

Factors Affecting the Speed of Word Retrieval in Children Learning English as a Foreign Language

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ABSTRACT

Vocabulary knowledge is not only about end products but also about the ability to access words efficiently. Within the context of foreign language learning, little is known about the influence of learners' characteristics on the ease with which children access L2 words in spoken production. In order to address this gap, we assessed the predictive effects of a range of learner variables (e.g. vocabulary knowledge, language proficiency, and cognitive ability) on the speed of L2 word retrieval. Thirty-nine Chinese learners of English as a foreign language (EFL) completed a picture naming task in English and a Chinese-to-English translation task. The participants' reaction times were analyzed using stepwise regression, the results of which demonstrated that L2 vocabulary size and learners' L1 lexical accessibility were significantly predictive of both naming and translation latencies. These results were discussed with reference to previous studies examining the determinants of lexical accessibility, with pedagogical implications advanced for current conceptualizations of EFL education to young children.

INTRODUCTION

When a child comes to know a word, he or she must store its semantic, phonological and orthographical representations, as well as associations between these representations. The child's stored knowledge needs to be accessed in the service of language comprehension and production. The speed with which a word is retrieved hinges on and reflects the child's ability to make use of its semantic-lexical knowledge. Thus, identifying the possible factors underlying children's lexical accessibility would likely help understand the sources of individual differences observed in language learners' performance.

In the second language (L2) literature a large body of research has examined the determinants of L2 speaking ability or proficiency (e.g. De Jong, Steinle, Florijn, Schoonen, & Hulstijn, 2013; Derwing, Munro, Thomson, & Rossiter, 2009; Riazantseva, 2001). Most of these studies have been conducted with adolescents and adults, whereas much less attention has been paid to primary-aged children, an L2 population of increasing importance around the world. Against this background, it is necessary to investigate L2, or more precisely EFL (English as a foreign language) children's emerging accessibility to already known words by assessing the relative contribution of several demographic and language-proficiency variables (e.g. L2 vocabulary size, L1 proficiency level, and residential areas) to their retrieval speed of L2 spoken words.

Two types of oral word production are common to L2 children: naming pictures that represent objects and entities, and translating individual words from one language into another. Pictures are thought of as symbols that approximate imagistic representations in the mind, and in this sense how children name pictures could provide insight into how they perform in communication. Bilingual language use also involves an ability to translate. Every bilingual has once engaged in translation, not to mention professional translators and interpreters. Additionally, translation is a pedagogical activity that often occurs in foreign language classes.

To sum up, the present study identified significant predictors of L2 lexical accessibility in picture naming and translation among EFL children, and advanced theoretical and practical implications for current conceptualizations of L2 learning and teaching within input-limited contexts.

LITERATURE REVIEW

Describing and defining EFL children

In the course of globalization, English has become an important world language. Many countries in the Asia-Pacific region have made English education compulsory at the primary level over the past decades. For example, in mainland China, English has been nationally recognised as a compulsory subject from the third grade onwards since September 2001 (Ministry of Education of China, 2001). Exact statistics on the number of Chinese EFL children are hard to come by, but the following figures present a rough picture. It was recently estimated that there were 379,253 primary-level Chinese teachers of English and 1,794,614 classes of third to sixth graders across the country (Ministry of Education of China, 2014). Conceivably, there must be a large population of children learning EFL outside

English-speaking countries; nevertheless, this Foreign Language (FL) population has hitherto been woefully underrepresented in the L2 literature.

Bilingual learners can be defined using different criteria (see Li, 2000, for a summary), such as language dominance (i.e. balanced vs. unbalanced), the sequence of acquisition (i.e. simultaneous vs. sequential), the onset age of L2 acquisition (i.e. early vs. late), and the preferential domain of language use (receptive vs. productive). According to these criteria, EFL children are a group of sequential bilingual beginners who use the first language (L1) dominantly in almost any setting and learn English as a foreign language through formal instruction. This population, when compared to their immersion counterparts, receives much less exposure to the target language, especially outside the classroom.

Process of spoken word production

Language speakers, regardless of age, constantly access their mental lexicons. Drawing on Levelt's blueprint for the speaker (1989), word production proceeds through conceptualization, grammatical encoding, articulation and self-monitoring. Research on spoken production has followed two main approaches: the study of speech errors (e.g. Poulisse & Bongaerts, 1994) and the measurement of production latencies (for a review, see Jiang, 2012).

The linguistic function of naming objects and entities develops early in young children (Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979). As a psycholinguistic tool, picture naming has been extensively used to define different stages of speech production and to uncover the mechanisms underlying this process (e.g. Glaser, 1992; Levelt et al., 1991; Potter, So, Eckardt, & Feldman, 1984). Picture naming is typically conducted in such a way that participants are presented with a series of pictures one by one, and as a picture appears on the computer screen, they name it as accurately and rapidly as possible. There are three main stages involved in picture naming: (1) object recognition and concept activation; (2) lexical selection and activation; and (3) response execution and production (Johnson, Paivio, & Clark, 1996). Additionally, picture naming is a common classroom activity, especially for young children who learn and recycle words with images and other visual aids.

Another way of examining spoken word production is through word-by-word translation. Any individual who has receptive and productive vocabulary knowledge of two languages is able to perform a kind of translation. As an experimental tool, translation is typically conducted in such a way that participants are presented with a series of stimulus words one by one, and as a word appears on the computer screen, they translate it into the target language as accurately and rapidly as possible. There are two directions of translation: forward translation (L1-to-L2) and backward translation (L2-to-L1). Given that the present study specifically addressed L2 lexical accessibility in production, only forward translation was examined. The stages involved in L1-to-L2 translation are similar to those in picture naming, except that translation starts with visual word recognition rather than object recognition (Snodgrass, 1993). Additionally, translation as a pedagogical tool has long been used in foreign language classrooms since the nineteenth century (Howatt, 1984; Richards & Rodgers, 2001), though it has had its ups and downs. Investigating translation illustrates how

such a classroom activity proceeds at the individual level.

Factors affecting spoken word production

A variety of factors are believed to affect the retrieval speed of spoken word production, as reviewed below.

