



# Contributions of Morphological Awareness and Reading Fluency to Uyghur Children's Reading Comprehension

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**How to cite this paper:** Gu, J.Y. (2024) Contributions of Morphological Awareness and Reading Fluency to Uyghur Children's Reading Comprehension. *Open Access Library Journal*, 11: e12000.  
<https://doi.org/10.4236/oalib.1112000>

**Received:** July 24, 2024

**Accepted:** September 22, 2024

**Published:** September 25, 2024

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## Abstract

This study investigates the influence of Chinese morphological awareness and reading fluency on reading comprehension, as well as the mediating role of reading fluency. The participants were 169 Uyghur children. Regression analysis was employed to examine the predictive effects of homophone morphological awareness and reading fluency on reading comprehension. The results revealed that both homophone morphological awareness and reading fluency had relatively stable predictive effects on reading comprehension. Additionally, homophone morphological awareness also had a certain predictive effect on reading fluency. It was found that morphological awareness can influence reading comprehension through reading fluency. These findings highlight the important role of Chinese morphological awareness in reading comprehension and its promotion through reading fluency. Therefore, schools and teachers in minority areas can enhance students' reading comprehension abilities by strengthening their morphological awareness and reading fluency.

## Subject Areas

Linguistics

## Keywords

Morphological Awareness, Reading Comprehension, Reading Fluency, Uyghur Children

## 1. Introduction

Reading comprehension involves the construction of meaning from text by decoding words and integrating both bottom-up word recognition and top-down

comprehension processes [1]. Fundamental to learning to read is metalinguistic awareness [2]. Research indicates that phonological awareness plays a critical role not only in phonetic scripts but also in logographic scripts like Chinese [3], underscoring its importance in reading acquisition.

However, reading goes beyond mere conversion of orthographic forms into phonological forms; it primarily involves mapping phonological forms to semantic information for comprehension and the development of reading skills.

Morphemes, as the smallest meaningful units, possess semantic, phonological, and grammatical properties. Morphological awareness refers to children's ability to manipulate morphemes cognitively and operationally, involving the analysis of word structure and meaning within a language [4]. In reading, morphological awareness facilitates the conveyance of semantic, phonological, and syntactic information, thereby aiding comprehension [5]. Hence, morphological awareness plays a crucial role in children's reading development.

In Chinese, due to its relatively simple phonological system, direct correspondence between characters, syllables, and morphemes, and variability in word positioning, morphological awareness assumes particular importance in reading development [6].

This study, guided by cognitive resources and automatization theories, aims to explore how morphological awareness influences reading comprehension among Uyghur children, and how reading fluency mediates this relationship. The findings seek to elucidate universal and specific patterns in Chinese reading development among children, offering insights into reading instruction in minority schools.

### 1.1. Structure of Chinese Morphological Awareness

Morphological Awareness (MA) refers to the conscious understanding of a word's morphemic structure and the ability to analyze and manipulate that structure [7]. This awareness is then applied in the process of visual word recognition [8]. Additionally, MA involves knowledge of the meaningful components of words [9].

Language learners utilize morphological awareness by breaking down unfamiliar, morphologically complex words into their constituent morphemes. They can then apply morphological rules to deduce the meanings of these unknown words [10]. Given its ability to aid in the inference of meanings for unfamiliar words, morphological awareness is considered crucial for the development of vocabulary knowledge and word learning [11].

The nature of morphological awareness varies across different language systems, particularly due to the unique characteristics of each language. For instance, Chinese characters are logographic, combining form, sound, and meaning within a single character. Consequently, Chinese morphological awareness exhibits distinct features. Researchers, such as Liu, McBride-Chang, Wong, Shu, and Wong, have categorized Chinese morphological awareness into two levels: morpheme level and morpheme structure level.

At the morpheme level, Chinese morphological awareness involves children's ability to identify and manipulate specific morphemes, including homophone and homograph awareness. Homophone awareness focuses on distinguishing words that share the same pronunciation. Given the abundance of homophones in Chinese, where identical syllables may have different characters and meanings, relying solely on phonetic cues is insufficient for vocabulary comprehension and reading development. Therefore, children must develop morpheme awareness to connect sounds with meanings [12]. Consequently, children proficient in homophone morphological awareness demonstrate enhanced vocabulary understanding and improved reading comprehension skills.

