Contribution of the Incomplete Use of Macro-Rules to Reading Comprehension Difficulty in Japanese Fourth to Sixth Graders

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The purpose of the study was to investigate the background factors involved in reading comprehension difficulty by examining the contribution of the incomplete use of three macro-rules namely, the deletion rule, generalization rule, and construction rule as well as the poor understanding of the reversible relationships in single paragraphs. The results revealed that the performance of fourth to sixth graders who had difficulties with Kanji reading was low in understanding the reversible relationship of a text in a single paragraph; verbal working memory was shown to be the significant background factor. Deletion of the less important parts of sentences, namely, applying the macro-rule of deletion, was found to be the background factor of reading comprehension difficulty in all graders who had no difficulty with Kanji reading. It is clarified that the background factors of reading comprehension difficulty vary between children with or without Kanji reading difficulty. Consequently, special support for facilitating reading comprehension is needed differentially.

Key Words: reading comprehension impairment, main idea, risk factor, expository text, macro-rules

Introduction

Low performance in reading comprehension is considered to be a factor that prevents children's understanding of elementary school subjects. Tanaka (2006) investigated 84 Japanese fourth graders by administering the Kyoken-shiki reading achievement test. The results revealed that children scored poorly on the test items that assessed their understanding of a paragraph's main ideas. Because effective procedures for the facilitation of reading comprehension are required for supportive teaching, it is important to clarify the background factors involved in the poor understanding of a sentence's main idea/s.

A number of themes can be found in long sentences. Kintsch's (1998) model proposes that readers understand a topic based on multiple representations in each sentence. This understanding of topics in each sentence is called a micro-structure. Readers grasp the main idea of a paragraph by organizing these micro-structures. The main idea of a paragraph in this stage is referred to as the macro-structure of the lower dimension. Finally, readers grasp the main idea of whole sentences by organizing macro-structures of lower dimensions. The main idea of whole sentences is known as the macro-structure of the higher dimension. Kintsch (1998) indicated that macro-structures are generated by using three macro-rules: the deletion rule, the generalization rule, and the construction rule (van Dijk & Kintsch, 1983). When applying the deletion rule, redundant information of the main idea is deleted while constructing macro-structures. When applying the generalization rule, sentences with concrete information are replaced by generalized expressions. Finally, the
construction rule involves replacing multiple sentences with a sentence that conveys the ideas of the multiple sentences.

In relation to reading comprehension in elementary schools, Nishigaki (2002) found that children start to build cohesive representations of total sentences in the middle grades; thus, during this stage, they begin to use macro-rules for constructing macro-structures of sentences. Nishigaki (2002) found that early middle graders mainly used the deletion rule because they experience difficulties with the generalization and construction rules. It is inferred that children with low reading performance may have difficulty in applying the deletion rule. Accordingly, further research is needed to clarify the background factors for low performance involved in understanding the main ideas of sentences.

Ishiwatari and Muramoto (2011) investigated the effect of the formation of the macro-structure of a single paragraph on the comprehension of multiple-paragraph expository texts in accordance with Kintsch and van Dijk’s (1978) model. They found in their examination of 181 fourth and fifth graders that task performance for comprehending the main idea of a multiple-paragraph expository text is influenced by the macro-processing of a single paragraph as well as auditory working memory (WM). Within the three types of macro-rules, they mainly examined the processing of the generalization rule. A consideration of Ishiwatari and Muramoto’s (2011) results suggests the importance of studying the relative contribution of the three types of macro-rules so as to understand the causes of reading comprehension difficulty.

Sato, Narukawa, Naka, Mekaru, Nakamura, and Koike (2017) examined the background factors of low performance in reading comprehension by conducting multiple logistic analysis. They found that poor understanding of the reversible relationships of a single paragraph is a background factor involved in the difficulties of comprehending the main ideas of multiple paragraphs. Sato et al. (2017) found that Kanji reading difficulty contributes to reading comprehension difficulty independently. However, it is imperative to clarify the degrees of difficulty in decoding skills, which interfere with reading comprehension. In Japanese literacy, decoding skills correspond to Kanji reading and fluent kana reading. Because distinctive background factors that interfere with reading comprehension might be expected in the difficulty of decoding skills, it is rational to examine background factors separately in children with or without the clarified degree of decoding difficulty that interferes with reading comprehension.

