were significant cross-linguistic relationships between corresponding reading sub-skills at both times; and (4) there was an independent contribution of Kannada decoding to English decoding at Time 1; however, the contribution of Kannada reading comprehension to English reading comprehension at Time 2 was not direct. The theoretical and pedagogical implications of these findings for alphasyllabic-alphabetic biliteracy development are discussed.

Keywords: Transfer; Kannada; Alphasyllabary; Comprehension.

There is increasing attention being given to understanding the process of reading development in diverse learners, including alphasyllabic (e.g., Cho & McBride-Chang, 2005; Nag & Snowling, 2012), morphosyllabic (e.g., Kuo & Anderson, 2006; McBride-Chang, 2004), syllabic monolingual learners (e.g., Fletcher-Flinn, Thompson, Yamada, & Naka, 2011), morphosyllabic-alphabetic (e.g., Wang, Perfetti, & Liu, 2005; Wang, Yang, & Cheng, 2009) and alphasyllabic-alphabetic bilingual learners (e.g., Kim, 2009; Reddy & Koda, 2013). Building on this emerging literature, this study investigated the contributions of decoding and language comprehension sub-skills in alphasyllabic Kannada and alphabetic English biliteracy development over the span of three years in multilingual students in low-income urban communities in Bangalore, India.

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According to the Simple View of Reading (SVR), two main competencies—decoding ability and linguistic comprehension—are required for reading comprehension competence (Gough & Tunmer, 1986; Hoover & Gough, 1990). While each of these skills makes independent contributions to reading comprehension in the early grades (Kendeou, van den Broek, White, & Lynch, 2009), the relative contribution of decoding skills is higher at the foundational stages of reading, whereas language comprehension sub-skills become increasingly more important as decoding reaches sufficient levels of fluency (Byrne, Freebody, & Gates, 1992; Florit & Cain, 2011; Hoover & Gough, 1990; Sticht & James, 1984; Tilstra, McMaster, van den Broek, Kendeou, & Rapp, 2009). These findings are in line with the phase theories of reading which posit that foundational reading sub-skills are prerequisites of later reading ability (e.g., Chall, 1996). Longitudinal research has also validated that early literacy sub-skills are strong predictors of later reading performance, including, for instance, phonological awareness and letter knowledge predicting decoding ability several months later (Cardoso-Martins & Pennington, 2004; Lonigan, Burgess, & Anthony, 2000; Scarborough, 1998; Wagner et al., 1997), and decoding sub-skills and linguistic competencies, such as vocabulary and grammatical knowledge, significantly predicting later reading comprehension skills in alphabetic languages (Aarnoutse, van Leeuwe, Voeten, & Oud, 2001; Muter, Hulme, Snowling, & Stevenson, 2004; Storch & Whitehurst, 2002). The consensus from monolingual studies suggests that reading comprehension is a multidimensional skill, in which decoding capacity and language comprehension skills are both critical; and, importantly, that the initial acquisition of the code depends heavily on grapheme-phoneme mapping ability, but when decoding fluency is achieved, there is a stronger reliance on language comprehension ability to support reading comprehension.

The notion that reading is jointly explained by a spoken language and its writing system holds true regardless of the language or writing system (Perfetti, 2003). In fact, the SVR has been tested in various languages, and it has been established that listening comprehension and word recognition together account for approximately half the variance in reading comprehension in French (Megherbi, Seigneuric, & Ehrlich, 2006), Norwegian (Høien-Tengesdal, & Høien, 2012), Spanish and Chinese (Joshi, Tao, Aaron, & Quiroz, 2012). Additionally, the SVR also has been shown to be applicable among bilinguals (Joshi, Padakannaya, & Nishanimath, 2010).