L2 vocabulary knowledge and L2 proficiency

Vocabulary knowledge is a multi-dimensional construct, which incorporates size (or breadth, i.e. the number of words a learner knows), depth (i.e. how well a learner knows individual words) (Nation, 2001; Schmitt & Meara, 1997), and the automaticity with which words are accessed or processed during language use (Meara, 1996). The literature abounds with studies examining the correlation between the first two dimensions. For instance, Vermeer (2001) observed that two measures of size (i.e. receptive vocabulary and description tasks) and a depth measure (i.e. an association task) were strongly correlated among Dutch bilingual kindergarteners. Vermeer interpreted this result from a network perspective, that is, lexical elements in the mind are connected to each other, and conceivably the size and depth dimensions hinge on the same or similar underlying construct. Moreover, the dimension of depth was found to explain additional variance in Dutch children's reading comprehension ability beyond what was explained by the dimension of size (Schoonen & Verhallen, 1998). The study by Cremer and Schoonen (2013) showed that the speed of access explained more variance in reading comprehension beyond decoding and the availability of semantic knowledge.

Despite this research, there is a paucity of research examining the relationship between instructed L2 children's vocabulary knowledge and their speaking ability, which is understandable given that beginning learners have limited knowledge of productive words and limited practice of productive skills (but see Koizumi, 2005 for studies on L2 adolescents). This is also one of the reasons why we investigated the child participants' production of single words instead of running speech. The adult literature, however, has shown that vocabulary knowledge is crucial to spoken fluency (e.g. De Jong et al., 2013; Hilton, 2008). For example, De Jong *et al.* (2013) examined the relationship between L2 linguistic knowledge and spoken fluency among intermediate and advanced speakers of Dutch, demonstrating a strong correlation between the adults' vocabulary knowledge and their speaking rate (mean syllable times) ($r = -0.58$).

Vocabulary knowledge has been shown to be a robust indicator of language proficiency (Cummins, 2000). In effect, language proficiency likely affects the ease of access to individual words in spoken production. An obvious example is that L2 speakers have slower speech and articulation rates, longer pause times, and shorter runs than L1 speakers (Wiese, 1984). As shown in Riazantseva (2001), university-level Russian speakers with high English proficiency made shorter pauses than those with intermediate English proficiency. Note that child participants are clearly limited in producing spoken or written sentences, in which case the variable of L2 proficiency was defined by the children's receptive knowledge of English¹.

Despite the common assumption that vocabulary knowledge and language proficiency

are predictive of lexical accessibility in spoken production, few studies have empirically addressed this relationship, particularly with instructed FL children.

L1 proficiency and L1 lexical accessibility

The issue of cross-language influence has received much attention in the literature. According to the *developmental interdependence hypothesis* (DIH, Cummins & Swain, 1986), the development of L1 literacy goes hand in hand with that of L2 literacy. As argued by Cummins and Swain (1986, p. 87), ‘To the extent that instruction in Lx is effective in promoting proficiency in Lx, transfer of this proficiency to Ly will occur provided there is adequate exposure to Ly (either in school or environment) and adequate motivation to learn Ly.’ In explaining such a close relationship between L1 and L2 literacy, Geva and Ryan (1993) emphasized the important roles of common cognitive components and processes (e.g. working memory, executive control function, and self-regulation) in sustaining the development of both languages.

Empirically, cross-language associations have been demonstrated in examining adolescent and adult EFL learners’ reading and writing skills (e.g. Lee & Schallert, 1997; Sasaki & Hirose, 1996; Yamashita, 2002). Most relevant to the present study, Derwing et al. (2009) compared L1 and L2 spoken fluency over two years among Russian-and Ukrainian-and Mandarin-speaking adult immigrants to Canada. The result showed that L2 fluency was significantly and positively correlated with L1 fluency in the early stages of L2 exposure, although the correlation coefficient was higher in the Slavic learners ($r = .62$) than in the Mandarin learners ($r = .53$). Spoken fluency partially hinges on the speed of accessing individual words. It is therefore conceivable that L2 lexical accessibility is intertwined with L1 lexical accessibility. Note that the present study included both L1 proficiency and L1 lexical accessibility as predictors for the purpose of cross-validating L1 influence on the processing of L2 words.

Non-verbal ability

As a form of human’s mental abilities, intelligence (in particular reasoning ability) is fundamental to the development of language proficiency (Hulstijn, 2015). A classic view, represented by Piaget (1954), holds that children’s language development is contingent on the knowledge and understanding accumulated through cognitive development. Most of the empirical studies has demonstrated strong correlations between cognitive ability and different linguistic aspects in monolingual and bilingual learners (Andringa, Olsthoorn, Van Beuningen, Schoonen, & Hulstijn, 2012; Saklofske, Caravan, & Schwartz, 2000; Sasaki & Hirose, 1996; Verhoeven & Vermeer, 2009; Wechsler, 1999; but also see Oller, Kim, Choe, & Jarvis, 2001), indicating that performing reasonably well in most situations of language use is intricately associated with a relatively high degree of cognitive ability.

In the literature on L2 children, inconsistent results have been reached with regard to the relationship between cognitive ability and L2 proficiency. Verhoeven and Vermeer (2009) investigated the extent to which L2 overall proficiency was predicted by a wide range of cognitive and social-cultural predictors (e.g. rule discovery, parental education, and home

language use) among Turkish children (4 years old) of Dutch in Netherlands. The result showed that cognitive ability was the strongest predictor of L2 proficiency above and beyond other predictors. This result, however, has not been observed in Oller et al.'s (2001) study, in which Oller and colleagues examined 50 primary-aged Spanish children learning English in a bilingual school in Mexico City. The participants were tested on nonverbal IQ, English vocabulary, articulation and morphology. The children's non-verbal ability did not turn out to be significantly correlated with any measures of L2 proficiency. It should be acknowledged that these two studies are not directly comparable due to different research contexts and target populations. At the moment, it would be difficult to interpret these inconsistent results until more empirical studies are conducted to address the relationship between children's cognitive ability and L2 proficiency.

To sum up, the present study assessed the relative contribution of a range of learner variables to L2 lexical accessibility in spoken production among EFL children, a population of increasing importance but underrepresented in the L2 literature.

THE PRESENT STUDY

Research questions

The present study addressed the following questions:

1. What is the relationship between a range of learner variables and the retrieval speed of L2 words in spoken production?
2. What variable(s) best predict the retrieval speed of L2 words in spoken production?

Population and sample

The target population was primary-aged children learning EFL in public schools in Mainland China. With the release of *Guidelines for Vigorously Promoting the Teaching of English in Primary Schools* (Ministry of Education of China, 2001), English education was made compulsory from the 3rd grade onwards on a national scale.