Therefore, the purpose of this study was to investigate the background factors involved in reading comprehension difficulty by examining the contribution of the failure of applying three types of macro-rules and the poor understanding of reversible relationships in single paragraphs. As decoding skills, performances of Kanji reading and fluent kana reading that interfere with reading comprehension were evaluated by conducting Chi-squared Automatic Interaction Detector (CHAID) analysis. Furthermore, multiple logistic analysis was employed to evaluate the contribution of each background factor to reading comprehension difficulty in fourth to sixth grade children in relation to the difficulties they experienced in decoding skills.

**Method**

**Participants**

The participants included 1,186 elementary school students. Of these, 26 students who had worked on less than one third of all the tests were excluded from the analysis. Thus, 1,160 students were selected for analysis: 408 (211 females, 197 males), 392 (188 females, 204 males), and 360 (192 females, 168 males) fourth, fifth, and sixth graders, respectively. Resource room users were excluded.

Tokyo Gakugei University and each board of education reached an agreement to conduct the investigation. The agreement included compliance with protection of personal information, conditions regarding the publication of the investigation’s results at an academic society, the process of using the results as general educational information for classroom teaching, and the process of obtaining consent for participation from parents. All the participants were informed of the purpose and design of the study by means of a notice from the principal. Consent to participate was obtained from the parents during meetings with the classroom teachers.

**Materials**

The present study used multiple-paragraph (MP) text and single-paragraph (SP) texts. Low performance or non-attainment was evaluated for each test.
The method for giving answers and the evaluation criteria thereof are presented in Table 1. A score of 1 or less out of a possible score of 3 was regarded as non-attainment in accordance with Sato et al. (2017) for the multiple and single paragraphs. To examine the ability to read sentences, fluent searching of kana words, reading Kanji words, and auditory WM, the 10th percentile of scores was calculated and classified.

| Tests                | Method for giving answers                                                                 | Criteria of evaluation                      |
|----------------------|-------------------------------------------------------------------------------------------|---------------------------------------------|
| **Multiple-paragraph test** |                                                                                            |                                             |
| MP-MI test: A test to evaluate the comprehension of the main idea of a multiple-paragraph text | Participants were required to select one correct answer from three choices. | Maximum score was three. The scores of one or less were regarded as non-attainment. |
| **Single-paragraph test** |                                                                                            |                                             |
| SP-MI test: A test for selecting the main idea of a single-paragraph text | Participants were required to select one correct answer from three choices. | Maximum score was two. The scores of one or less were regarded as non-attainment. |
| SP-DR test: A test for selecting the redundant sentence of a single-paragraph text | Participants were required to select one correct answer from three choices. | Maximum score was two. The scores of one or less were regarded as non-attainment. |
| SP-GR test: A test for selecting the abstracted expression which represents the concrete information of three sentence | Participants were required to select one correct answer from three choices. | Maximum score was two. The scores of one or less were regarded as non-attainment. |
| SP-CR test: A test for selecting a sentence which induces the background of the situation from the concrete facts of three sentence | Participants were required to select one correct answer from three choices. | Maximum score was two. The scores of one or less were regarded as non-attainment. |
| SP-RR test: A test for understanding the reversible relationships in a single-paragraph text | Participants were required to write the answers. | In each part of the test, full marks were evaluated as an attainment. |
| **Basic skill test** |                                                                                            |                                             |
| Kana word-searching test | Participants were required to find and mark meaningful words from the field of kana in 60 seconds. | The number of words which marked correctly was measured. When number of correct item was lower than a 10th percentile value, it was evaluated as a low performance. |
| Reading Kanji words test | Participants were required to write the answers. | The number of correct answers was calculated for each participant. When number of correct item was lower than a 10th percentile value, it was evaluated as a low performance. |
| **Cognitive test** |                                                                                            |                                             |
| Auditory WM test | Participants were required to write the answers. | Performance was evaluated on a total scores for two types of test; auditory digit recall of forward order and auditory digit recall of ascending order. Total number of correct spans were calculated as scores. When scores were lower than a 10th percentile value, it was evaluated as a low performance. |
as low performance for each test in accordance with Naka, Yoshida, Kumoi, Ozeki, Igarashi, and Koike (2014).

Multiple-paragraph text for the comprehension of main ideas (MP-MI test). This test examined the comprehension of the main ideas (MI) of multiple paragraphs. In the MP-MI test, which Sato et al. (2017) employed, three test items were provided: Two items concentrated on the main ideas of the paragraphs and one item on the main ideas of whole sentences. The legibility of the sentences in the test corresponded to a fourth grade level (Sato et al., 2017).

