Evaluation of the effectiveness of "analytic" and "whole-word" approaches for teaching Chinese dyslexic children double character words

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The purpose of this project was to evaluate the effectiveness of different instructional approaches for Chinese dyslexic children with different types of problems in word recognition. Based on the dual-route model of reading, readers may use either the lexical (words are recognized as wholes) or sub-lexical (words are recognized through grapheme-phoneme correspondence) procedure to read. Castles & Coltheart (1993) have provided evidence for the existence of these two mechanisms in English reading and they suggest deficits in one and/or the other mechanism lead to different patterns of reading disability. Surface dyslexia results from impairment of the lexical procedure with an intact phonological route to reading. Deep dyslexia results from a highly selective deficit in the grapheme-phoneme transformation mechanism. In the case of Chinese reading, Elliott & Ho (1996) also found the existence of surface and deep dyslexic reading patterns in the Chinese reading disabled subjects. This study made use of the analytic approach with a focus on highlighting the phonetic components within the words as well as the whole-word approach with a focus on recognizing words as " wholes" to teach those subjects with different patterns of reading problems.The results indicated that the analytic method was useful for teaching different sub-types of readers double irregular character words.

Instructional effects of the analytic and whole-word approaches diversified for teaching different sub-types of readers single character and double character words (Ho &Elliott, 2000). In general, the surface dyslexics performed better under the analytic instruction in single character word reading while they found little difference between the use of analytic and whole word methods in double word reading. On the other hand, the deep dyslexics found that whole word instruction was more appropriate for both single and double character word learning. The normal and subjects with both dyslexias had similar performance patterns. Both two sub-types of readers preferred the analytic instruction for single word reading and whole word instruction for double character reading. It can be seen that other than that of the instructional methods, the nature of Chinese words had played a role on the learning outcomes of the readers.

Based on the phonological regularity principle, the double character words could have the following combinations: double regular character (RR) word, double irregular word (II), one regular one irregular character (RI) word and one irregular one regular character word (IR). The regular characters contain phonetic hinting information whereas the irregular characters do not follow the regularity rule and have no sound clues.

In the previous experiment, the double character word consisted of one known character and one unknown character. The known character played the role as the phonetic component as that the phonetic part in a single character word. The combination variable of those double character words was not taken into consideration in the previous experiment.

In the present study, it was our interest to investigate the impact of the four different types of double character words on the teaching of different sub-types of readers.

The purpose of this experiment was to further investigate the efficacy of analytic and whole-word for various sub-types of dyslexia in the acquisition of double character word recognition skill.

METHOD

Subjects

Ten subjects from each category (i.e., normal, surface, deep and both dyslexics) were chosen for the present experiment.

Stimulus materials

Eight double character words of each category, i.e., RR, II, RI, IR, were derived from the Chinese Vocabulary Used in Primary Schools in Hong Kong (Educational Research Establishment, Education Department, 1979), Primary Syllabus in Chinese (Curriculum Development Council, Education Department, 1990), and Two Thousand Most Frequency Used Chinese Characters (Ho, 1993). (See Appendix I). The 32 double character words were then divided into two lists: 1) , , , , , ; 2) , , , , , . The words were categorized into two lists, which consisted of 4 RR, 4 II, 4 RI, and 4 IR words, in order to help preparation time and eliminate the possibility of error during the recombination of words and conditions for different students

The two lists of double character words were balanced to contain an equal number of each category of words. In addition, there was no significant difference in the word frequency, the number of strokes and the facility value of each pair of the words used in the lists. The facility value is referred to as the difficulty level of writing the character.

The 32 words were printed on 12×6 cm white cards and laminated with plastic. In addition, each character within the words was prepared in separate laminated white cards of 6×6 cm for instructional purpose in the analytic method.

In the present experiment, characters in the four types of double character words were novel to the subjects. The relationship of the two characters in the present experiment was different from the first experiment.

Design

Repeated measures of a 3-way analysis of variance (ANOVA) were carried out on the data of the proportion mean of correct responses. The repeated-measures factor were instructional method (analytic, whole-word) and word type (RR, RI, IR, II), and the between-subjects factor was reading group (normal, surface, deep, both). In particular, statistical analyses tested two contrasts in reading group [i.e., surface versus deep, and normal versus both] and two contrasts in word type [i.e., RR versus II, and RI versus IR]. The grouping of subjects and the presentation of word lists and instructional methods were similar to those in the first experiment.

Procedure

There were two treatment conditions and all the words were categorized into 2 groups, each group consisting of 4 words from each category of words (i.e., two regular character word, one regular one irregular character word, one irregular one regular character word, two irregular word). The order of the presentation of the 32 double character words of four types was randomly selected for presentation.