Despite the SVR's manifestation in various languages, the encoding mechanisms of various writing systems differ leading to varied decoding developmental trajectories across languages (Lei et al., 2011; Nag, 2007; Perfetti, 2003). After conducting a meta-analysis of SVR studies, Florit and Cain (2011) concluded that "the relative influence of decoding and linguistic comprehension on reading comprehension is different for readers of different types of orthography during the course of early reading development" (p. 553). A number of studies have begun to highlight the different processing demands required to successfully learn how to read alphasyllabic scripts. For example, both syllabic and phonemic processing ability are required for early reading development, reflecting the hybrid syllabic and alphabetic nature of the script (Cho & McBride-Chang, 2005; Kim & Petscher, 2011; Nag & Snowling, 2011, 2012; Reddy & Koda, 2013; Vaid & Gupta, 2002; Vasanta, 2004; Winskel & Iemwanthong, 2010). Another important difference is that relative to alphabetic writing systems, a greater number of syllabographs have to be mastered in alphasyllabaries, and thus, the development of fluent decoding takes until grade 4 or 5 in Kannada speakers as opposed to grade 3 for English speakers (Nag, 2007; Tewari, Nair, & Krishnan, 2011). A third point of divergence between alphabetic and alphasyllabic scripts is that the latter is characterised by visual complexity and non-linearity, which increases difficulty of segmenting syllabographs, and in turn decoding ability (Kandhadai & Sproat, 2010; Kim & Davis, 2004). Such visual complexity of the

diacritic ligaturing rules of alphasyllabaries significantly influences Kannada dictation (Nag, Treiman, & Snowling, 2010) and reading ability (Nag & Snowling, 2011). In general, therefore, alphasyllabic reading studies illustrate that learners need to be able to manipulate both syllable and phoneme constituents within visually complex and non-linear syllabographs for successful decoding acquisition.

Turning from monolingual to bilingual reading development, an important difference emerges in the form of dual language involvement in biliteracy and L2 reading (Koda, 2005, 2008). According to the Transfer Facilitation Model (TFM), metalinguistic resources, sharpened through experiences with any one language become sharable with the second language to the extent that both languages call upon the same skill, and in turn these shared resources play a critical role in facilitating reading development in a new language (Koda, 2008). Studies have shown several manifestations of these cross-language influences, including the presence of significant correlations between language-neutral phonological awareness and morphological awareness, but not language-specific orthographic-awareness skills (Abu-Rabia & Siegel, 2003; Da Fontoura & Siegel 1995; Geva & Siegel, 2000; Gholamain & Geva, 1999; Verhoeven, 1994); significant and independent contributions made by L1 metalinguistic resources to L2 reading outcomes (Carlisle, Beeman, Davis, & Spharim, 1999; Gottardo, Yan, Siegel, & Wade-Wolley, 2001; Hancin-Bhatt & Nagy, 1994; Koda, 1998; Mumtaz & Humphreys, 2002; Wang, Perfetti, & Liu, 2005) and L1-induced procedural variations in L2 processing (Koda, 2000; Wang, Koda, & Perfetti, 2003).

Biliteracy research with alphasyllabic learners are rare, but a few Korean-English biliteracy studies have demonstrated stronger correlations between phonological awareness than orthographic knowledge, suggesting that the former is a language-independent skill that can be shared between the two languages and the latter requires the ability to manipulate the phonemic components within the syllable blocks in Hangul (Cho, Chiu, & McBride-Chang, 2011; Kim, 2009; Wang, Park, & Lee, 2006). Similarly, biliterate learners of Kannada and English display strong relationships between phonological awareness in both languages; however, given that Kannada *akshara* maps both syllabic and phonemic information in each syllabograph, whereas English maps only phonemic information, it is phonemic awareness that can be traced as the mediator of cross-linguistic resource sharing (Reddy & Koda, 2013).

Beyond the initial stages of learning to read, L2 reading comprehension studies have focused primarily on determining the relative roles of L1 reading ability versus L2 linguistic knowledge in explaining L2 reading comprehension (Alderson, 1984; Bernhardt & Kamil, 1995; Carrell, 1991; Lee & Schallert, 1997; Taillefer, 1996). Applying the componential view to L2 reading development, van Gelderen and colleagues demonstrated that L2 reading comprehension variation is explained by the joint contribution of L1 reading comprehension and L2 linguistic ability (van Gelderen et al., 2004; van Gelderen, Schoonen, Stoel, de Glopper, & Hulstijn, 2007).