Single-paragraph texts for understanding the main idea (SP-MI test). This test examined each participant’s understanding of the text's main idea. Both of the two test items in the test consisted of one paragraph of three sentences. Both items examined the children's understanding of the text's main idea. Each item was evaluated separately.

Single-paragraph texts for deletion rule (SP-DR test). This test examined the use of the deletion rule (DR). Deletion of redundant parts was tested in a single-paragraph text of three sentences. The test comprised two test items. While one was a translated item used in Kimura's (2013) study, the other was original item based on Kimura’s (2013) study. Both items examined children's understanding of the redundant sentences of a text. Each item was evaluated separately.

Single-paragraph texts for generalization rule (SP-GR test). This test, which consisted of two items, examined the use of the generalization rule (GR) to select abstracted expressions that represented the concrete information of three sentences.

Single-paragraph texts for construction rule (SP-CR test). This two-item test examined the use of the construction rule (CR) to determine a situation’s background from the concrete facts presented in three sentences.

Single-paragraph text for understanding reversible relationships (SP-RR test). This test, which Narukawa, Goto, Koike, and Inagaki (2010) used, was employed. The test, which examined the comprehension of reversible relationships (RR), involved a four-sentence paragraph. Each of the four test items evaluated an understanding of the reversible relationship of the text separately.

Basic skill test. The basic skill test consisted of the kana word-searching test and reading Kanji words test.

The kana word-searching test was developed by following the procedure suggested by Fujii, Yoshida, Jo, Okano, Koike, and Kumoi (2012). Meaningful and non-meaningful words written in kana were printed together in a field of kana letters. Each of the 14 lines of the test paper had 14 kana letters. Participants were given one minute to mark meaningful words with a pencil.

The reading Kanji words test included 16 items selected from lists of new Kanji words sourced from the national language textbook in preceding grades. The attributes of Kanji words, that is, familiarity and imageability have been found to affect the acquisition of reading Kanji words (Kumazawa, Goto, Kumoi, & Koike, 2011). The Kanji words whose attributes were confirmed to be within the range of Onda, Sato, Takimoto, Mekaru, Naka, and Koike’s (2015) study were selected.

Auditory WM test. The auditory WM test included auditory digit recall in presented and ascending order. Sequences of numbers were aurally presented. In the presented order test, the participants were required to write the numbers in their presented order. Four, five, and six digit spans were provided. In the test of ascending recall, they had to write the numbers in ascending order. Three, four, and five digit spans were provided. Two trials of each digit span were presented in the test phase.

Procedure
All tests were conducted during the middle of the first academic term in July. The participants followed the teachers’ instructions so as to complete each test. The tests were conducted in approximately 40 minutes during one session. Each school was entrusted to administer the tests in the correct order.

Analysis
To evaluate the combined occurrences of risk scores related to the non-attainment of the MP-MI test and low performance in the basic skill test, CHAID analysis was conducted. In CHAID analysis, frequency distributions of correct answers of the MP-MI test were differentiated according to the combination of scores in the basic skills test. The independence of these distributions was evaluated by a chi-squared test. The combinations of risk factors were displayed as tree view differentiated frequency distributions.
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To examine developmental changes in the performances of these tests, chi-squared analysis and residual analysis were applied to the contingency table in which numbers of children were listed in relation to each grade.

To evaluate the number of children with the non-attainment of the MP-MI test, a contingency table was prepared in each grade. The numbers of children were listed in relation to the belongingness of the differentiated frequency distribution of the results of CHAID analysis. Chi-squared analysis and residual analysis were applied to these tables.

By employing multiple logistic analysis, odds ratios (ORs) were calculated for occurrences of non-attainment in the MP-MI test for each distribution generated through CHAID analysis, which indicated the combinations of scores for the MP-MI test and the basic skills test. The explanatory variables included non-attainment of the single-paragraph test and low performance in the WM test. In relation to the SP-CR test for sixth graders, all children who showed attainment in the MP-MI test in Group B (a group classified through CHAID analysis) obtained full marks; therefore, the condition to calculate ORs was not satisfied. In the multiple logistic analysis, the ORs were calculated for plural objective variables (Groups A and B) at the same time. Consequently, the SP-CR test for sixth graders in Group A was also eliminated from the analysis. The SP-DR and SP-MI tests shared the same sentences. Furthermore, it was necessary to pass the SP-DR test so as to obtain the correct answers for the SP-MI test. Consequently, the children who demonstrated non-attainment in both the SP-DR and SP-MI tests were defined as those with non-attainment of the SP-MI test whereas those who demonstrated non-attainment of the SP-MI test, but passed the SP-DR test were regarded as those with non-attainment of SP-MI test.