The present sample consisted of thirty-nine 5th grade students ($M = 10.31$ years) who had learned English for two and a half years (on average, 120 minutes per week). The participants were selected using convenience sampling due to practical considerations. The sampling procedure is presented in Figure 1.

In advance of participating in the reaction-time-based experiments, a measure of nonverbal IQ (the Wechsler Abbreviated Scale of Intelligence test (WASI), matrix reasoning) and the Word Associates test (WAT) were administered to candidate participants for screening out those children with limited cognitive and linguistic abilities. Twenty-two children whose WASI or WAT scores were lower than three standard deviations below the mean were excluded from our study. Subsequently, picture naming and L1-to-L2 translation were found to be beyond 12 participants' ability to complete, reducing the sample size down to 39 (19 boys and 20 girls).

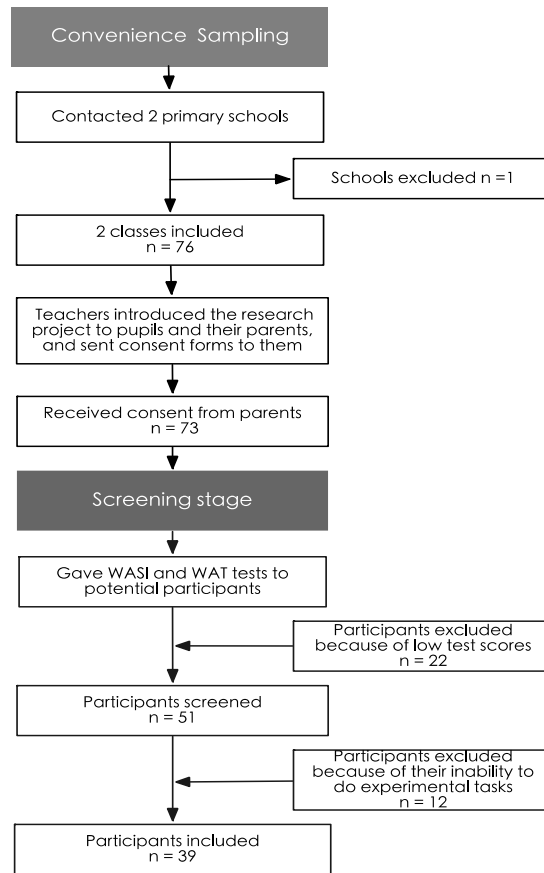


Figure 1. Sampling procedure of the present study

Reaction-time experiments

The experiment was run using the Superlab software (Cedrus Corporation, 2007). The participants completed picture naming and L1-to-L2 translation in a quiet room during scheduled school hours. They were seated individually at a comfortable distance from a MacBook computer screen (see Figure 2a). They read step-by-step written instructions in Chinese. They were instructed to produce response words as accurately and rapidly as possible. In order to ensure that each participant was clear about the experimental procedures, five practice trials preceded test trials.

Two stimulus blocks consisted of 104 words in total, depicting animals, nature, fruits and vegetables, body parts, colors, numbers, household objects, clothing, activity, and people. No words were repeated across stimulus conditions. These stimuli were from the course books that the participants had used at school². The participants performed picture naming on one block and Chinese-to-English translation on the other. As illustrated in Figure 2b, an experimental trial began with the presentation of a blank screen for 1500 milliseconds (ms), followed by a beep sound for 476 ms. As soon as a stimulus picture or Chinese word appeared on the screen, the participant was required to generate a response (e.g. banana). Once a response was produced, the experimenter initiated the next trial. The trials in each block were randomized. The participants were required to take a two-minute break between blocks to reduce the likelihood of fatigue.

Reaction time or response latency is defined as the duration between the presentation of a stimulus and the initiation of a vocal response. The participants' responses were recorded digitally using Audacity software 2.0.2 (<http://audacity.sourceforge.net>). As illustrated in Figure 2c, reaction times were calculated as the time difference between the end of a 'beep' sound and the onset of a stimulus. The first author and another researcher manually calculated reaction times for response words, and the calculations were compared against each other. Their inter-rater agreement, estimated with Pearson's correlation, was high ($r = .92$) and significant at 95% level. Any obvious differences (> 10.00 ms) were double-checked and then corrected.

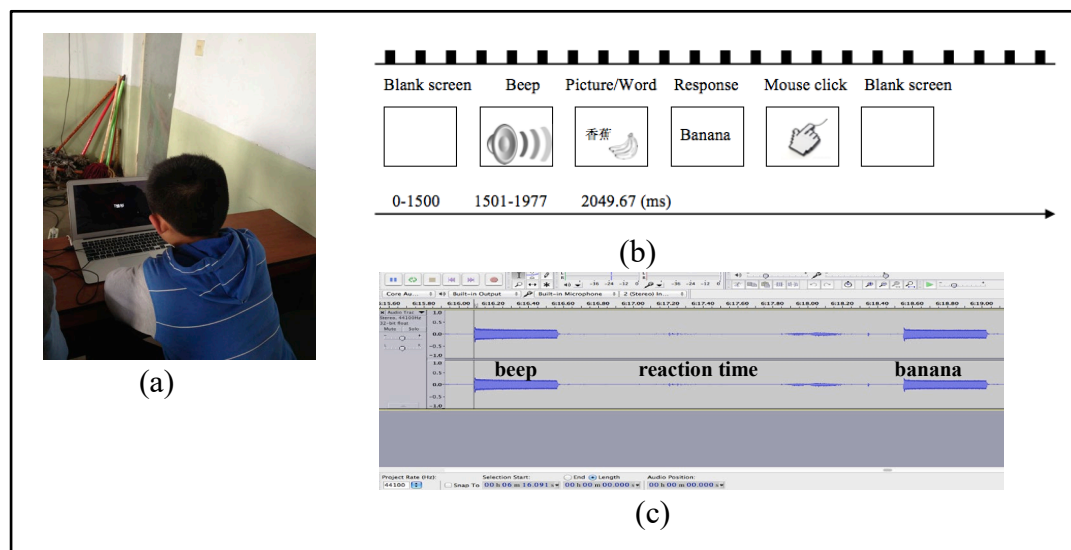


Figure 2. Experimental setup, components and waveforms of a trial

Measures of predictors

Predictors are normed as follows³.