RESULTS

Table 4

Mean correct responses of two instructional methods in four types of double character word conditions for the four groups of subjects

Reader	Treatment		
	Word type	Analytic	Whole word
Normal	RR	.96 (.06)	.93 (.12)
	RI	.78 (.11)	.77 (.20)
	IR	.79 (.14)	.82 (.14)
	II	.83 (.15)	.76 (.16)
Surface	RR	. 78 (.11)	. 77 (.14)
	RI	. 45 (.21)	. 41 (.26)
	IR	. 50 (.15)	. 54 (.21)
	II	. 50 (.30)	. 40 (.24)
Deep	RR	. 78 (.25)	. 78 (.28)
	RI	. 59 (.23)	. 54 (.31)
	IR	. 57 (.24)	. 51 (.24)
	II	. 62 (.22)	. 58 (.19)
Both	RR	. 64 (.19)	. 68 (.21)
	RI	. 47 (.18)	. 41 (.20)
	IR	. 60 (.07)	. 46 (.16)
	II	. 51 (.22)	. 39 (.12)

Comparison between deep and surface dyslexics.

Insert Figure 1 about here

Observation of the Figure 1 indicates that both the surface and deep dyslexics showed a similar pattern of reading performance in RR and II word reading. No significant interaction

was detected for the 3-way ANOVA of surface versus deep and treatment and RR versus II words [$F(1,36)=.14$, $p>.05$]. Their performance under the analytic instruction in RR word reading did not differ from that of the whole word instruction. Both the surface and deep dyslexics preferred to use the analytic instruction to read II words.

In RI and IR word reading, the surface and deep dyslexics found that the difference between the use of analytic and whole word methods to learn to read was very small. Again, no significant interaction for surface versus deep and treatment and RI versus IR was observed [$F(1,36)=.60$, $p>.05$].

Comparison of normal and subjects with both dyslexias

Insert Figure 2 about here

It was shown in Table 1 that the preferences of both normal and subjects with both dyslexias for teaching methods were similar. Both these two sub-types of readers found no differences to use the analytic and whole word methods to learn to read RR words. Both types of readers performed better under the analytic method in reading II words. The normal and subjects with both dyslexias also showed a similar performance pattern in RI and IR word reading. They found that both analytic and whole word methods had a similar effect on RI word as well as IR word reading.

Comparison of effects of different types of double character words on different types of readers

Insert Figure 3 about here

It has been mentioned that different combinations of double character words might have an impact on the learning outcomes of different sub-types of dyslexics. This assumption was confirmed by the significant interaction between surface versus deep dyslexics and RR versus II words, [$F(1,36)=4.58$, $p<.05$]. This result indicated that the surface dyslexic children performed the same as the deep dyslexic children in the RR word reading. However, the surface dyslexic children differed from the deep dyslexic children in the II word condition.

Insert Figure 4 about here

Interaction was also observed between surface versus deep dyslexics and RI versus IR words, [$F(1,36)=4.43$, $p<.05$]. The surface dyslexics particularly performed worse than the deep dyslexics did in RI word recognition.

Comparison of effects of analytic and whole-word methods on different types of double character words

Insert Figure 5 about here

A statistically significant interaction of treatment with RR versus II words was obtained in this experiment, [$F(1,36)=4.19$, $p<.05$]. Figure 5 shows that different effects between the analytic and whole word instructional methods were shown on the teaching of double irregular character words. The analytic instructional method seemed to be a more effective teaching approach for the double irregular character words. In teaching the double character words, it is important to highlight the sound of the individual characters.

DISCUSSION

Table 2

Summary of the findings for the effectiveness of the two instructional methods on teaching four sub-types of readers different types of double character words

	Analytic				Whole word			
	RR	RI	IR	II	RR	RI	IR	II
Normal	✓	✓	✓	✓	✓	✓	✓	
Surface	✓	✓	✓	✓	✓	✓	✓	
Deep	✓	✓	✓	✓	✓	✓	✓	
Both	✓	✓	✓	✓	✓	✓	✓	

With inspection of Table 2, it was shown that the two instructional methods made no difference for all sub-types of readers to learn to read RR, RI and IR words. It was consistent that all readers found the analytic method more effective for reading II words.

As the characters within the II words in this experiment were unfamiliar and unknown to the children, readers tended to examine each of the characters before they were able to process the whole compound words. In addition, the II words contain no phonological information and sound clues within these II words. The analytic approach provided the children the opportunity to decompose the II words into character components before the introduction of the whole terms. This implies that the unit for processing difficult II words would be the character components instead of the whole double character words. It was important to analyze the words into character components if the words were unfamiliar to the readers.

The results of this study also showed that the combination of double character words influenced the learning performance of the surface and deep dyslexics. It was found that the performance of the surface dyslexics at recognizing the II words as well as the RI words was poorer than that of the deep dyslexics. It was not difficult to understand as the surface dyslexics had a difficulty at reading II words. To process II words of no phonological components depends very much on the lexical procedure. However, it was a surprising result that the surface dyslexics did not have desirable performance as the deep dyslexics did in the RI word reading. The RI words consisted of the regular character in the first position and the irregular character in the second position. It was supposed that the surface should have no difficulty in using the sub-lexical procedure to read the regular characters. This might be due to the fact that they were not able to make use of the sound clue from the character in the first position.

In fact, the character in the first position of a double character word was supposed to play a more important role than that in the second position for cueing the pronunciation of the whole word. In this experiment, the analytic instruction highlighted the individual character as the sound clue of the whole compound word. The phonetic component within the single character had not been used. In the next experiment, it would be useful to redesign the presentation of the analytic instruction. That is, a) to read the phonetic component of the single character; b) to read the single character and c) to read the whole double character word. The major difference with the previous experiment was the addition of the first step.