〔博士論文概要〕

Contributions of cognitive abilities and home literacy environment to Japanese Hiragana, Katakana, and Kanji acquisition: A longitudinal study from kindergarten to grade 2

（ひらがな、カタカナ、漢字の習得における認知能力と
家庭での読み書きに関する環境要因の貢献
―幼稚園年長から小学 2 年生までの縦断研究―）

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I. INTRODUCTION

Reading and spelling are important skills that become the basis of school learning and are necessary for one's future. The role of children's cognitive abilities in reading acquisition has been examined for several decades. Phonological awareness, naming speed, and letter knowledge have been consistently reported to predict reading attainment both concurrently and longitudinally (e.g. Fricke et al., 2015; Furness & Samuelsson, 2011). Despite less attention, visual skills and oral vocabulary have also been reported to be associated with reading acquisition (e.g. Haruhara et al., 2011; Ho & Hanley, 1997; Ricketts et al., 2007). The relationship between literacy acquisition and environmental factors has been examined in various languages. The most investigated environmental factors associated with early literacy acquisition are at-home book-reading activities or print exposure and direct teaching at home (e.g. Bus et al., 1995; Hood et al., 2008; Sénéchal et al., 1998). Previous studies on alphabetic orthographies have revealed that book-reading activities and literacy skills are related, however, the relationship is relatively weak, and the relationship between direct teaching and literacy acquisition is more evident (e.g. Hood et al., 2008; Sénéchal et al., 1998). Longitudinal effects of early, direct teaching have also been reported in several studies (e.g. Hood et al., 2008; Sénéchal, 2006). However, there are few studies on

Japanese reading and spelling development and related factors of the development, especially longitudinal studies and those examining spelling as well as reading. In addition, some researchers in English-speaking countries rely excessively on phonological awareness, and visual skills and oral vocabulary are often not included in their analyses. Moreover, environmental factors have been examined without considering several important cognitive predictors. The effects of home environmental factors or interventions may appear differently depending on children's cognitive characteristics; therefore, children's cognitive abilities should be considered when investigating the contribution of home literacy. In this study, Japanese-speaking children were followed from kindergarten to grade 2 to examine cognitive and environmental factors associated with Japanese reading and spelling acquisition using a comprehensive test of cognitive ability, home literacy environment, and reading and spelling. The moderating effect of cognitive ability on the relationship between environmental factors and reading and spelling attainment was also investigated.

II. STUDY 1: A CROSS-SECTIONAL STUDY

The purpose of Study 1 was to examine the contribution of cognitive abilities and home literacy environment to Hiragana reading and spelling acquisition among

Japanese kindergarten children. Participants comprised 333 (158 boys and 175 girls) five- to six-year-old children from two kindergartens in Japan. Children's cognitive abilities and Hiragana character reading and spelling skills were assessed in September during the middle of the last year of kindergarten. A phonological awareness task (word repetition in reverse order), a phonological short-term memory task (non-word repetition), a naming speed task (rapid automatized naming task; RAN), a visual task (copying and immediate recall of three abstract figures), and an oral receptive vocabulary task (Picture vocabulary test - R) were administered to children. Questionnaires were distributed to parents between October and December to measure maternal education, family income, and home literacy regarding the frequency of home book-reading activity and parent teaching of reading/spelling.

Multiple regression analyses revealed that performance on word repetition in reverse order, non-word repetition, and RAN significantly predicted Hiragana-character reading score. This result was in line with previous findings in Japan (Kaneko et al., 2004; Uno et al., 2007) and of alphabetic languages (e.g. Kirby et al., 2008; Melby-Lervåg et al., 2012), suggesting that phonological processing and naming speed are also important for acquisition of Japanese Hiragana reading accuracy in kindergarten. Regarding Hiragana spelling, in addition to the cognitive tasks related to

Hiragana reading, the performance on the figure-copying task was also a significant predictor. It remained significant even after the reading score was controlled. Moreover, the frequency of parent teaching of spelling explained an additional variance in spelling attainment, suggesting that the more frequent the teaching, the higher the child's score, although the variance explained was small compared to that of cognitive abilities.

III. STUDY 2: A LONGITUDINAL STUDY

In Study 2, the participants from Study 1 were followed for two years and their reading and spelling attainment were reassessed once a year, in the summer of grades 1 and 2, to examine the contribution of early cognitive abilities and home literacy environment to reading and spelling attainment after school entry. There were 163 children (76 boys and 87 girls) and their parents, and 133 children (66 boys and 67 girls) and their parents who agreed to participate in grades 1 and 2 respectively. Nonverbal intelligence test, Hiragana-reading fluency tasks (words, non-words, and paragraph), Hiragana, Katakana, and Kanji reading- and spelling-accuracy tasks were administered to the children. Both words and non-words were used for the Kana reading and spelling tasks. The predictor variables were the same as those measured in Study 1.