1. Vocabulary size was assessed by a revised *X_Lex* test (adapted from Meara, 2005). The test words were based on the suggested vocabulary list appended to each lesson in the participants' course book. The words ranged from the 100-word level to the 500-word level, depending on the grade at which the participants had learned them. Each level contained 20 real words. In order to check the reliability of test takers' Yes responses to the real words (Meara, 1992), a total of 20 pseudo-words that sound or look like English words were also added to the test. The test words appeared on the computer screen one by one. The participants pressed Yes (i.e. a happy face) or No (i.e. an unhappy face) to indicate whether they knew each word's meaning. The participants were awarded 5 points for knowing a real word, and lost 25 points for giving a 'Yes' response to a pseudoword. The scoring method of *X_Lex* has been elaborated in Meara (1992). Additionally, the concurrent validity of the *X_Lex* test has been demonstrated by its reasonably good correlation with a multiple choice test included in the Cambridge First Certificate Examination (Meara, 1992). Learners'

performance on the Yes/No test format has been found to significantly predict their performance on the VLT (Vocabulary Levels Test) (Harrington, 2006).

2. Vocabulary depth was assessed by a revised *Word Associates* test (adapted from Read, 1993). How well a learner knows a word can be estimated (in part) by his or her knowledge of the word's paradigmatic, syntagmatic and analytical associates. A paradigmatic associate is a synonym, antonym, hypernym or hyponym for the test word; a syntagmatic relation rests on its strength of association (i.e., collocational features), that is, two words normally occur together; and an analytical associate involves the test word's dictionary definition. In total, this test consisted of 24 words (8 nouns, 8 adjective, and 8 verbs), and each word was followed by six choices: three associates and three distractors. The participants needed to select three choices as correct answers. In scoring, one point was awarded for each correct choice, with a full score of 72 for all test words.
3. The subset of *Matrix Reasoning of Wechsler Abbreviated Scale of Intelligence* (WASI, Wechsler, 1999) was used to assess the participants' non-verbal skills. The participant completed a missing section of a matrix by selecting the correct response option. A correct response received one point, with a maximum score of 32 for all test items. The participants' raw scores were totaled and then standardized according to the WASI manual.
4. Cambridge Young Learners English test (YEL, starters level) was administered to the participants. This test level was appropriate given the participants' English proficiency and hours of EFL training received. Two papers of the YEL test were used: (1) listening, and (2) reading and writing. The total scores of each paper are 20 and 25 respectively.
5. We administered picture naming in Chinese (30 stimuli) to assess the participants' accessibility of L1 lexical items. Thirty response words were piloted with 28 children who were comparable to the main study participants in terms of demographic characteristics. All test items were familiar to the pilot participants.
6. The participants' demographic and language background information were gathered through the student progress files to which the researcher had access, including (1) age; (2) gender; (3) residential areas (rural or urban); and (4) mid-term exam grades of English and Chinese courses, as indicative of the participants' English and Chinese proficiency.

Data screening

As a first step, the entire data set was screened for errors (both incorrect and inaccurate responses), omissions, and those participants with an error-omission rate higher than 20%. We also deleted the participant's latencies that were greater than 3 standard deviations beyond the mean or less than 350 ms. Note that the low and high cut-offs were set against different criteria, because some extremely short reaction times were still found to fall between -3.00 standard deviations and .00. This screening procedure led to a loss of 11.28%

and 11.50% of the data points in picture naming and in L1-to-L2 translation respectively, and these data were replaced by the means of each participant's reaction times.

RESULTS

Relations among predictors

Descriptive statistics of predictor and outcome variables are summarized in Table 1. Table 2 displays Pearson product-moment correlations among assessment scores. Vocabulary size and depth were significantly and positively correlated with English course grades, and with YLE reading and writing. Such high correlations corroborated the validity of the revised vocabulary tests. Also, there was a significant and positive correlation between English and Chinese course grades. None of the correlation coefficients exceeded .90, indicating the absence of multicollinearity and linearity.

Table 1: Descriptive statistics of predictor and outcome variables (n = 39)

Predictor Variable (Categorical)			Frequency		Percentage	
Demographic Information	Age	10 years	27		69.2	
		11 years	12		30.8	
	Gender	Male	19		48.7	
		Female	20		51.3	
	Living area	Urban	24		61.5	
		Rural	15		38.5	
Predictor Variable (Continuous)			M	SD	Min	Max
Assessment Scores	Vocabulary size (Max: 500)		202.08	48.66	115	305
	Vocabulary depth (Max: 72)		47.38	4.29	40	59
	WASI-III (MR) ¹		60.49	3.66	52	68
	English course grades (Max: 100)		89.46	4.54	82	100
	Chinese course grades (Max: 100)		93.00	2.73	86	97
	YLE (Reading and Writing) (Max: 25)		13.31	2.56	9	22
	YLE (Listening) (Max: 20)		15.41	3.42	7	19
	Chinese lexical accessibility (in ms)		1012.47	156.44	695.29	1314.31
Outcome Variable						
Naming and	Speed of picture naming		1803.73	276.35	1173.72	2382.00
Translation Speed	Speed of translation		1752.07	227.93	1195.71	2285.00

Notes: MR: matrix reasoning; WASI: Wechsler Abbreviated Scale of Intelligence; YLE: Cambridge Young Learners' English Test (starters).

¹: WASI scores were higher than its raw scores (i.e. 32) after being standardized.

Table 2: Pearson product-moment correlations among assessment scores (n = 39)

<i>Variable Name and Number</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>
1. Vocabulary size	1							
2. Vocabulary depth	.32	1						
3. WASI (MR)	.23	.24	1					
4. English course grades	.41*	.39*	-.03	1				
5. Chinese course grades	.24	.42**	.17	.49**	1			
6. YLE (Reading and Writing)	.50**	.17	.21	.33*	.28	1		
7. YLE (Listening)	.60**	.41**	.38*	.60**	.43**	.62**	1	
8. Chinese lexical accessibility	.06	.05	-.01	-.08	-.26	.02	-.12	1

Notes: MR: matrix reasoning; WASI: Wechsler Abbreviated Scale of Intelligence; YLE: Cambridge Young Learners' English Test (starters); * $p < .05$ (two-tailed), and ** $p < .01$ (two-tailed).

Relations between predictor and outcome variables

Table 3 summarizes the magnitude and direction of correlations between predictor variables and naming and translation latencies. The outcome variables are presented side by side for the convenience of comparison. The results showed that Chinese lexical accessibility, English vocabulary size, Chinese course grades, and living area were significantly correlated with the latency of picture naming, and that Chinese lexical accessibility, English vocabulary size, YLE reading and writing, and YLE listening were significantly correlated with the latency of L1-to-L2 translation. Clearly, Chinese lexical accessibility and English vocabulary size were significantly correlated with both naming and translation latencies.

