Cognitive-Linguistic Factors in Japanese First Grader's Reading

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Typically developing Japanese first graders (n=44) were studied to determine the extent to which cognitive-linguistic measures (phonological awareness, rapid automatic naming, phonological memory, visual processing) would predict early reading abilities (oral reading accuracy and speed, reading comprehension). Given the differences between English and Japanese orthography, it was hypothesized that unique patterns of relationships would be obtained for children learning to read Japanese. Multiple regression analysis determined that the cognitive-linguistic measure that most effectively predicted oral reading accuracy was phonological awareness, while rapid naming was the best predictor of oral reading speed. Reading comprehension was best predicted by phonological awareness and phonological memory with rapid Kanji naming contributing some additional unique variance. Predictors of Japanese early reading performance overlapped with those cognitive-linguistic measures important for learning to read English.

Key words: phonological awareness, rapid automatic naming, visual processing, phonological memory, fluency, reading

Specific cognitive and linguistic abilities (phonological awareness, rapid automatic naming, visual processing, and phonological memory) are associated with accuracy and speed of word recognition and reading comprehension skills in English (Badian, 1994, 1995, 1998; Cornwall, 1992; Meyer, Wood, Hart, & Felton, 1998; Scarborough, 1998). Some studies have indicated that phonological processing in particular is an important skill in the acquisition of reading Japanese (Akita & Hatano, 1999; Amano, 1988). This study examined whether cognitive-linguistic abilities predicted early reading abilities in Japanese and determined the extent to which each variable made independent contributions to these reading outcomes.

METHOD

Participants: Forty-four children (18 boys, 26 girls) from three classrooms in public schools in Zama, Kanagawa-prefecture participated in this study. Mean age at the time of testing of the first grade group was 86.4 months of age (SD= 3.8), with a range of 80 to 92 months.

Measures:

  Phonological Awareness: Children were required to hold an orally presented target word in short-term memory, delete a specified mora (syllable) and say the reconstructed word. The task consisted of three practice items and 20 test items.

  Rapid Naming: Two rapid naming tasks (objects, Kanji) required the child to name as quickly as possible four rows of six recurring, systematically randomized items. The rapid object naming contained the following pictures: pencil, star, fish, chair, boat, key. The rapid Kanji naming items were selected based on frequency and visual dissimilarity. For both rapid naming measures, the score was time in seconds.

  Visual Processing: The task was constructed with visually similar Kanji and pseudo-Kanji. The child looked at a target symbol on the left side of the page, and searched for (circle) five identical symbols included randomly in a row of 19 stimuli. The score was items correct per second.

  Phonological Memory: The child listened to a phonologically plausible non-word presented by the examiner, and repeated it orally. The task consisted of three practice items and 20 test items of increasing syllabic length. The score was the total number correct

  Reading Accuracy and Speed: The child read aloud a short first grade level passage comprised of Hiragana, Katakana, and Kanji. Scores for oral reading accuracy (number of errors) and speed (time taken to read a passage) were converted to z-scores for analysis.

  Reading Comprehension Test: Children responded to 17 multiple-choice and 17 fill-in-the-blank items based on six short stories leveled for first and second graders. The score was the number of correct items.

Procedures: The reading comprehension test was group-administered to participants in their classrooms. The rest of the measures were administered individually.

RESULTS

Multiple regression analyses were conducted to determine whether these cognitive-linguistic abilities predicted early reading performance, and to examine the extent to which each variable made a unique contribution to reading performance. With respect to *oral reading accuracy*, Variable Set 1 (phonological awareness, phonological memory, visual processing and rapid object naming) predicted 33% of the unique variance [$F_{(4,39)}=4.72$, $p<.01$]. The largest amount (29%) of unique variance in reading accuracy is attributed to phonological awareness ($\beta=.57$, $p<.001$). None of the other predictors in this set accounted for significant unique variance in oral reading accuracy. When rapid Kanji naming was substituted for rapid object naming (Variable Set 2), 59% of the variance in reading accuracy was accounted for [$F_{(4,39)}=5.32$, $p<.01$]. Again, phonological awareness accounted for the only significant unique variance (21%, $\beta=.50$, $p<.001$) in this latter model. When *oral reading speed* was examined, the Variable Set 1 predicted 36% of the variance [$F_{(4,39)}=5.40$, $p<.001$]. The largest amount (11%) of unique variance in reading speed is attributed to rapid object naming ($\beta=.38$, $p<.05$). None of the remaining predictors in this set accounted for

