Cognitive Factors in Children's L1 and L2 Reading

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Abstract

This study aims to identify the similarities and differences in cognitive and metacognitive skills employed by native English (NE) speakers and English (L2) learners at the elementary school level, and how these skills relate to their reading proficiency levels. Regardless of students' native language status, strong readers and struggling readers appear to share many features in common. The only differences between NE and L2 students were found to be in their receptive vocabulary size and their vocabulary-related skills.

Introduction

There are a growing number of bilingual children who come from non-English speaking homes in the U.S., and the challenges they face in developing their English ability as well as their academic achievement are a major concern among educators. According to the NAEP (National Assessment of Educational Progress) 2003 Reading Report Card for the United States, 72% of the fourth graders who come from non-English speaking homes read "below basic level" (National Center Educational Statistics, 2003). While we must understand what prevents these children from reading English well in order to be able to develop appropriate pedagogies for them, cognitive and metacognitive processing and strategies in L2 reading studies among young students in the U.S. have been somewhat neglected. In particular, we have relatively little knowledge of how such cognitive and metacognitive processes and strategies differ between native English speaking students and bilingual English learning students (Garcia, 2000; Jimenez, Garcia, & Pearson, 1996). This study aims to enhance our understanding of this issue by identifying the similarities and differences in cognitive and metacognitive skills employed by monolingual native English speakers and bilingual English learners at the elementary school level. The study then examines how these skills relate to students' reading proficiency levels.

L1 and L2 reading

Much of our knowledge of second language reading (L2 reading) depends on existing theories of native language reading (L1 reading): such theories include the bottom-up model (e.g., Gough 1972; LaBerge & Samuels, 1974); the psycholinguistic approach (e.g., Goodman, 1967; Smith, 1994); Schema theory (e.g., Rumelhart, 1980); and the interactive model (Stanovich, 1980). Based on these models, a number of important subskills in reading have been identified. Over the years, researchers have tried to clarify the relationships among these subskills as well as the relationship between these skills and reading comprehension. Subskills that have been identified and studied include phonological awareness, vocabulary knowledge, memory, morpho-syntactic knowledge, background knowledge, inference and reasoning skills, metacognitive strategies, as well as a number of additional subskills. Although one can expect that these subskills are all important for L2 reading as well as L1 reading, L2 reading should be fundamentally different from L1 reading since one cannot ignore readers' L1 knowledge and their prior experience of reading in their L1 (Koda, 2005). Moreover, in understanding young children's L2 reading, one needs to consider some additional

factors. Unlike adults, children are still in the process of developing their L1 as well as their L2. Their general cognitive and metacognitive capacities are also still being developed. One may hypothesize that these cognitive and metacognitive factors may affect young learners' reading comprehension performance differently in their L1 and L2.

The limited studies available so far on L2 reading among young learners indicate that the following cognitive and metacognitve factors are influential with respect to young students' L2 reading: metalinguistic awareness and strategies, phonological/phonemic awareness, and vocabulary (Pang & Kamil, 2004). Garcia (1991) found that an unknown vocabulary hindered young L2 readers' comprehension. The relationship between students' oral proficiency in L2 and their L2 reading comprehension remains unclear. This partially may stem from the fact that the oral proficiency measurements that have been employed in studies thus far may not accurately capture those oral proficiency skills that are more closely related to literacy (Pang & Kamil, 2004). In sum, we still do not fully understand either how cognitive and metacognitive subskills may affect young L2 students' reading performance or how such subskills may differ in terms of their effects on young L2 learners versus young NE readers.

Research Questions

Given our relative lack of knowledge regarding cognitive factors in childrens' L1 and L2 reading, the present study aims to investigate the relationship among the major reading subskills that have been identified and to examine how their effects vary depending on the students' reading performance. Our main goal is to identify what causes students to experience difficulty reading, and to compare the causes of their reading difficulties between English learning students (L2 students) and native English speakers (NE students). We administered to NE and L2 students a number of assessments that were designed to capture a wide range of subskills, including subskills that have yet to be examined thoroughly (e.g., the ability to infer the meaning of unknown words and academic related oral proficiency), in order to accomplish this goal.