Table 3: Correlations between predictor and outcome variables (n = 39)

<i>Predictor variables</i>	<i>Speed of picture naming</i>	<i>Speed of L1-to-L2 translation</i>
Gender	-.03	.08
Age	-.16	-.10
Living area	.32*	.19
Vocabulary size	-.40*	-.48**
Vocabulary depth	-.12	-.19
WASI-III (MR)	-.16	-.29
English course grades	-.20	-.23
Chinese course grades	-.41*	-.15
YLE (Reading and Writing)	-.31	-.36*
YLE (Listening)	-.29	-.36*
Chinese lexical accessibility	.48**	.31*

Notes: MR: matrix reasoning; WASI: Wechsler Abbreviated Scale of Intelligence; YLE: Cambridge Young Learners' English Test (starter); * $p < .05$ (two-tailed), and ** $p < .01$ (two-tailed). Pearson product-moment correlations were conducted to examine the relationship between continuous variables, and Point-biserial correlations were conducted to examine the relationship between nominal and continuous variables.

Stepwise regression was performed to assess the unique contribution made by each predictor in explaining the outcome variance. Note that the present data were submitted to stepwise rather than standard and hierarchical analyses, because there was a lack of theoretical and empirical grounds on which the entry order of predictors was based, and also because stepwise analysis can yield the relative contribution of each predictor to the processing outcome. It should be emphasized that non-significance does not necessarily mean that the variable has no effect on the outcome. This is because it is possible that the variable is closely intertwined with other related predictors, as a result of which its effect is partialled out. Nevertheless, as long as a variable is significantly predictive of the outcome even after potential confounds are considered, we can confidently conclude that the predictor holds its own explanatory power for explaining the outcome variance.

The results of the regression analyses are shown in Table 4. As regards picture naming, the R (.70) was significantly different from zero, $F(3, 32) = 10.45$, $p < .001$, with R^2 at .50 (a

large effect size). The adjusted R^2 value of .45 indicated that 45% of the naming variance was predicted by the included predictors. The size and direction of the relationships demonstrated that the participants with faster access to Chinese words ($\beta = .56, p < .001$), larger English vocabulary ($\beta = -.35, p < .05$), and from urban areas ($\beta = .28, p < .05$) tended to access L2 words more rapidly in spoken production.

As regards translation, the R (.58) was significantly different from zero, $F(2, 33) = 8.29, p < .01$, with R^2 at .33 (a large effect size). The adjusted R^2 value of .21 indicated that 21% of the translation variance was predicted by the included predictors. The size and direction of the relationships showed that the participant with larger English vocabulary ($\beta = -.52, p < .01$) and faster access to Chinese words ($\beta = .38, p < .05$) tended to access L2 words more rapidly in spoken production.

Table 4: Stepwise regression analysis of picture naming and L1-to-L2 translation

<i>Predictor variables</i>	<i>Picture naming</i>			<i>L1-to-L2 translation</i>		
	β	PC	UV	β	PC	UV
Gender (Male = 0, Female = 1)	.07	.09	<i>ns</i>	.16	.19	<i>ns</i>
Age	.13	.16	<i>ns</i>	.04	.05	<i>ns</i>
Living area (Urban = 0, Rural = 1)	.28	.35	.06*	.08	.10	<i>ns</i>
Vocabulary size	-.35	-.42	.17*	-.50	-.52	.20**
Vocabulary depth	.05	.07	<i>ns</i>	-.07	-.08	<i>ns</i>
WASI-III (MR)	.06	.08	<i>ns</i>	-.15	-.18	<i>ns</i>
English course grade	.07	.09	<i>ns</i>	-.01	-.01	<i>ns</i>
Chinese course grade	-.09	-.10	<i>ns</i>	.05	.06	<i>ns</i>
YLE (Reading and Writing)	-.05	-.06	<i>ns</i>	-.16	-.17	<i>ns</i>
YLE (Listening)	.21	.21	<i>ns</i>	-.04	-.04	<i>ns</i>
Chinese lexical accessibility	.56	.61	.22***	.34	.38	.09*

Notes: MR: matrix reasoning; WASI: Wechsler Abbreviated Scale of Intelligence; YLE: Cambridge Young Learners' English Test (starter level); β : the standardized regression coefficients; PC: partial correlation; UV: unique variance (measured by adjusted R^2); * $p < .05$, ** $p < .01$, and *** $p < .001$.

As shown in Table 4, both L2 vocabulary size and L1 lexical accessibility were significantly predictive of naming and translation latencies, although the relative magnitude of these two predictors was not consistent across stimulus conditions. Moreover, the variable of living area contributed significantly to naming latencies but not to translation latencies, possibly due to the different cognitive process and demands involved in performing each task. It is worth noting that, in the correlation analysis, Chinese course grades were significantly correlated with both naming and translation latencies, and YLE scores were significantly correlated with translation latencies; however, in the regression analysis, these predictors turned out to be non-significant. This could be because, as already mentioned above, the effects of Chinese course grades and YLE scores were partialled out by other related predictors.

GENERAL DISCUSSION

It is not only what we know that matters in L2 learning but also what we can do with the knowledge that we have. Likewise, vocabulary knowledge is not only about end products but also about the ability to access lexical items effortlessly and efficiently. The present study examined the contribution of several predictors to L2 lexical accessibility in spoken production among EFL children. The participants' L2 vocabulary size and L1 lexical accessibility were found to significantly predict the speed of accessing L2 words. This result will be discussed with reference to previous studies examining determinants of lexical accessibility.

As mentioned above, vocabulary knowledge includes three dimensions: size, depth and automaticity. In the present study the dimension of size explained a relatively large proportion of the outcome variance, a result which lends credence to the previous observation that vocabulary knowledge was strongly correlated with spoken fluency in adult speakers (e.g. De Jong et al., 2013; Hilton, 2008). One explanation for this result concerns children's phonological knowledge. As a consequence of acquiring more words, children's phonological awareness likely becomes more robust (Walley, 1993). Given this, it is reasonably possible that the effects that vocabulary size exerts on L2 lexical accessibility are partly mediated via children's phonological knowledge. This is to say, an increase in L2 vocabulary size does not simply mean that children know more words, but also indicates that the associations between words' forms and meanings are strengthened, and this consequently facilitates children's access to the content of their mental lexicons.