Results

Performance for the MP-MI Test, SP-MI Test, SP-DR Test, SP-GR Test, SP-CR Test, and SP-RR Test

Bar graphs of the component ratios of the scores for multiple-paragraph and single-paragraph tests are depicted in Fig. 1. While the grades are shown on the vertical axis, the component ratio of the number of children is shown on the horizontal axis. The results revealed that the performance of 110 (26.9%), 62 (15.8%) and 29 (8.0%) fourth, fifth, and sixth graders,
respectively, in the MP-MI test was low. Chi-squared and residual analyses revealed that the number of children with a score of 0 or 1 in the fourth grade and those with a score of 2 or above in the sixth grade were significantly greater than the expected values \((p<.01)\) for the MP-MI, SP-DR, SP-MI, and SP-RR tests. Only the number of fourth graders with a score of 0 was significantly greater than the expected values \((p<.01)\) for the SP-CR test. These results revealed that the scores for each test increased as the children advanced through the grades.

**Performance in Basic Skills Test and Auditory WM Test**

Box-and-whisker diagrams of the scores of the kana word-searching test, reading Kanji words test, and auditory WM test are found in Fig. 2. The vertical and horizontal axes show the number of correct items or scores and the grades, respectively. The median values (quartile deviation) were 9.0 (5.0), 10.0 (4.0), and 11.0 (5.0) in the fourth, fifth, and sixth grade, respectively, for the kana word-searching test. The values for the scores of reading Kanji words test were 16.0 (1.0) for each grade. The values for the scores of the auditory WM test were 10.0 (3.0), 10.0 (2.0), and 10.5 (2.0) in the fourth, fifth, and sixth grade, respectively. The Kruskal–Wallis test revealed that the scores for the sixth grade were significantly higher than those of the fifth grade in the kana word-searching test \((p<.01)\) and auditory WM test \((p<.01)\).

**Background Factors Affecting Non-Attainment of the MP-MI Test**

To evaluate the effect of low performance in decoding skills, CHAID analysis was conducted. In CHAID analysis, the distribution of scores of the MP-MI test was classified according to explanatory variables and statistical differences of these distributions were evaluated by employing chi-squared values. In this study, the scores of the reading Kanji test and those of the kana word-searching test were used as explanatory variables. The results of the analysis are illustrated in Fig. 3. The vertical and horizontal axes indicate the component ratio of the number of children and scores of the MP-MI test, respectively. The scores of the reading Kanji test were detected in each grade as the first factor. The second factor was not detected. The total distribution of the scores of the MP-MI test in the fourth grade was differentiated into three distributions in accordance with the range of scores of the reading Kanji test: Below 14, 14 and 15, and 16. The distribution of the scores of the MP-MI test in the fifth grade was differentiated into two in accordance with the range of scores of the reading Kanji test: Below 15 and above or equal to 15. The distribution of scores of the MP-MI test in the

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![Fig. 2 Score Distributions of the Tests of kana Word-Searching, Reading Kanji Words, and Auditory WM](image)

![Fig. 3 The Distributions of the MP-MI Test According to the Classification of the Scores of Reading Kanji Words Test Based on CHAID Analysis](image)
sixth grade was differentiated into two according to the range of scores of the reading Kanji test: Below 14 and above or equal to 14. From the above results, it is indicated that 53 (13%), 52 (13.3%), and 55 (15.3%) of the fourth, fifth, and sixth graders, respectively, scored below the lowest range in the reading Kanji test. In the present study, these children were defined as those with low performance in the reading Kanji words tests. They corresponded to approximately the 10th percentile in each grade. This result suggests that children with scores below approximately the 10th percentile in the reading Kanji test tend to obtain lower scores in the MP-MI test; of these, some demonstrate non-attainment in the MP-MI test.

The children with reading comprehension difficulties were classified into three groups, namely, Groups A, B, and C. Group A consisted of children who showed non-attainment of the MP-MI test and low performance in the reading Kanji words tests. Group B consisted of children who showed non-attainment in the MP-MI test but did not show low performance in the reading Kanji words tests. The children who showed attainment in the MP-MI test were placed into Group C. There were 32 (7.8%), 23 (5.9%), and 18 (5.0%) children in Group A in the fourth, fifth, and sixth grades, respectively. Group B comprised 78 (19.1%), 39 (10.0%), and 11 (3.1%) fourth, fifth, and sixth graders, respectively.