Method

Participants In recruiting participants for this study, we controlled a number of factors that could potentially influence students' reading performance. These factors often have been neglected in previous studies (e.g., Padron, Knight, & Waxman, 1986) on reading among English learning students. These factors include: (1) basic oral proficiency in English; (2) the amount and type of English instruction previously received; (3) formal literacy instruction in their native language; and (4) socio-economic background. In order to be able to compare students' performance in various skill domains between L2 students and NE students, the general reading proficiency level between these two groups (NE and L2 groups) were controlled as explained below.

The participants in this study were 61 4th graders who had been in an English-only school district in the San Francisco Bay Area of California since kindergarten. There were 24 NE students and 37 L2 students from either Spanish- or Vietnamese-speaking homes. No formal L1 literacy instruction had been offered to the L2 students. Both the NE and L2 students were further classified into two groups - strong or struggling readers - based on their reading levels in English. Reading levels for non-native English speakers were gauged by students' performance on the following measurements: the San Diego Quick test, SAT9 scores in reading (40 and lower and 60 and higher in NCE), a district-administered reading record, and recommendations from district ELD (English Language Development) teachers who worked with the non-native English speakers. SAT9 test scores were used for the native English speakers. All of the L2 students who participated in this study had acquired sufficient oral skills in English (based on an Idea

Proficiency Test that had been used by the district as a designation criterion for the need for English language support services). The participants were randomly selected from the students who met these criteria. The majority of the participants came from Title I schools; as such, they came from middle to lower social economic backgrounds. The number of students in each group is shown in Table 1. See issue website http://rapidintellect.com/AEQweb/spr2006.htm

Instruments A number of assessments were administered as summarized in Table 2. These assessments were designed to measure different factors that could influence students' reading comprehension. This approach integrates multiple perspectives, including psychological, linguistic, educational, and socio-cultural perspectives, in order to better understand students' problems with reading comprehension. Among the assessments employed in this study, two were developed by the authors in order to capture those subskills that had not been adequately measured in previous studies: the two assessments were a vocabulary inference test and an oral assessment of the students' understanding of academic English. In addition to examining the students' receptive vocabulary size (measured by PPVT (Peabody Picture Vocabulary Test III)), the vocabulary inference test was developed in order to capture the students' ability to infer the meaning of unfamiliar words in context and the students' metacognitive abilities to describe their strategies for inferring meaning.[1] The oral assessment in academic English was developed in order to capture whether or not the students had acquired the oral skills needed for content instruction.[2] This latter assessment attempts to capture the students' CALP (Cognitive Academic Language Proficiency. Cummins, 1979, 2000), and thus requires oral comprehension and production of more technical vocabulary and syntax.

Among the assessments listed in Table 2, the qualitative data gathered as part of this study (namely, the questionnaire and interview data) is excluded from the analyses of the present study. Please refer to Butler & Gutierrez (2003) for the analyses of the qualitative part of the data. See http://rapidintellect.com/AEQweb/spr2006.htm

Results

Intercorrelations among cognitive variables First, intercorrelations among cognitive variables were examined as shown in Table 3. High Frequency Word Reading was not included in this analysis because it had a ceiling effect (i.e., almost everybody had perfect scores). Overall, the results of the PPVT test (a standardized receptive vocabulary test) showed relatively high correlation with all of the other variables. It is not surprising that PPVT results were highly correlated with the two vocabulary measures (i.e., the ability to infer word meaning in context and the ability to explain how the students inferred word meanings). The PPVT results also showed a relatively high correlation with academic oral proficiency. Basic phonetic skills were mildly related to other measures except non-verbal intelligence (Raven). It is interesting to see that Raven scores did not seem to show a high correlation with other measures (other than for a mild correlation with academic oral proficiency). Spelling was highly correlated with vocabulary inference and the two oral reading measurements. Consistent with previous research, this result might be seen because phonological awareness plays an important role in both spelling and decoding (e.g., Goswami & Bryant, 1990). See http://rapidintellect.com/AEQweb/spr2006.htm