The reported correlation between vocabulary size and depth was high in the literature (e.g. $r = .62$, Nurweni & Read, 1999; $r = .82$, Qian, 1999). Vermeer (2001) even asserted that there appeared to be no 'conceptual distinction' between these two dimensions of vocabulary knowledge. However, such a high correlation was not replicated in the current study ($r = .32$, $p = .05$). This could be because having in-depth knowledge of words is not the main focus of initial stages of EFL learning and teaching. Where this occurs, children have limited experience with each word and accordingly limited knowledge of individual lexical respects (e.g. multiple senses of polysemous words). Another explanation concerns the participants' low EFL proficiency. As observed in Nurweni and Read (1999), the magnitude of size-depth associations largely reduced as learners' proficiency decreased, a result which leads the authors to argue that it would be unrealistic for learners with a small number of words to display any depth of vocabulary knowledge. It is thus understandable why the variable of depth was not significantly predictive of the participants' lexical accessibility in the current study.

Together with vocabulary size, L1 lexical accessibility was found to contribute significantly to predicting L2 naming and translation latencies. This can be explained by the *developmental interdependence hypothesis* (Cummins, 1978, 1991, 2000; Cummins & Swain, 1986) and the *common underlying cognitive processes framework* (CUCPF, Geva & Ryan, 1993). According to the DIH, L1 literacy skills appear to develop in parallel with L2 literacy skills. The present data converges with and extends previous attempts (e.g. Derwing et al., 2009; Lee & Schallert, 1997; Sasaki & Hirose, 1996; Yamashita, 2002) by demonstrating that

L1 lexical accessibility was significantly predictive of L2 lexical accessibility during production. Drawing on the CUCPF, the observed L1-L2 parallel development can be attributed to the participants' underlying cognitive properties that sustained the acquisition and maintenance of both languages.

Another way of interpreting the predictive ability of L1 retrieval speed relates to the *developmental hypothesis* (Kroll & De Groot, 1997)—an L2 word is initially connected to its L1 equivalent (i.e. the lexical route) and then connected to a common conceptual system between languages (i.e. the conceptual route). As a learner's proficiency increases, the conceptual route may take the place of the lexical route. Considering that the present participants were L2 beginners, L1 equivalents or lexical routes were more likely to be activated in naming and translation (see Figure 3 for an example). In this sense, the processing mechanisms specific to L2 young children explain why L1 influence was present in the production of L2 words. Note that Chinese course grades were significantly correlated with naming latencies (see Table 3), but its significance was not retained in the regression analysis, possibly because its effects were partialled out by the inclusion of L1 retrieval speed.

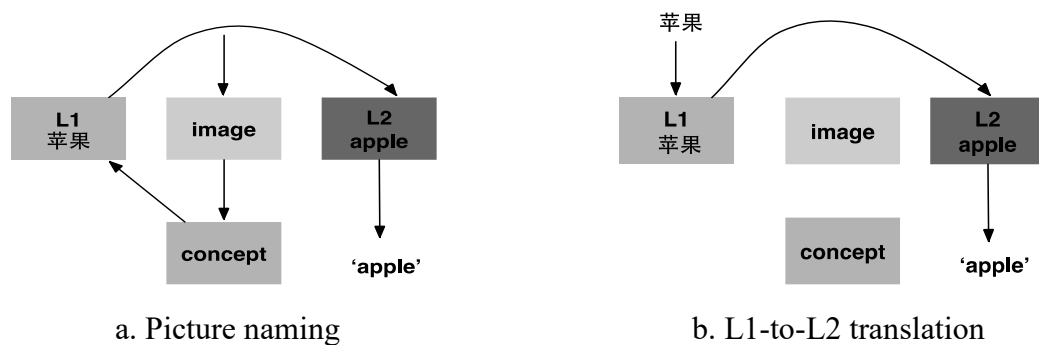


Figure 3. Processes of picture naming and L1-to-L2 translation among L2 beginners

L2 proficiency (listening, reading and writing) was strongly correlated with translation latencies ($r = -.36, p < .05$; $r = -.36, p < .05$) and moderately correlated with naming latencies ($r = -.31, p = .06$; $r = -.29, p = .07$) but none of these variables was significantly predictive of the observed latencies (see Table 4 above). In order to clarify the precise relationship between L2 proficiency and L2 lexical accessibility, the translation data⁴ were submitted to path analysis using the statistical software AMOS v.20 (Analysis of MOment Structures). We hypothesized that L2 proficiency had an indirect impact upon L1-to-L2 translation via vocabulary size, as shown in Figure 4. The results demonstrated that the proposed model was of reasonable goodness-of-fit, $\chi^2(2, n = 39) = .97, p = .62$, CFI (Comparative Fit index) = 1.00, $RMSEA$ (Root Mean Square Error of Approximation) = .00, and that there was a significant indirect effect of listening proficiency on translation latencies via vocabulary size ($\beta = -.23, p < .01$), indicating that L2 proficiency may greatly influence L2 lexical accessibility in an indirect but not direct manner. Methodologically speaking, a predictor's non-significance identified in regression analysis does not necessarily mean that the predictor has little or no indirect effects on the outcome, a constraint that appears to be inherent in

using regression analysis.

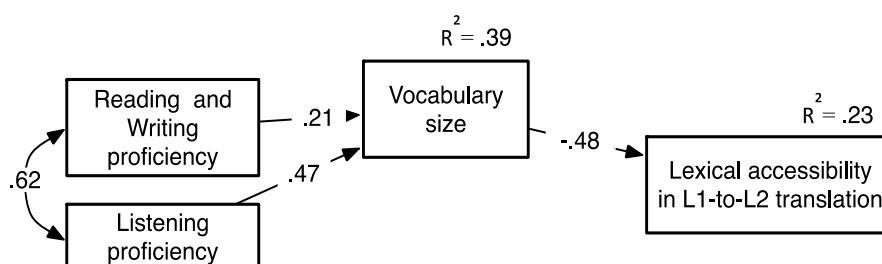


Figure 4. Path model: Predictive effects of reading, writing and listening proficiency on L1-to-L2 translation via vocabulary size

There was a significant correlation between residential areas and naming latencies ($r = .32, p < .05$): the participants in urban areas named pictures more rapidly than the participants in rural areas. The variable of residence also contributed significantly to explaining translation variance ($\beta = .28, p < .05$). These results appear to be consistent with Butler (2014) observation that the parents' socio-economic status affected primary-aged EFL children's speaking abilities at the fourth-grade, if not earlier. The observed correlations between non-verbal IQ (matrix reasoning) and most indicators of verbal performance (i.e. $r < .30$) were much weaker than those found in the L1 literature (e.g. $r > .40$, Raven, Raven, & Court, 1996; Saklofske et al., 2000; Wechsler, 1999). The present result, however, replicates some previous studies (Oller et al., 2001) in which non-significant correlations were found between non-verbal ability and three respects of English proficiency (i.e. vocabulary, articulation, and morphology) among EFL children. All these results taken together indicate that an individual's verbal and non-verbal abilities are not always strongly related to each other, and one exception may involve primary-aged EFL children.