Similarly, homograph morphological awareness involves recognizing that a single character can convey multiple meanings in different contexts. In Chinese, many characters are polysemous, possessing the same form (identical pronunciation and character) but differing meanings. Understanding the morphemes within a word and its semantic context is crucial for comprehending meaning during reading [13]. Children with strong homograph morphological awareness achieve more precise vocabulary comprehension, can more readily discern meanings, and thus advance in their reading abilities.

Compound morphological awareness pertains to children's understanding of word internal structure and their capacity to combine key morphemes to form new words. Given the absence of distinct word boundaries in Chinese, children with proficient compound morphological awareness excel in segmenting words at the word level. This ability enables them to use their knowledge of key morphemes to infer unfamiliar vocabulary meanings swiftly, facilitating rapid text comprehension.

## **1.2. The Role of Morphological Awareness in Reading Comprehension**

How does morphological awareness contribute to children's reading development? Researchers have explored the distinct role of morphology in word recognition, separate from orthography and semantics, using the priming paradigm. Studies demonstrate that morphological relationships between prime and target words facilitate word recognition, indicating an independent psychological representation of morphology [14]. Zhou and colleagues proposed a multi-level representation model wherein both whole words and morphemes exist at the semantic level. The interaction between whole word and morpheme representations influences reading, with morphology impacting form, sound, and meaning interactions.

In Chinese, which lacks fixed morphological structures and visual cues like spaces, reading heavily relies on morphological processing. Children's morphological awareness enhances sensitivity to meaning, reducing reliance on context [15]. Empirical studies underscore the crucial role of morphological awareness in Chinese children's reading comprehension [16]. For instance, Li Hong et al. found

morphological awareness contributed uniquely to reading comprehension even after accounting for phonological awareness and rapid naming.

Research involving children with reading difficulties reinforces these findings. Shu *et al.* studied fifth and sixth-graders in Chinese mainland with reading disabilities, noting that homophonic morpheme awareness independently predicted reading comprehension. Similarly, Zhang *et al.* identified compound morpheme awareness as crucial for predicting and distinguishing between children with and without reading difficulties in Beijing and Hong Kong.

### 1.3. The Mediating Role of Reading Fluency

Recent research indicates that reading fluency plays a crucial role in reading comprehension [17]. Reading fluency encompasses the reader's ability to decode text accurately and swiftly. According to cognitive resources and automatization theory [18], an individual's cognitive resources are limited, and focusing on decoding can divert attention from understanding meaning. Conversely, automating word decoding reduces the cognitive load, leaving more resources for comprehension.

A multidimensional perspective on fluency [19] suggests it integrates various skills, including phonological and morphological processing. This is particularly critical in languages like Chinese, where characters may share sounds or meanings. Understanding morphemes is essential for precise word recognition [20], promoting fluency by linking spoken and written forms efficiently.

However, studies on word-level reading fluency as a mediator are limited, particularly among Language Minority learners acquiring English as a second language, yielding inconsistent results. For instance, Kieffer and Box found word-level reading fluency partially mediated outcomes for Spanish-speaking sixth graders versus native English speakers. In contrast, another study with similar participants did not confirm this effect [21]. Additionally, while morphological awareness predicted fluency across diverse Language Minority groups, it did not consistently predict comprehension, suggesting complex acquisition patterns among second-language learners.

## 2. Research Design

The subjects of this study were Uyghur children from three elementary schools in Turpan, Kashgar, and Urumqi, respectively, in third grade (60), fourth grade (54), and fifth grade (55). Two morpheme awareness test tasks (homophone awareness task and homograph awareness task) were used to examine whether Uyghur children's Chinese morpheme awareness was a stable predictor of reading comprehension and whether word reading fluency played a mediating role. Since general cognitive ability and phonological awareness have been found to be closely related to grapheme reading and reading comprehension [22], general cognitive ability and phonological awareness were also included in the present study as control variables to examine the relationship between morpheme awareness, reading fluency and reading comprehension.