The performance on the RAN task significantly predicted almost all reading

measures in grades 1 and 2. Phonological awareness also predicted reading fluency and Kanji word-reading accuracy. When kindergarten Hiragana reading accuracy score, autoregressive effect, was controlled, the contribution of phonological awareness became insignificant, whereas RAN remained as a significant predictor. The results that RAN predicted Hiragana and Katakana reading accuracy and reading fluency were in line with studies in other orthographies (e.g. Fricke et al., 2015; de Jong & van der Leij, 1999), and further supported and extended previous findings with cross-sectional studies in Japanese (Haruhara et al., 2011). Receptive vocabulary also predicted paragraph reading speed in grade 1. This was also consistent with the cross-sectional study by Haruhara et al. (2011) and supported their view that vocabulary size is strongly related to the fluent reading of words or paragraphs, in other words, prints with meanings. Meanwhile, phonological awareness, which is consistently reported as a strong predictor for reading in English-speaking countries, did not predict growth in Japanese reading, although it was related to Kanji reading accuracy and reading fluency. Japanese is a mora-based language, and Kana characters have an almost perfect one-to-one relationship between character and mora. In the acquisition of Kana characters, a high level of phonological awareness would not be required compared to opaque orthographies. Accordingly, phonological awareness may have not predicted

subsequent reading development in Japanese. Besides cognitive abilities, Hiragana character-reading accuracy in kindergarten predicted not only subsequent Hiragana reading accuracy, but also Kanji-reading accuracy. These scripts were presumed to require a common cognitive process, and the results highlight the importance of acquisition of Hiragana before learning Kanji.

The results were similar for spelling in grades 1 and 2. The RAN performance significantly predicted the grade 1 Hiragana- and grade 2 Katakana-word spelling, and the contribution to Hiragana-word spelling remained significant even after kindergarten reading and spelling scores were controlled. This was in line with previous reports (Georgiou et al., 2012; Verhagen et al., 2010) that support the theory that RAN task reflects the ability to form high-quality orthographic representations (Bowers & Wolf, 1993), and that ability is associated with the development of accurate word spelling. In addition, the performance of phonological processing tasks predicted all spelling performances in grades 1 and 2, and this relationship remained significant even after kindergarten spelling was controlled. This was similar to previous findings in other orthographies (Babayiğit & Stainthorp, 2007; Nikolopoulos et al., 2006). Phonological processing seems to play a role in accurate perception and segmentation of stimuli during spelling. However, its contribution became insignificant after the kindergarten

Hiragana reading score was controlled. The kindergarten reading score had a strong effect on all spelling tasks in grades 1 and 2. This suggests that there is a strong relationship between reading and spelling, and early Hiragana reading attainment would be a good indicator of later spelling development irrespective of scripts.

Regarding home literacy, inconsistent with previous studies in alphabetic orthographies, no direct relationship between parental teaching at home and reading and spelling were found in either grade. In contrast, the frequency of book reading at home significantly predicted performance on word-reading fluency tasks in grade 1 and all reading-fluency tasks in grade 2, even with demographics, an autoregressive effect, cognitive abilities, and parental teaching statistically controlled: the more often children read books, the faster they read. These results indicate that frequent book reading, which leads to frequent exposure to print, may contribute to fluent reading. The contribution of book reading was observed consistently in the word-reading fluency task, and also in the grade 2 paragraph-reading fluency task. These results seemed to support previous studies concerning print exposure and orthographic processing (Stanovich & West, 1989), and suggest that frequent reading supports the acquisition of whole-word orthographic-lexical processing. However, a part of this relationship was moderated by children's cognitive ability. The interaction RAN × book-reading activity was

significant in non-word fluency in both grades and paragraph-reading fluency in grade 1, and the contribution of book reading was found only when RAN performance was high. This suggests that children with a high RAN performance who frequently engaged in book-reading activities tend to read the stimuli faster, while children with a low RAN performance do not benefit from the book-reading activity. The results indicate that not all children respond to book-reading activity, and individual support and interventions are needed depending on the child's cognitive ability.

IV. CONCLUSIONS

This was the first longitudinal study with Japanese orthographies, Hiragana, Katakana, and Kanji, which examined cognitive and home environmental factors associated with literacy acquisition. This study revealed that in addition to naming speed and phonological processing, visual perceptual skill and vocabulary are also important predictors of Japanese literacy acquisition. Moreover, naming speed and oral vocabulary as well as Hiragana reading accuracy in kindergarten were confirmed as predictors of Japanese reading and spelling development. This study also revealed the contribution of book-reading activity in kindergarten to subsequent Hiragana reading fluency and part of its relationship was moderated by children's cognitive ability. The

book-reading activity seems to play more of a role when children have high cognitive ability, while children with lower cognitive ability do not benefit as much from the book-reading activity. These findings have educational implications in that teachers should observe children carefully and be aware of children who show difficulties with Hiragana learning from earlier, primary grades, and specialised teachers or therapists need to provide support according to each child's cognitive development.