The overall effect of variables on comprehension In order to compare the students' performance between strong and struggling readers (by READING LEVEL) and between NE and L2 readers (by NATIVE), results from the students' performance on the assessments described above were converted into z-scores (standardized) and we compared the means for each group. A multivariate analysis of variance (MANOVA) was employed. The MANOVA performed on these variables showed a statistically significant main effect for READING LEVEL (Wilks' Lamba = 14.81, $p < .0001$, Eta squared = .74) and for NATIVE (Wilks' Lambda = 2.70, $p < .05$, Eta squared = .34). There was no interaction effect between READING LEVEL and NATIVE. Therefore, a much larger proportion of the variance in these independent variables is accounted for by the differences between strong and struggling reading groups rather than between NE and L2 reading groups. Table 4 shows a univariate analysis for each variable. The order of the dependent variables was rearranged according to their effect sizes (please refer to Figures 1 and 2). As one can see, all of the variables that we employed showed a significant main effect for

READING LEVEL; all of these assessments showed significant differences between strong readers and struggling readers. Regardless of the students' native language status (whether NE or L2), strong readers and struggling readers seem to share many features in common. The results also demonstrates that struggling readers showed lower performance than strong readers in all of the different subskills used in reading, including academic oral proficiency.

Notably, only one variable (PPVT) showed a main effect for NATIVE. Two other variables approached the significant level: the ability to infer the meaning of unknown words in context (voc.infer) and the metacogntiive strategies used to determine meaning (voc.meta). These are all vocabulary-related variables and such vocabulary-related abilities as well as vocabulary size appear to be important factors for characterizing the poorer performance in reading comprehension among L2 readers. See http://rapidintellect.com/AEQweb/spr2006.htm

Conclusion

The present study examined the relationship among the major reading subskills that have been identified in previous research and examined whether the effect of such subskills differs depending on students' reading performance in English and their native language status (whether students are NE or L2 learners). We found that all of these measures in general were either mildly or highly correlated with each other. This appears to be indicative of the complex and interdependent nature of cognitive and metacogntive competencies related to reading comprehension.

Strong and struggling readers, regardless of their language status, showed significant differences in all of the skill measures that we tested. In other words, L2 students who are strong readers in English had similar characteristics with strong NE readers, and the same holds for struggling readers in both groups. The only differences between NE and L2 students were found in their receptive vocabulary size and vocabulary related skills. In their case study, Jimenez, et al. (1996) found that Latino bilingual students who are strong readers of English developed unique strategies to infer and construct meaning in context even though they frequently encounter unknown words. The result of the present study similarly suggests that instructional support for vocabulary learning (not only helping students increase their vocabulary size but also other skills such as context-based lexical inference skills) would be particularly helpful for L2 students.

One limitation of the present study is that we were not able to systematically investigate the L2 students' L1 literacy skills and how these might have affected their L2 reading. The students in the present study hand all been enrolled in an English-only school district since kindergarten, and they had not received any formal L1 literacy instruction at school as a result. Further research is warranted to compare the present results with those for L2 students who have received systematic support in developing their L1 literacy as well as their L2 literacy.

Endnotes

[1] The students first were asked to read a series of short paragraphs that each contained an unfamiliar word. The students were then asked to guess the meanings of the words in question (assessing the students' ability to infer and explain the meanings of unknown words in context). They were then asked to explain how they arrived at the meanings of the words as they defined them (measuring the students' metalinguistic strategies). The assessment was conducted individually and took the format of an interview. Please refer to Butler (2004) for a detail description of this measurement.