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significant unique variance. For Variable Set 2, 47% of the variance in reading speed was accounted for [$F_{(4,39)}$=8.49, p<.001]. Rapid Kanji naming accounted for the only significant unique variance (22%, β=.57, p<.001) in this model. When *reading comprehension* was examined, the Variable Set 1 predicted 52% of the variance [$F_{(4,39)}$=10.49, p<.001]. The largest amount (17%) of unique variance in reading comprehension is attributed to phonological awareness (β=.43, p<.001). In addition, unique variance of 13% was contributed by phonological memory (β=.36, p<.01). The other two variables – visual processing and rapid object naming – did not contribute significant unique variance. Using Variable Set 2, 55% of the variance in reading comprehension was accounted for [$F_{(4,39)}$=11.76, p<.001]. Several variables contributed significant unique variance: Phonological awareness accounted for 12% (β=.39, p<.01), followed by phonological memory (11%, β=.34, p<.01) and then rapid Kanji naming (7%, β=.32, p<.05).

DISCUSSION

The goal of the study was to examine predictors of beginning reading performance in Japanese first graders. As in studies of reading acquisition of English, our results indicate that all aspects of phonological processing (phonological awareness, phonological memory and rapid automatic naming) appeared to play an important role in Japanese children's early reading. Additionally, these cognitive-linguistic skills predicted different components of reading performance. Phonological awareness was the only significant predictor of reading accuracy while rapid automatic naming was the only significant predictor of reading speed. These findings are consistent with hypotheses proposed by Wolf and Bowers (1999) for acquisition of English reading skills. In contrast, several variables predicted reading comprehension: phonological awareness and phonological memory, with some additional unique variance contributed by rapid Kanji naming. The finding that phonological memory predicts reading comprehension is consistent with research in English, and buttresses the view that the phonological loop provides critical support for language comprehension (Gathercole, Willis, Baddeley, & Emslie, 1994).

Visual processing, although correlated with the rapid naming tasks and reading comprehension, did not add any unique variance in predicting the reading measures. While both the rapid naming and the visual processing tasks involve speed in identifying visual symbols, only the rapid naming tasks are tied to visual/verbal associations. Thus a test of visual processing speed alone does not seem to contribute significant information in accounting for reading performance in Japanese readers. This is consistent with findings in children's acquisition of reading in English discussed in Rayner, Foorman, Perfetti, Pesetsky and Seidenberg (2001).

As might be expected given the morpho-graphic nature of Kanji, rapid Kanji naming predicted both oral reading speed and reading comprehension. Rapid Kanji naming requires the ability to recognize Kanji characters visually and to accurately and quickly retrieve the target pronunciation. Efficient rapid Kanji naming appears to be related to the ability to read fluently and leaves more cognitive resources available to concentrate on the meaning of the text. In addition, the fact that rapid object naming -- a non-orthographic task -- predicted unique variance in reading speed, suggests that rapid naming tasks tap a more fundamental visual-to-verbal transfer rate.

In summary, taken together, the results of the present study indicate that Japanese young children learning to read Japanese rely on many of the same cognitive-linguistic skills found to be prerequisites for learning to read English. Phonological awareness, rapid naming, and phonological memory skills are related to key components of beginning reading abilities in Japanese first graders. Future researchers may wish to examine the longitudinal predictive power of phonological processing skills in relationship to the development of reading speed, accuracy and comprehension in Japanese. In addition, investigators may wish to study the power of phonological awareness and rapid naming performance to identify Japanese children who are at risk for or present with dyslexia.

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