Emanating from these theoretical contentions are complex patterns of interactions—both longitudinal and cross-linguistic—among decoding and comprehension sub-skills in biliteracy development. As noted, the SVR argues that reading comprehension is contingent on decoding and oral language skills; and the TFM posits that L1 reading skills transfer and facilitate the development of L2 reading. Within these frames, our primary objective in this study was to determine the relative contribution of decoding sub-skills and comprehension sub-skills in the development of alphasyllabic Kannada and alphabetic English biliteracy over time. While a relatively clear picture has been established on how monolingual reading develops over time, little is understood about how biliteracy development occurs over time; and even less is known about how this may play out in alphasyllabic-alphabetic learners. To address this gap, we ask three specific research questions:

1. Which sub-skills at Time 1 predict decoding, and at Time 2 predict reading comprehension, for each language, separately?
2. Are decoding and reading comprehension sub-skills related between Kannada and English?
3. Which English and Kannada sub-skills from Time 1 and Time 2 predict English reading comprehension at Time 2?

LANGUAGE, LITERACY AND EDUCATION IN URBAN SLUMS

A brief description of the language and literacy environment of the urban slums of Bangalore, India, is presented to provide context for the present study. India is a multilingual nation with 447 living languages, 75 of which are institutional and 22 of which are officially used by the states (Paul, Simons, & Fennig, 2013), and many schools and individuals use at least two languages on a daily basis (Annamalai, 2001). The nation's language-in-education policy, the Three Language Formula, states that all schoolgoing children are required to learn three languages by the end of secondary school (Department of Elementary Education and Literacy & Department of Secondary and Higher Education, 2005). Which languages are taught and their order of acquisition depends on the school, with private schools more likely to employ English as the medium of instruction, and subsequently introduce Hindi and another language; and government schools are more likely to employ the state's official regional language as the medium of instruction, followed by English and Hindi as later acquired languages (Annamalai, 2001; Vaish, 2008). In post-colonial India, like in many other emerging economies and developing countries, English language and literacy skills are related to higher socioeconomic mobility (Coleman, 2011; Euromonitor International, 2010), leading to a surge in demand for English-medium private schools in lower-income communities using English as a medium of instruction. Therefore, understanding what predicts English reading success remains a central concern to education stakeholders in the nation.

According to Bangalore's city council (Bruhat Bengaluru Mahanagara Palike), about a third of the city's population lives in urban slums, and this proportion is representative of several large cities across many emerging economies and developing world nations (Neuwirth, 2005). Exploratory analyses conducted by Reddy (2011) on the language and literacy environment of the same sample of participants in the present study found that all learners spoke a language other than Kannada at home (Telugu, Tamil or Urdu). Within the community, the primary language of wider communication was the regional language, Kannada. Due to the fact that families with various Mother Tongues lived in very close proximity to each other in these communities, participants also spoke and comprehended each other's "*mother tongues*" and Hindi, with varying degrees of proficiency. Yet, there were very limited print materials or print-related interactions and activities in the homes of these learners in any language, and even those materials that were available were mostly for decorative or religious purposes. Thus, exposure to literacy was largely limited to the formal instruction setting.

METHOD

Participants

Data were collected from 54 participants at Time 1, when they were ages 10–14 (Grades 3–5 equivalent), and again at Time 2 from 42 participants from the same sample who remained

in the study, when they were ages 13–16 (Grades 6–8 equivalent). At the time of data collection, all students were from the urban poor slum communities of Bangalore, India, and were attending a non-government organisation funded school, which had two campuses at Time 1 and three campuses at Time 2. The medium of instruction was Kannada, with English being taught as a second language from Grade 3, and Hindi being added as a third language in high school. In the elementary years, the learning and teaching materials and curriculum were created by the school and adopted both a phonics and whole word approach to teaching reading; however, at Time 2, the curriculum was aligned more consistently with the state-mandated textbooks and materials, while continuing to teach additional critical thinking and composition-writing skills.