[2] Each student received a brief science lesson on magnetism on an individual basis. During the lesson, students conducted a hands-on experiment. They had a chance to manipulate objects based on oral instructions (e.g., sticking two magnets together and feeling the magnetic force).

They then were asked to hypothesizing about the results and orally explain what they observed. The students answered (orally) a series of questions that were designed to assess their comprehension as well as their inferential, analytical, and metacognitive skills. This one-on-one assessment took approximately 30 minutes to administer to each student, and all of the sessions were videotaped and transcribed. Since some of the questions asked during the assessment were redundant, ten of the most typical and important questions were chosen for analysis. These consisted of 6 comprehension questions, 2 observation questions, 1 inference question, and 1 analytical question. A series of coding schema were developed, and for each response, the following components were analyzed: accuracy of comprehension; use and accuracy of technical vocabularies that were introduced during the lesson; syntactic complexities; and the extent to which the students were able to form oral responses well.

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Table 1
Description of the participants

	NATIVE FACTOR	
READING LEVEL FACTOR	NE (Native English Speakers)	L2 (English Learners)
Strong Readers	(NE+) n = 12	(L2+) n = 18 (Spanish n = 3) (Vietnamese n = 15)
Struggling Readers	(NE-) n = 12	(L2-) n = 19 (Spanish n = 11) (Vietnamese n = 8)

Table 2
Lists of Assessments Employed in the Original Study

Skill domain	Assessments administered	Subskills measured
Phonemic awareness/ decoding/spelling	Basic Phonetics Skills Test (BPST)	Basic phonetics skills (BPST)
	Johnson Primary Spelling Inventory	Spelling skills (Spelling)
	High Frequency Word Reading	Word reading skills
Vocabulary	Peabody Picture Vocabulary Test (PPVT)	Receptive vocabulary skills (PPVT)
	*Vocabulary Inference Test	Interring the meaning of unknown words (voc.infer) (Metacognitive skills to infer the word meaning (voc.meta)
Academic oral skills	*Oral Assessment in Academic English	Oral proficiency in academic contexts (Academic.oral)
Oral reading	Reading record	Accuracy of oral reading (oral.read.accu) Fluency of oral reading (oral.read.flu)
Non-verbal cognition	Raven's Progressive Matrices Test	Non-verbal cognitive skills (Raven)
Social and social-cognitive factors	*Background questionnaire for the parents*	*Home background information*
	Interview with students	*Social perception/attitudes on bilingualism and reading*

Note. Assessments with * were developed by the authors. Labels used in the analyses are indicated in parenthesis.

Table 3
Intercorrelations of All Variables

Variable	1	2	3	4	5	6	7	8	9
1. PPVT									
2. BPST	.39**								
3. Raven	.39**	.25							
4. Spelling	.46**	.42**	.26*						
5. Voc.infer	.75**	.44**	.22	.60**					
6. Voc.meta	.64**	.36**	.15	.37**	.70**				
7. Oral.read.accu	.41**	.41**	.21	.69**	.43**	.33**			
8. Oral.read.flu	.45**	.40**	.31*	.61**	.55**	.37**	.61**		
9. Academic.oral	.53**	.35**	.36**	.37**	.45**	.41**	.35**	.36**	

Notes. ** Correlation is significant at the .01 level (2-tailed)
* Correlation is significant at the .05 level (2-tailed)
PPVT = Peabody Picture Vocabulary Test: BPST = Basic Phonetic Skills Test; Raven = Raven's Progressive Matrices Test; Spelling = Johnson Primary Spelling Inventory; Voc.infer = Contextual Vocabulary Test (inferring word meanings): Voc.meta = Contextual Vocabulary Test (metacognitive reasoning): Oral.read.accu = Oral reading accuracy; Oral.read.flu = Oral reading flueny; Academic.oral = Oral assessment in academic English.