## 2.1. Research Instruments

### 2.1.1. Morphological Awareness Task

We will examine both homophone awareness and homograph awareness, ranging from the ability of judgment, production, oddity tests and so on. The morphological awareness test had a split-half reliability coefficient (Spearman-Brown) of 0.77 ( $n = 106$ ).

#### Homograph awareness task

This task consists of 20 true or false questions focused on homograph awareness, with 1 point assigned to each item. Students were asked to determine whether the meaning of the marked morphemes in two words is identical or not. For example, they were asked to consider the morpheme “慧” in “智慧” or “聪慧” or the morpheme “面” in “面包” or “面子”.

#### Homophone awareness task

There were ten tasks in homophone awareness tests, with 8 points assigned to each item. A homophone generating task is used, where ten words are given and students are asked to form words with different homophones of the marked morphemes, the more the better (The upper limit is 8.), and morphemes they do not know can be replaced with pinyin. For example, here's a word “月亮”. They were asked to consider different homophones of “月”, and form words with those homophones like “阅读”、“喜悦”、“翻越”, etc.

### 2.1.2. Reading Comprehension

The reading comprehension task comprises three subtests, encompassing both short-text and long-text reading. The split-half reliability coefficient (Spearman-Brown) for these tests is denoted as 0.64 ( $n = 125$ ). The first subtest consists of 10 items of short sentence readings with 10 points, 15 sets of paragraph readings with 15 points. Take one example from the paragraph reading, “她很活泼, 说话很有趣, 总能给我们带来欢乐, 我们都很喜欢和她在一起。(she is very outgoing and funny, and always brings us happiness, so we all like to be with her).” And students would choose one from these four items: “A. 乐观和友善的人; B. 音高和小气的人; C. 内向和胆小的人; D. 话不太多的人” Another example is from short sentence reading that includes the multiple choices of adverbs (e.g, 直到, 一直), prepositions (e.g, 在, 下), negators (e.g, 没有, 不用), passive makers (e.g, 被). The second subtest of 10 items asked students to reorder the given sentences based on their understanding and the logic of the events. For example, the following sentences appeared randomly and students were expected to reorder the event (C→B→A) “A. 小明知道猫咪可能没有家人照顾它, 所以他下定决心要带回家给它喂食和照顾。B. 他发现这只猫咪很瘦, 毛发也很脏。C. 小明今天去学校的路上看到了一只猫咪。” The third part is a long text reading, which was a story of “哪吒闹海”. There are 20 multiple choices, one point for each. The main focus of the questions was to assess students' comprehension of the Chinese words and sentences present in the article. Moreover, we also add two short answer questions that ask students to make in-depth thinking. For instance, “哪吒杀死坏蛋后可能

有多种不同的感受, 比如兴奋、自豪、遗憾等, 你能说说他可能会有什么感受并说说原因呢吗?”

### 2.1.3. Reading Fluency Test

A 5-minute silent reading task was conducted, consisting of 75 simple sentences arranged in increasing order of sentence length. Each sentence was worth one point. For example, “Tiananmen Square is in Beijing.” (True) “Tigers like to eat green grass.” (False) During the experiment, participants were required to quickly determine the meaning of the sentences within 5 minutes. The more sentences they correctly identified, the faster their reading speed at the sentence level. The final score was calculated by dividing the total number of correctly answered items by the total time.

## 2.2. Data Analysis

Data analysis was conducted using SPSS 21.0. Descriptive statistics were computed for each grade level, and correlation coefficients were calculated to examine the relationships between morphological awareness, reading fluency, reading comprehension, and other variables. Regression analyses were then performed to test the predictive role of morphological awareness on reading comprehension and the mediating effect of word and character reading fluency between morphological awareness and reading comprehension. General cognitive abilities and phonological awareness were included as control variables.

## 3. Results

### 3.1. Descriptive Statistics and Correlation Analysis

From **Table 1** and **Table 2**, it can be seen that there is a significant correlation between reading fluency and reading comprehension, but there is no significant correlation between the other variables.

From **Table 3** and **Table 4**, it is clear that there is a significant correlation between homophone awareness, reading fluency and reading comprehension.