Pedagogically, vocabulary knowledge is fundamental to children's L2 learning and development, thus vocabulary expansion should be stressed in primary-level course design. Children should be encouraged to develop vocabulary knowledge in combination with repeated use and practice of known words so as to accelerate the speed of accessing target lexical items. Language instructors should be aware that the development of L2 literacy goes hand in hand with the development of L1 literacy, and that children do not learn EFL at the expense of L1 learning.

In the present study the unexplained variance of the outcome may be due to several unexplored variables, such as intra-lexical representations and characteristics, children's phonological awareness, and working memory. As such, a more holistic analysis is needed to encompass significant predictors identified in the present study as well as those beyond the present scope. Another limitation that we should acknowledge concerns the use of a non-experimental design, which makes it impossible to provide unequivocal explanations of causality between significant predictors and the outcome under examination.

CONCLUSION

The speed with which L2 words are accessed in picture naming and L1-to-L2 translation is under the influence of several learner variables. The present study provides converging evidence regarding the importance of vocabulary knowledge in language use and the interdependence between L1 and L2 literacy, and more importantly, extends previous research by considering L2 lexical accessibility as the outcome against which to identify its significant predictors.

The conclusions can be summarized as follows: Vocabulary size and L1 lexical accessibility significantly predicted the speed with which primary-aged EFL children produced L2 spoken words in picture naming and in L1-to-L2 translation. This observation, however, does not necessarily mean that all other predictors like L2 proficiency failed to exert any influence on L2 lexical accessibility. The present study holds implications for the production of L2 words in young children and for current conceptualizations of EFL vocabulary teaching within input-limited contexts. In general, there are two obvious directions for future research examining L2 lexical accessibility: to compare the explanatory power of a range of predictors across different proficiency groups, and to assess how each predictor varies with the outcome over time.

Notes:

1. We administered the Cambridge Young Learners' English Test (starter level) to the participants. This test includes a reading and writing paper, which consists of five parts and 25 test items in total. In this chapter only the last five items test writing one-word answers in response to given questions. It is thus acceptable to consider the score of this chapter as more indicative of the child participants' receptive knowledge of English.
2. The stimuli used in the reaction-time based experiment were different from the test words used in assessing the participants' vocabulary depth. But some stimuli were repeated in the vocabulary-size test, which was administered two weeks after the reaction-time experiment. Due to the washout period, the priming effect, if any, between these two tests was considered minimal.
3. The predictors were all related to learners' L2, unless otherwise specified.
4. We conducted path analysis on the data collected through translation but not naming. This is because the relationship between three respects of English proficiency and translation latencies reached statistical significance in the correlation analysis but not in the regression analysis. Exactly for this reason, we examined whether or not any significant indirect effects existed.

REFERENCES

- Andringa, S., Olsthoorn, N., Van Beuningen, C., Schoonen, R. and Hulstijn, J. (2012) Determinants of success in native and non-native listening comprehension: An individual differences approach. *Language Learning* 62 (s2), 49-78.
- Bates, E., Benigni, L., Bretherton, L., Camaioni, L. and Volterra, V. (1979) *The Emergence of Symbols: Cognition and Communication in Infancy*. New York: Academic Press.

- Cedrus Corporation. (2007) Super Lab 4.5. San Pedro: Cedrus Corporation.
- Cremer, M. and Schoonen, R. (2013) The role of accessibility of semantic word knowledge in monolingual and bilingual fifth-grade reading. *Applied Psycholinguistics* 34 (6), 1195-1217.
- Cummins, J. (1978) Educational implications of mother tongue maintenance in minority language groups. *Canadian Modern Language Review* 34 (3), 395-416.
- Cummins, J. (1991) Interdependence of first-and second-language proficiency in bilingual children. In E. Bialystok (eds) *Language Processing in Bilingual Children* (pp. 70-89). New York: Cambridge University Press.
- Cummins, J. (2000) *Language, Power, and Pedagogy: Bilingual Children in the Crossfire* (Vol. 23). Clevedon: Multilingual Matters.
- Cummins, J. and Swain, M. (1986) *Bilingualism in Education*. London: Longman.
- De Jong, N.H., Steinel, M.P., Florijn, A., Schoonen, R. and Hulstijn, J.H. (2013) Linguistic skills and speaking fluency in a second language. *Applied Psycholinguistics* 34 (5), 893-916.
- Derwing, T. M., Munro, M. J., Thomson, R. I. and Rossiter, M. J. (2009) The relationship between L1 fluency and L2 fluency development. *Studies in Second Language Acquisition* 31 (4), 533-557.
- Geva, E. and Ryan, E.B. (1993) Linguistic and cognitive correlates of academic skills in first and second languages. *Language Learning* 43 (1), 5-42.
- Glaser, W.R. (1992) Picture naming. *Cognition* 42 (1), 61-105.
- Harrington, M. (2006) The Yes/No test as a measure of receptive vocabulary knowledge. *Language Testing* 23 (1), 73-98.
- Hilton, H. (2008) The link between vocabulary knowledge and spoken L2 fluency. *Language Learning Journal* 36 (2), 153-166.
- Howatt, A.P.R. (1984) *A History of English Language Teaching*. New York: Oxford University Press.
- Hulstijn, J.H. (2015) *Language Proficiency in Native and Non-native Speakers: Theory and Research*. Amsterdam: John Benjamins Publishing Company.
- Jiang, N. (2012) *Conducting Reaction Time Research in Second Language Studies*. New York: Routledge.
- Johnson, C. J., Paivio, A. and Clark, J. M. (1996) Cognitive components of picture naming. *Psychological Bulletin* 120 (1), 113-139.
- Koizumi, R. (2005) Predicting speaking ability from vocabulary knowledge. *JLTA Journal* 7, 1-20.
- Kroll, J.F. and De Groot, A.M.B. (1997) Lexical and conceptual memory in the bilingual: Mapping form to meaning in two languages. In A. M. B. De Groot and J. F. Kroll (eds) *Tutorials in Bilingualism: Psycholinguistic Perspectives* (pp.201-224). Mahwah, NJ: Lawrence Erlbaum Associates Publishers.
- Lee, J. W. and Schallert, D. L. (1997) The relative contribution of L2 language proficiency and L1 reading ability to L2 reading performance: A test of the threshold hypothesis in an EFL context. *TESOL Quarterly* 31 (4), 713-739.