Test instruments

All tasks were designed by the researcher or adapted from existing tests in order to maintain task parity to the extent that the two languages elicited similar processing demands. Given some of the inherent differences between the properties of Kannada and English, for instance, the level of phonological granularity that is encoded in each language's orthography, certain tasks were intended to shed light on cross-linguistic similarities and differences within the same psychological construct. In addition, due to the fact that Kannada was the primary literacy and English the second literacy, the Kannada tests were inherently more difficult than the English tests.

Time 1 measures

Deletion

Syllabic awareness and phonemic awareness were tested using a phonological deletion task. This task was utilised because the participants were older than those usually in a study of beginning reading. For the English test, based on Stahl and Murray's (1994) study, the participants were asked to say out loud a word after removing a phonological unit—either a syllable or a phoneme—from it. For example, they were asked to say /cricket/ without /cri/ or /face/ without /f/. A total of 25 items were given, with five syllable-level deletion items and 20 phoneme-level deletion items. For the Kannada deletion task as well there were syllable and phoneme deletion items; with 17 and 13 test items, respectively. The former included C+V diacritic units, CCV units and CVCV units; and the latter included C+schwa units, vowels, vowel diacritics and consonant diacritics. For example, learners were required to delete ಹ (he) from ಹೆಚ್ಚು (hecchu), meaning 'more', or ಮ (m + schwa) from ಮಗ (maga), meaning 'son'. In both languages, the unit to be deleted appeared in either word initial, medial or final positions. The unit to be deleted was always a single syllable or a single phoneme. Given the high frequency of poly-syllabic words in Kannada (Nag, 2007), all words were poly-syllabic; compared to the English test in which only the five syllable deletion items were poly-syllabic, and the remaining phonemic deletion items were monosyllabic. All words were selected from grade-appropriate textbooks, and included verbs, nouns and adjectives. There were six practice items (three syllable and three phoneme) in each language.

Decoding

In order to assess the ability to sound out printed words, learners were presented with real and pseudowords on flashcards and requested to name each one. The English tests consisted of 20 real words and 20 pseudowords from the Woodcock Reading Mastery test (Woodcock, 1987). All real words were monomorphemic. The Kannada test was

constructed with 15 real words and 15 pseudowords. Both real words and pseudo words included C + schwa, CV and CCV syllabographs within the words.

Non-verbal intelligence
Non-verbal intelligence was also measured utilising the Ravens Standard Progressive Matrices (Raven, Raven, & Court, 2000).

Time 2 measures

Reading comprehension
Reading comprehension tests comprised of four short passages in Kannada (of 250–350 words) and five short passages in English (of 100–150 words) with five multiple-choice questions each; two questions targeting retrieval of explicit information within one sentence of text, two targeting retrieval of explicit information across 2–3 adjacent sentences of text, and one question focusing on implicit integrated information extraction across the entire passage. Linguistic difficulty was controlled by ensuring that at least 80% of the vocabulary and grammatical structures that were included in the passages had either appeared in the textbook or had been taught before data collection.

Listening comprehension
Language comprehension ability was assessed with a listening comprehension test comprising of the same sub-constructs as the reading comprehension test in terms of multiple-choice questions and their targeted sub-skills. However, the passages were played on a CD player rather than written down; only the questions provided to them were in written form. The questions were also read out to the participants through the CD to ensure that the amount of literacy skills required to do the test was limited only to following along on the paper what answer choices were being read to them.

General procedure

All tests were administered in the school by the lead author during students' breaks and after-school hours. Testing occurred one-to-one with the participants in a quiet space in the school. There was no time limit for any of the tests. All participants conducted the test items in the same order; however, the languages and the constructs that they were tested on were counterbalanced across participants. As compensation for participation, students were given a small item of stationery during the first phase of the study and a gift card for a bookshop in the second phase of the study.