**Table 1.** Descriptive statistics in grade 3.

	Mean	S.D.	N
RT	26.77	8.697	60
RC	10.50	4.164	60
SRC	19.40	9.597	60
LC	16.90	6.532	60
MA1	10.33	2.741	60
MA3	7.633	6.3432	60
RF	180.5233	36.75414	60

**Table 2.** Correlations in grade 3.

		RT	RC	SRC	LC	MA1	MA3	RF
	r	1	0.425**	0.412**	0.208	0.029	0.337**	0.436**
RT	Sig.		0.001	0.001	0.112	0.826	0.008	0.001
	N	60	60	60	60	60	60	60
	r	0.425**	1	0.711**	0.080	0.049	0.251	0.346**
RC	Sig.	0.001		0.000	0.545	0.710	0.053	0.007
	N	60	60	60	60	60	60	60
	r	0.412**	0.711**	1	-0.111	0.052	0.245	0.397**
SRC	Sig.	0.001	0.000		0.398	0.696	0.059	0.002
	N	60	60	60	60	60	60	60
	r	0.208	0.080	-0.111	1	0.020	0.331**	0.326*
LC	Sig.	0.112	0.545	0.398		0.880	0.010	0.011
	N	60	60	60	60	60	60	60
	r	0.029	0.049	0.052	0.020	1	0.208	0.170
MA1	Sig.	0.826	0.710	0.696	0.880		0.111	0.193
	N	60	60	60	60	60	60	60
	r	0.337**	0.251	0.245	0.331**	0.208	1	0.209
MA3	Sig.	0.008	0.053	0.059	0.010	0.111		0.109
	N	60	60	60	60	60	60	60
	r	0.436**	0.346**	0.397**	0.326*	0.170	0.209	1
RF	Sig.	0.001	0.007	0.002	0.011	0.193	0.109	
	N	60	60	60	60	60	60	60

\*\*\*Correlation is significant at the 0.001 level. \*\*Correlation is significant at the 0.01 level.

\*Correlation is significant at the 0.05 level.

**Table 3.** Descriptive analysis in grade 4.

	Mean	S.D.	N
RT	37.96	7.785	54
RC	13.49	4.870	53
SRC	24.98	7.512	54
LC	27.06	5.178	54
MA1	11.72	2.949	54
MA3	12.09	9.162	54
RF	216.3185	33.14126	54

**Table 4.** Correlations in grade 4.

		RT	RC	SRC	LC	MA1	MA3	RF
RT	r	1	0.260	0.348**	0.074	-0.074	0.223	0.424**
	Sig.		0.060	0.010	0.595	0.593	0.106	0.001
	N	54	53	54	54	54	54	54
RC	r	0.260	1	0.554**	0.281*	0.243	0.423**	0.509**
	Sig.	0.060		0.000	0.041	0.080	0.002	0.000
	N	53	53	53	53	53	53	53
SRC	r	0.348**	0.554**	1	0.070	0.071	0.314*	0.566**
	Sig.	0.010	0.000		0.613	0.608	0.021	0.000
	N	54	53	54	54	54	54	54
LC	r	0.074	0.281*	0.070	1	0.257	0.075	0.280*
	Sig.	0.595	0.041	0.613		0.061	0.592	0.040
	N	54	53	54	54	54	54	54
MA1	r	-0.074	0.243	0.071	0.257	1	0.344*	0.237
	Sig.	0.593	0.080	0.608	0.061		0.011	0.085
	N	54	53	54	54	54	54	54
MA3	r	0.223	0.423**	0.314*	0.075	0.344*	1	0.399**
	Sig.	0.106	0.002	0.021	0.592	0.011		0.003
	N	54	53	54	54	54	54	54
RF	r	0.424**	0.509**	0.566**	0.280*	0.237	0.399**	1
	Sig.	0.001	0.000	0.000	0.040	0.085	0.003	
	N	54	53	54	54	54	54	54

\*\*\*Correlation is significant at the 0.001 level. \*\*Correlation is significant at the 0.01 level.  
\*Correlation is significant at the 0.05 level.

From **Table 5** and **Table 6**, it can be seen that there is a significant correlation between homophonic morpheme awareness, reading fluency and reading comprehension.