Table 4
Summary of Univariate Analysis of Variance

	Dependent variables	F values	Effect size
READING LEVEL	Oral.read.flu	73.27**	.57
	Voc.infer	48.63**	.47
	Academic.oral	46.40**	.45
	PPVT	40.35**	.42
	Spelling	22.70**	.29
	Voc.meta	21.61**	.28
	Oral.read.accu	21.10**	.26
	BPST	13.26**	.19
	Raven	12.35**	.18
NATIVE	PPVT	18.61**	.25
	Voc.meta	7.02*	.11
	Voc.infer	5.00*	.08
	Oral.read.accu	3.74	.06
	Academic.oral	2.08	.04
	BPST	2.05	.04
	Spelling	1.01	.02
	Oral.read.flu	.19	.00
	Raven	.12	.00

Notes. ** Correlation is significant at the adjusted alpha level .005 (.05/9)
* Correlation is approaching to the significant level.
Order of dependent variables are rearranged according to their effect size.
No significant effects were found in interaction between READING LEVEL and NATIVE.

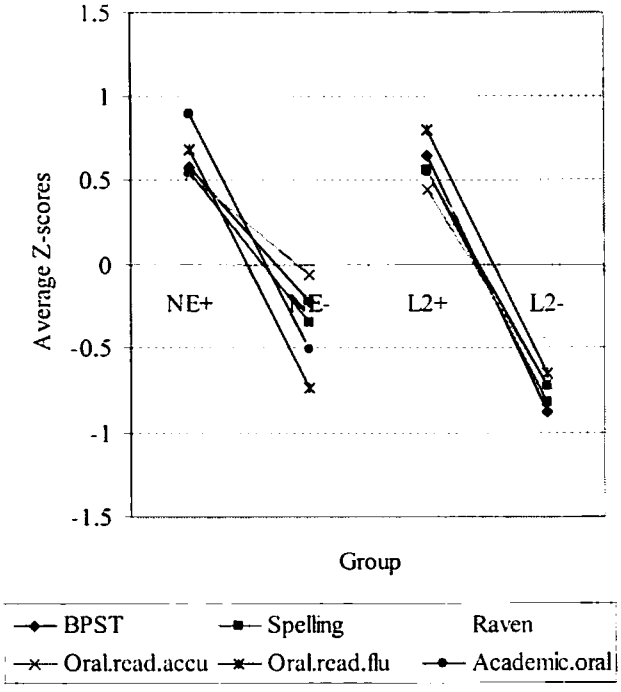

Figure 1
Assessments that showed difference only between strong and struggling readers

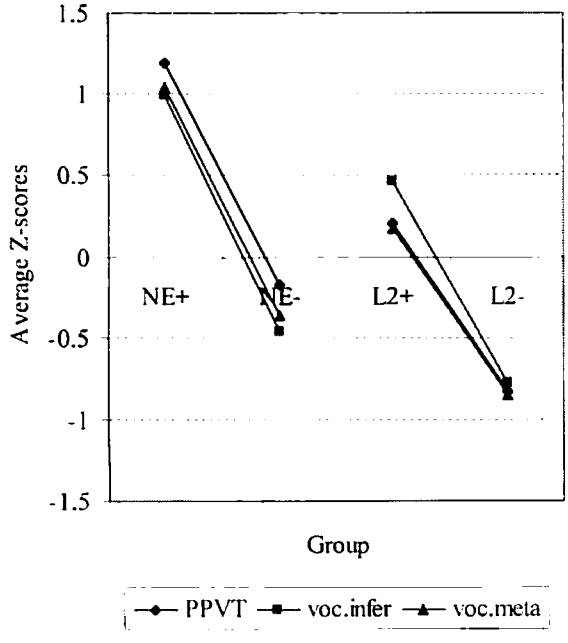

Figure 2
Assessments that showed difference between NE and L2 readers as well as between strong and struggling readers