RESULTS AND DISCUSSION

The descriptive results for all variables, including Cronbach's alpha for test reliability scores, in both languages at both testing times are presented in Table 1, and correlations among all reading sub-skills are presented in Table 2.

Predicting reading outcomes at time 1 and time 2 in Kannada and English, separately

Our first question was concerned with which sub-skills predict decoding outcomes at Time 1, and reading comprehension outcomes at Time 2, for each language separately. In looking at Time 1 only, the correlations in Table 2 show that both syllable and phoneme awareness were related to decoding in Kannada; whereas only phonemic awareness related to English decoding. This finding mirrors the orthographic properties of each language,

TABLE 1
Means, standard deviations and reliability scores for all reading skills at both times

	Kannada						*English*					
	Points possible	*Max*	*Min*	*Mean (%)*	*SD (%)*	*Cronbach's α*	*Points possible*	*Max*	*Min*	*Mean (%)*	*SD (%)*	*Cronbach's α*
Time 1												
PA-Syll	17	17	11	15.64 (92.02)	1.46 (8.60)	.70	5	5	1	3.56 (71.90)	1.08 (21.67)	.67
PA- Ph	13	13	5	9.81 (75.46)	2.42 (18.63)	.75	20	20	2	10.07 (50.36)	4.67 (23.36)	.87
Dec	30	30	4	24.21 (80.71)	5.75 (19.16)	.90	40	35	1	13.76 (34.40)	10.17 (25.44)	.95
Time 2												
LC	20	19	7	11.98 (59.88)	3.29 (16.44)	.92	30	29	3	14.74 (49.13)	5.69 (18.96)	.83
RC	20	18	5	10.74 (53.69)	3.56 (17.81)	.72	25	23	1	11.19 (46.76)	5.65 (23.41)	.86

Note: PA-Syll = Syllabic Awareness; PA-ph = Phonemic Awareness; Dec = Decoding; LC = Listening Comprehension and RC = Reading Comprehension

TABLE 2
Bivariate intercorrelations of all reading measures at both times, within and across languages

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1. K PA-Syll (T_1)	-									
2. K PA-Ph (T_1)	.74***	-								
3. K Dec (T_1)	.60***	.43**	-							
4. K LC (T_2)	.41**	.24	.56***	-						
5. K RC (T_2)	.41**	.25	.71***	.68***	-					
6. E PA-Syll (T_1)	.34*	.23	.30	.28	.23	-				
7. E PA-Ph (T_1)	.38*	.52***	.29	.17	.29	.48**	-			
8. E Dec (T_1)	.45**	.41**	.51**	.41**	.53***	.21	.59***	-		
9. E LC (T_2)	.18	.19	.29	.46**	.67***	.22	.36*	.49**	-	
10. E RC (T_2)	.06	.22	.23	.43**	.56***	.06	.36*	.55***	.69***	-

Note. PA-Syll = Syllabic Awareness; PA-Ph = Phonemic Awareness; Dec = Decoding; LC = Listening Comprehension; RC = Reading Comprehension; K = Kannada; E = English; T_1 = Time 1 and T_2 = Time 2
*$p < .05$. **$p < .01$. ***$p < .001$.

wherein phonological information is encoded at syllabic and sub-syllabic levels within each symbol in alphasyllabic Kannada, and solely at the phonemic level in alphabetic English. We further conducted stepwise regressions to test the relative contributions of each phonological awareness sub-skill to decoding in Kannada. In all stepwise regression analyses, non-verbal intelligence was entered as a covariate at the first step. As seen in Table 3, it was found that when phonemic awareness was entered before syllabic awareness, both sub-skills were significant predictors of Kannada decoding; however, when the entry order was altered and syllabic awareness was entered before phonemic awareness, phonemic awareness did not explain any additional variance in Kannada decoding. This result suggests that both syllabic and sub-syllabic phonological manipulation ability relate to decoding scores in Kannada; but that phonemic awareness is subsumed within syllabic awareness. Thus, it can be argued that a learners' awareness of the phonemic sub-components within the syllabic *akshara* is significantly related to Kannada decoding ability; however, due to the visual and phonological prominence of the syllable in the orthography, phonemic awareness does not support decoding in Kannada more than the role of syllabic awareness. This finding corroborates recent alphasyllabic reading studies which point to a dual role of syllabic and sub-syllabic phonological manipulation ability