The mean and SD of the scores of each test in Groups A, B, and C are presented in Table 2. The scores of the grades were compared for the Kruskal–Wallis and Steel-Dwass tests. With reference to Group A, none of the tests showed a significant difference between the grades. Significant differences were only found in the SP-RR test between the fourth grade and sixth grade in Group B. Furthermore, significant differences were found in the SP-MI test, SP-DR test, and SP-GR test between the fourth grade and sixth grade in Group C. Significant differences were found between the fourth and fifth grades, and fifth and sixth grades in the SP-RR test. Accordingly, the results showed that the children in Group C might be able to acquire the macro-rules as they advance through the grades. On the contrary,

| Table 2 The Results of the Multiple Comparison of the Tests for the Background Factors between Grades |
|-------------------------------------------------|---------------------------------|---------------------------------|-------------------|
| SP-MI test                                      | Group A                         | Group B                         | Group C           |
| Grade 4                                         | 0.25 (0.56)                     | 0.64 (0.80)                     | 1.04 (0.85)       |
| Grade 5                                         | 0.48 (0.65)                     | 0.74 (0.84)                     | 1.09 (0.89)       | * t=2.36 |
| Grade 6                                         | 0.67 (0.82)                     | 0.64 (0.88)                     | 1.19 (0.88)       |
| SP-DR test                                      | Grade 4                         | 0.88 (0.78)                     | 1.17 (0.90)       | 1.50 (0.80)       |
| Grade 5                                         | 0.83 (0.70)                     | 1.31 (0.88)                     | 1.55 (0.78)       | ** t=2.92 |
| Grade 6                                         | 1.11 (0.94)                     | 1.36 (0.88)                     | 1.67 (0.68)       |
| SP-GR test                                      | Grade 4                         | 0.50 (0.75)                     | 0.92 (0.80)       | 0.96 (0.77)       |
| Grade 5                                         | 0.74 (0.79)                     | 0.97 (0.77)                     | 1.07 (0.79)       | ** t=2.54 |
| Grade 6                                         | 0.89 (0.81)                     | 1.36 (0.77)                     | 1.11 (0.75)       |
| SP-CR test                                      | Grade 4                         | 0.78 (0.70)                     | 1.40 (0.65)       | 1.59 (0.56)       |
| Grade 5                                         | 1.04 (0.75)                     | 1.38 (0.66)                     | 1.62 (0.58)       | 1.59 (0.56)       |
| Grade 6                                         | 1.17 (0.76)                     | 1.73 (0.45)                     | 1.66 (0.57)       |
| SP-RR test                                      | Grade 4                         | 0.31 (0.88)                     | 0.96 (1.41)       | 1.72 (1.63)       |
| Grade 5                                         | 0.74 (1.26)                     | 1.64 (1.70)                     | 2.23 (1.68)       | ** t=3.61 |
| Grade 6                                         | 0.22 (0.92)                     | 2.45 (1.62)                     | 2.82 (1.46)       | ** t=4.49 |
| Auditory WM test                                | Grade 4                         | 7.53 (2.08)                     | 8.91 (2.06)       | 9.78 (1.86)       |
| Grade 5                                         | 7.30 (2.39)                     | 9.64 (2.01)                     | 9.99 (1.52)       |
| Grade 6                                         | 7.89 (3.12)                     | 10.18 (1.47)                    | 10.13 (1.57)      |

p<.01: **, p<.05: * , df=2

Note. The numbers show the mean of scores. The numbers in the parentheses shows the standard deviation. Significant differences are indicated by the t-value and asterisks.
the children in Groups A and B may have difficulty acquiring those rules.

In Table 3, the estimated ORs of children with non-attainment of the MP-MI test in Groups A and B are presented. With regard to group A, significant ORs were found in the non-attainment of the SP-RR test and low performance in the verbal WM test in each of the grades. Significant ORs were also found in the SP-CR test in the fourth and fifth grades, and in the SP-DR test in the fourth graders. In relation to Group B, significant ORs were found in the non-attainment of the SP-DR test in all the grades. Significant ORs were also found in the SP-MI test and SP-RR test in the fourth grade. These results reveal that the background factors involved in difficulties encountered in reading comprehension vary by group.