- Levelt, W.J.M. (1989) *Speaking: From Intention to Articulation*. Cambridge, MA: MIT Press.
- Levelt, W.J.M., Schriefers, H., Vorberg, D., Meyer, A.S., Pechmann, T. and Havinga, J. (1991) The time course of lexical access in speech production: A study of picture naming. *Psychological Review* 98 (1), 122-142.
- Li, W. (2000) Dimensions of bilingualism. In W. Li (eds) *The Bilingualism Reader* (pp. 3-25). London: Routledge.
- Meara, P. (1992) *EFL Vocabulary Tests*. Swansea: Centre for Applied Language Studies.
- Meara, P. (1996) The dimensions of lexical competence. In G. Brown, K. Malmkjaer and J. Williams (eds) *Performance and Competence in Second Language Acquisition* (pp. 35-53). Cambridge: Cambridge University Press.
- Meara, P. (2005) *X_Lex: The Swansea Vocabulary Levels Test (version 2.05)*. Swansea: Lognostics.
- Ministry of Education of China (2001) 教育部关于积极推进小学开设英语课程的指导意见[The Ministry of Education Guidelines for Vigorously Promoting the Teaching of English in Primary Schools]. Retrieved October 6, 2015, from http://www.moe.gov.cn/publicfiles/business/htmlfiles/moe/moe_711/200407/665.html
- Ministry of Education of China (2014) *Educational Statistical Yearbook of China*. Beijing: People's Education Press.
- Nation, I. S. P. (2001) *Learning Vocabulary in Another Language*. Cambridge: Cambridge University Press.
- Nurweni, A. and Read, J. (1999) The English vocabulary knowledge of Indonesian university students. *English for Specific Purposes* 18 (2), 161-175.
- Oller, J.W., Kim, K., Choe, Y. and Jarvis, L.H. (2001) Testing relations between language (verbal) and nonverbal abilities in children and adults acquiring a nonprimary language. *Language Testing* 18 (1), 33-54.
- Piaget, J. (1954) *The Construction of Reality in the Child*. New York: Basic Books.
- Potter, M.C., So, K.F., Eckardt, B.V. and Feldman, L.B. (1984) Lexical and conceptual representation in beginning and proficient bilinguals. *Journal of Verbal Learning and Verbal Behavior* 23 (1), 23-38.
- Poulisse, N. and Bongaerts, T. (1994) First language use in second language production. *Applied Linguistics* 15 (1), 36-57.
- Qian, D.D. (1999) Assessing the roles of depth and breadth of vocabulary knowledge in reading comprehension. *Canadian Modern Language Review/La revue canadienne des langues vivantes* 56 (2), 282-308.
- Raven, J., Raven, J.C. and Court, J.H. (1996) *Raven Manual: Section 1, General Overview*. Oxford: Oxford Psychologists Press.
- Read, J. (1993) The development of a new measure of L2 vocabulary knowledge. *Language Testing* 10 (3), 355-371.
- Riazzantseva, A. (2001) Second language proficiency and pausing a study of Russian speakers of English. *Studies in Second Language Acquisition* 23 (4), 497-526.
- Richards, J.C. and Rodgers, T.S. (2001) *Approaches and Methods in Language Teaching*. Cambridge: Cambridge University Press.

- Saklofske, D.H., Caravan, G. and Schwartz, C. (2000) Concurrent validity of the Wechsler Abbreviated Scale of Intelligence (WASI) with a sample of Canadian children. *Canadian Journal of School Psychology* 16 (1), 87-94.
- Sasaki, M. and Hirose, K. (1996) Explanatory variables for EFL students' expository writing. *Language Learning* 46 (1), 137-174.
- Schmitt, N. and Meara, P. (1997) Researching vocabulary through a word knowledge framework. *Studies in Second Language Acquisition* 19 (1), 17-36.
- Schoonen, R. and Verhallen, M. (1998) *Aspects of vocabulary knowledge and reading performance*. Paper presented at the Annual Meeting of the American Educational Research Association, San Diego, April.
- Snodgrass, J.G. (1993) Translating versus picture naming. In R. Schreuder and B. Weltens (eds) *The Bilingual Lexicon* (pp. 83-114). Amsterdam/Philadelphia: John Benjamins.
- Tabachnick, B. G. and Fidell, L. S. (1983). *Using Multivariate Statistics*. New York: Harper & Row.
- Verhoeven, L.T.W. and Vermeer, A. (2009) Cognitive predictors of children's first and second language proficiency. In J. Guo, E. Lieven, N. Budwig, S. Ervin-Tripp, K. Nakamura and S. Ozcaliskan (eds) *Crosslinguistic Approaches to the Psychology of Language: Research in the Tradition of Dan Isaac Slobin* (pp. 481-492). New York: Psychology Press.
- Vermeer, A. (2001) Breadth and depth of vocabulary in relation to L1/L2 acquisition and frequency of input. *Applied Psycholinguistics* 22 (2), 217-234.
- Walley, A.C. (1993) The role of vocabulary development in children's spoken word recognition and segmentation ability. *Developmental Review* 13 (3), 286-350.
- Wechsler, D. (1999) *Wechsler Abbreviated Scale of Intelligence* (3rd edn). San Antonio, TX: The Psychological Corporation.
- Wiese, R. (1984) Language production in foreign and native languages: Same or different. In W. Dechert, D. Mohle and M. Raupach (eds) *Second language Productions* (pp. 11-25). Tübingen: Gunter Narr Verlag.
- Yamashita, J. (2002) Mutual compensation between L1 reading ability and L2 language proficiency in L2 reading comprehension. *Journal of Research in Reading* 25 (1), 81-95.