TABLE 3
Hierarchical regression models predicting Kannada decoding (time 1)

	R^2	ΔR^2	ΔF
Model 1			
Ravens	.05	.05	2.03
K PA-Ph (T_1)	.24	.19	9.14**
K PA-Syll (T_1)	.46	.22	14.92***
Model 2			
Ravens	.05	.05	2.03
K PA-Syll (T_1)	.46	.41	28.03***
K PA -Ph (T_1)	.46	.00	.17

Note. PA-Syll = Syllabic Awareness; PA-Ph = Phonemic Awareness; K = Kannada; T_1 = Time 1 and T_2 = Time 2
*$p < .05$. **$p < .01$. ***$p < .001$.

for successful decoding, while stressing the salience of the syllabic structure of the alphasyllabic writing system (e.g., Nag & Snowling, 2012).

In the second part of our first question, we examined which reading sub-skills predict reading comprehension ability over time within each language, by inputting decoding skills measured at Time 1 as well as listening comprehension skills measured at Time 2 into a stepwise hierarchical regression for each language separately. Tables 4 and 5 display these results, for Kannada and English, respectively. It is evident from these results that regardless of the entry order, both early decoding ability and concurrent language-comprehension skills make independent contributions to reading comprehension in both languages. This finding lends support to the main tenets of the SVR even in alphasyllabic languages, extending the findings from Joshi et al. (2012) who confirmed the importance of these two critical sub-skills for alphabetic Spanish and morphosyllabic Chinese. In addition, this finding reveals that even in biliteracy acquisition, decoding skills and language-comprehension skills independently underpin the process of reading comprehension in each language being acquired.

At the same time, most previous studies have shown a diminishing role of decoding skills, and an intensifying role of linguistic skills as the level of reading comprehension increases in monolingual readers (e.g., Tilstra et al., 2009), and in second-language readers

TABLE 4
Hierarchical regression models predicting Kannada reading comprehension (time 2)

	R^2	ΔR^2	ΔF
Model 1			
Ravens	.14	.14	6.23*
K Dec (T_1)	.52	.38	28.70***
K LC (T_2)	.61	.09	8.01**
Model 2			
Ravens	.14	.14	6.23*
K LC (T_2)	.45	.31	20.85***
K Dec (T_1)	.61	.15	14.04**

Note. Dec = Decoding; LC = Listening Comprehension; RC = Reading Comprehension; K = Kannada; T_1 = Time 1 and T_2 = Time 2

*$p < .05$. **$p < .01$. ***$p < .001$.

TABLE 5
Hierarchical regression models predicting English reading comprehension (time 2)

	R^2	ΔR^2	ΔF
Model 1			
Ravens	.13	.13	5.74*
E Dec (T_1)	.34	.21	11.97**
E LC (T_2)	.54	.20	15.64***
Model 2			
Ravens	.13	.13	5.74*
E LC (T_2)	.49	.35	25.47***
E Dec (T_1)	.54	.06	4.48*

Note. PA-Syll = Syllabic Awareness; PA-ph = Phonemic Awareness; Dec = Decoding; LC = Listening Comprehension; K = Kannada; E = English; T_1 = Time 1 and T_2 = Time 2

*$p < .05$. **$p < .01$. ***$p < .001$.