### Discussion

**Difficulties of Reading Comprehension and Support Needs**

In English literature, children with reading comprehension difficulties are believed to demonstrate a pattern of reading difficulties that contrasts sharply with that of children with reading disabilities. Hulme and Snowling (2009) found that these children recognize words accurately, but have problems in understanding the main idea of what they are able to read aloud with normal accuracy and speed. Although special support were indicated for Japanese children who read words accurately, but had difficulty comprehending paragraphs, the details of these children’s difficulties has not been fully examined. Tanaka (2008) investigated the attainment level of a Kyokenshiki reading achievement test for 480 to 630 children in each grade. He found between 15.1% and 23.9% of children in each grade demonstrated stage 1st or stage 2nd levels of reading comprehension, which were below that of full attainment of 5th level.

The present study investigated low performance in understanding the main ideas of texts with multiple paragraphs in relation to the comorbidity of Kanji reading difficulty. The readability of the examined texts, which were the same in each grade, corresponded to the fourth grade. Furthermore, the reading comprehension performance of 110 (26.9%), 62 (15.8%), and 29 (8.0%) fourth, fifth, and sixth graders, respectively, was poor. Because special support
needs have been suggested for children with low performance below approximately the 10th percentile, it might be important to evaluate these needs and to supply facilitating instruction in reading comprehension, especially for fifth and sixth graders.

In relation to the comorbidity of Kanji reading difficulty, CHAID analysis was conducted in the study. In each grade, the total distribution of the scores of the MP-MI test varied according to the range of the reading Kanji test scores. The number of children with scores below the lowest range of the Kanji reading test corresponded to approximately the 10th percentile in each grade. The number of children (rate) who showed difficulties in both reading comprehension and low performance in Kanji reading, children of group A, included 32 (7.8%), 23 (5.9%), and 18 (5.0%) in the fourth, fifth, and sixth grade, respectively. Those who only showed difficulties of reading comprehension without low performance in Kanji reading, children of group B, included 78 (19.1%), 39 (10.0%), and 11 (3.1%) in the fourth, fifth, and sixth grades, respectively. While children with Kanji reading difficulty tend to show a constant ratio in reading comprehension difficulty in the fourth to sixth grades, children without Kanji reading difficulty show a remarkable decrease in reading comprehension difficulty in these grades. This indicates that the background factors of reading comprehension difficulty might vary between children with or without Kanji reading difficulty.

Background Factors of Reading Comprehension Difficulty

With regard to the background factors of reading comprehension difficulty, ORs using multiple logistic analysis were examined in the present study. With reference to the children without Kanji reading difficulty (group B), significant ORs were found in the non-attainment of the SP-DR test in each grade. It was suggested that children with non-attainment in the SP-DR test might have difficulty in applying the macro-rule of deletion. Brown and Smiley (1977) revealed that middle graders experienced difficulty deleting less important parts of sentences. Ishiwatari and Muramoto (2011), especially for children with Kanji reading difficulty, it might be important to support weaknesses of auditory WM as well as difficulties in understanding the relationship among sentences in a paragraph. Brown, Day, and Jones (1983) revealed that summarizing texts is enhanced by making rough drafts of small part of sentences among some fifth and seventh graders. Making rough drafts might reduce the demands on auditory WM for sum-
marizing texts. However, further research is needed to clarify effective methods for children with Kanji reading difficulty, which may facilitate the understanding of the relationship of sentences by making rough drafts of small parts of sentences. In the present study, fluent writing skills were necessary in answering the reading Kanji words test and auditory WM test. However, as the influence of low performance in these skills on the difficulty of reading comprehension was not examined in the present study, further research is needed to investigate this.

Endnote

The following tests were printed in Japanese.

1) SP-DR test
Select a redundant sentence to summarize the sentences below.
1. I and Taro played with a ball.
2. The ball was yellow.
3. Playing with a ball was so much fun.
   The correct answer: 2

2) SP-MI test
Select a sentence that summarizes the sentences given in the SP-DR test.
1. The color of the ball was yellow.
2. I played with my friend, and it was fun.
3. The friend I played with a ball was Taro.
   The correct answer: 2

3) SP-GR test
Select a sentence that summarizes the following three sentences: Hanako played with blocks.
Then, Hanako played with dolls. After that, Hanako enjoyed playing house.
1. After playing with blocks, Hanako played with dolls.
2. Hanako lost interesting in playing with blocks.
3. Hanako was playing with toys.
   The correct answer: 3

4) SP-CR test
Select a sentence that summarizes the following three sentences: My father went to the station. He bought a ticket to Tokyo. He took the 10:10 train.
1. My father went to the station and bought a ticket.
2. My father went to Tokyo by train.
3. My father also bought lunch.
   The correct answer: 2

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