(e.g., Droop & Verhoeven, 2003). The fact that decoding ability remains a unique predictor of middle-school reading comprehension has potentially significant implications for alphasyllabic-alphabetic biliteracy development in limited resource environments. One possible explanation for a prolonged role of basic decoding into the middle-school years may be due to the extensiveness of the Kannada orthography, requiring learners to master a large set of symbols, including a series of complex diacritic ligaturing patterns (Nag, 2007; Nag & Snowling, 2012). It is also possible that limited print resources and print-related activities in the home, community and educational contexts of these children—and thus, the lack of input and opportunities to interact with text—results in a slower pace of acquisition of beginning reading skills when compared with learners from print-rich environments. Thirdly, it is also probable that due to the functionally multilingual context of the urban slums, oral language proficiency in both languages is not uniformly available to all learners, leading to difficulties in decoding even after multiple years of instruction. Further research is necessary to investigate the extent to which each of these explanations may be responsible for the extended role of decoding in reading comprehension in these learning environments; however, our findings do imply the importance of supporting foundational reading skills until individual variation is drastically reduced, and a vast majority of the students have achieved word reading fluency.

Relating corresponding sub-skills between Kannada and English at times 1 and 2

In our second question, we shifted our inquiry to cross-linguistic relationships, and asked whether the reading sub-skills are related between Kannada and English at both Time 1 and Time 2, specifically to understand what skills might be shared between the two languages over the biliteracy development period. Understanding these relationships allows us to hypothesise possible mechanisms of transfer facilitation in reading comprehension development over time, if cross-linguistic contributions are found. The bivariate correlations reported in Table 2 show strong significant correlations between all corresponding reading sub-skills in Kannada and English. This is in line with several biliteracy studies, which have established significant cross-linguistic relationships in reading competencies, especially metalinguistic skills, like phonological awareness (August & Shanahan, 2006; Koda & Reddy, 2008). It is important to note that the weakest cross-linguistic correlation was in syllable awareness, the only skill which is not similarly demanded in the decoding process in both languages. Although many facets of listening comprehension are also language specific such as vocabulary knowledge and grammar, the strong relationship between the two languages is consistent with the notion that there are also shared processes in language comprehension, such as the ability to make inferences, integrate information across lexical items and entire passages, and background knowledge.

Relative contributions of Kannada and English skills from time 1 and 2 to English RC

Our final question focused on the relative roles of English and Kannada skills from both Time 1 and Time 2 in explaining variance in English reading comprehension scores at Time 2. The correlations from our second research question support significant cross-linguistic relationships in all reading sub-skills that are similarly demanded in Kannada and English, including reading comprehension itself. To test the relative contributions of each of these sub-skills within and across languages, we present two hierarchical regression models in Table 6. The results from Model 1 show that Kannada reading comprehension makes a significant, independent contribution to English reading comprehension when

TABLE 6
Hierarchical regression models predicting English reading comprehension (time 2) using both English and Kannada predictors

	R^2	ΔR^2	ΔF
Model 1			
Ravens	.13	.13	5.74*
K RC (T_2)	.32	.19	10.07**
K Dec (T_1)	.38	.06	3.63
K LC (T_2)	.39	.01	.43
E Dec (T_1)	.53	.14	10.03**
E LC (T_2)	.59	.07	5.25*
Model 2			
Ravens	.13	.13	5.74*
E Dec (T_1)	.34	.21	11.97**
E LC (T_2)	.54	.20	15.64***
K RC (T_2)	.54	.00	.00
K Dec (T_1)	.59	.05	3.85
K LC (T_2)	.59	.00	.21

Note. Dec = Decoding; LC = Listening Comprehension; RC = Reading Comprehension; K = Kannada; E = English; T_1 = Time 1 and T_2 = Time 2
*$p < .05$. **$p < .01$. ***$p < .001$.

entered first, controlling for non-verbal intelligence. The results also indicate that the role played by Kannada decoding and Kannada listening comprehension in English reading comprehension is likely to be subsumed within the contribution of Kannada reading comprehension. Both English decoding skills and listening-comprehension skills remain independent predictors of English reading comprehension when entered after all Kannada reading sub-skills. In Model 2, the data show that English sub-skills are significant predictors of English reading comprehension; whereas Kannada reading sub-skills do not explain any variance in English reading comprehension above and beyond the language-specific skills. These data suggest that the role of Kannada reading comprehension is subsumed within the contribution made by English reading sub-skills.

According to the Transfer Facilitation Model, the path of transfer is through skills that are shared between the two languages, and thus not all sub-skills may uniformly and directly contribute to reading comprehension in the second language. Our findings indicate that Kannada decoding and listening-comprehension skills support Kannada reading comprehension, and that Kannada reading comprehension is a significant predictor of English reading comprehension. However, the finding that Kannada reading sub-skills do not predict any variance in English reading comprehension above and beyond the English reading sub-skills, suggests that the contribution of Kannada reading comprehension to English reading comprehension may be mediated by English reading sub-skills. Thus, we hypothesise that the mechanism of transfer facilitation at the reading comprehension stage may be more indirect, and dependent on target language linguistic ability, which is in sharp contrast to the decoding stages of biliteracy development.

Taken together, the results from question 3 indicate that both the Simple View of Reading and the Transfer Facilitation Model are applicable in this case of biliteracy development. Critically, the findings show that linguistically more demanding reading outcomes may require more language-specific fine-tuning to fully exploit previously acquired reading skills. As noted in the findings from the first question, there are more direct roles of Kannada phonemic awareness in English decoding skills at the earlier

form-to-form mapping stages of biliteracy development, but facilitation from transferred comprehension sub-skills may be strongly constrained by linguistic knowledge in the target language at the more advanced stages of biliteracy development.

CONCLUSION

As one of the first studies to investigate the development of alphasyllabic-alphabetic biliteracy over time, our findings shed light on the dynamic predictors of reading in Kannada and English. First, our results extend the findings of the Simple View of Reading to this case of biliteracy, with two main implications: alphasyllabic reading comprehension ability, like alphabetic and morphosyllabic reading comprehension ability (Joshi et al., 2012), is contingent on both foundational reading abilities, such as phonological awareness and decoding skills, and on present linguistic proficiency levels; and that there are similarities in the predictors of reading comprehension in both a primary and secondary literacy.

Second, this study supports the likelihood of transfer facilitation even at higher levels of reading development, extending the Transfer Facilitation Model to more advanced stages of biliteracy acquisition. The evidence suggests that there are strong cross-linguistic relationships between Kannada and English reading sub-skills, over time. Kannada reading skills played a significant, independent role in English reading skills at the beginning stages of learning to read; whereas within-language skills were independent predictors of reading comprehension at more advanced text comprehension stages. Importantly, however, there is evidence that the development of these target language predictors is likely to be predicted by reading comprehension ability in the first literacy. These findings clearly indicate that cross-linguistic effects in biliteracy development are not uniform across sub-skills, as well as across the stages of reading development, and that there are shifts in the predictors over time.

Pedagogically, the findings from this study suggest that it would serve students well if teachers focused initially on sharable resources in their stronger language, while also highlighting aspects of the alphasyllabic writing system that are most challenging for learners, such as mastering the phonemic diacritics within the syllabic cluster. A recent study has shown that when the sound structure of Kannada syllabographs was used to teach English letters and sounds, there was a significant improvement in decoding compared to the comparison group and the group that did not use the Kannada sounds to learn English words (Nishanimut, Johnston, Joshi, Thomas, & Padakannaya, in press). At the middle-school grades, it is most sensible for teachers to use the limited available class time enhancing vocabulary-learning skills and overall language comprehension through reading and listening activities, so as to support the development of reading skills in the target language and the linguistic proficiency required to trigger facilitation from transferred reading-comprehension skills.

We note some limitations to this study, the major one being the difficulty in matching the tasks in English and Kannada. It is also important to note that this study was conducted with a small sample, and only reports correlation data; therefore, future studies would benefit from uncovering possible causal impacts of primary literacy on secondary (and later) literacy acquisition, and also examining reading sub-skill relationships over time in a variety of different contexts and orthographies. While acknowledging these limitations, the results from the present study can help in using the structure and metalinguistic resources from the local languages to support English learning. Future studies like this are important

to widen our evidence base on several similar contexts of education across the developing world, where learners are acquiring biliteracy in environments that are print-scarce and characterised by multiple languages, including at least one local language and one post-colonial language.

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