**Table 5.** Descriptive analysis in grade 5.

	Mean	S.D.	N
RT	37.98	11.120	55
RC	15.71	5.583	55
SRC	25.15	7.030	55
LC	28.98	4.253	55

## Continued

MA1	12.33	2.037	55
MA3	23.64	12.833	55
RF	231.1630	38.66471	54

**Table 6.** Correlations in grade 5.

		RT	RC	SRC	LC	MA1	MA3	RF
	r	1	0.736**	0.577**	0.177	0.204	0.714**	0.623**
RT	Sig.		0.000	0.000	0.196	0.136	0.000	0.000
	N	55	55	55	55	55	55	54
	r	0.736**	1	0.690**	0.122	0.191	0.745**	0.758**
RC	Sig.	0.000		0.000	0.374	0.163	0.000	0.000
	N	55	55	55	55	55	55	54
	r	0.577**	0.690**	1	0.148	0.387**	0.655**	0.749**
SRC	Sig.	0.000	0.000		0.281	0.004	0.000	0.000
	N	55	55	55	55	55	55	54
	r	0.177	0.122	0.148	1	0.123	0.261	0.184
LC	Sig.	0.196	0.374	0.281		0.373	0.054	0.182
	N	55	55	55	55	55	55	54
	r	0.204	0.191	0.387**	0.123	1	0.341*	0.442**
MA1	Sig.	0.136	0.163	0.004	0.373		0.011	0.001
	N	55	55	55	55	55	55	54
	r	0.714**	0.745**	0.655**	0.261	0.341*	1	0.747**
MA3	Sig.	0.000	0.000	0.000	0.054	0.011		0.000
	N	55	55	55	55	55	55	54
	r	0.623**	0.758**	0.749**	0.184	0.442**	0.747**	1
RF	Sig.	0.000	0.000	0.000	0.182	0.001	0.000	
	N	54	54	54	54	54	54	54

\*\*\*Correlation is significant at the 0.001 level. \*\*Correlation is significant at the 0.01 level.

\*Correlation is significant at the 0.05 level.

### 3.2. Regression Analysis

**Table 7** shows that after controlling for general cognitive ability and phonological awareness, morpheme awareness and reading fluency did not significantly predict reading comprehension.

As can be seen from **Table 8**, after controlling for general cognitive ability and phonological awareness, homophonic morpheme awareness and fluency remained significant predictors of reading comprehension.

**Table 7.** Grade 3.

		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	S.E.	Beta		
1	(Constant)	5.048	1.600		3.155	0.003
	RT	0.204	0.057	0.425	3.580	0.001
2	(Constant)	5.120	1.896		2.701	0.009
	RT	0.205	0.059	0.427	3.487	0.001
	LC	-0.006	0.078	-0.009	-0.073	0.942
3	(Constant)	4.560	2.652		1.720	0.091
	RT	0.204	0.059	0.426	3.450	0.001
	LC	-0.006	0.079	-0.009	-0.076	0.939
	MA1	0.056	0.184	0.037	0.305	0.762
4	(Constant)	5.151	2.724		1.891	0.064
	RT	0.187	0.062	0.390	3.016	0.004
	LC	-0.029	0.082	-0.045	-0.349	0.728
	MA1	0.017	0.188	0.011	0.090	0.928
	MA3	0.087	0.090	0.132	0.962	0.340
5	(Constant)	2.861	3.051		0.938	0.353
	RT	0.145	0.066	0.303	2.184	0.033
	LC	-0.065	0.084	-0.102	-0.769	0.445
	MA1	-0.038	0.189	-0.025	-0.200	0.842
	MA3	0.093	0.089	0.141	1.042	0.302
	RF	0.025	0.016	0.222	1.584	0.119

**Table 8.** Grade 4.

		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	S.E.	Beta		
1	(Constant)	7.327	3.274		2.238	0.030
	RT	0.162	0.084	0.260	1.921	0.060
2	(Constant)	1.148	4.435		0.259	0.797
	RT	0.150	0.082	0.240	1.823	0.074
	LC	0.246	0.123	0.264	2.000	0.051

## Continued

	(Constant)	-1.972	4.811		-0.410	0.684
3	RT	0.162	0.081	0.261	1.996	0.051
	LC	0.194	0.126	0.208	1.545	0.129
	MA1	0.343	0.221	0.210	1.556	0.126
	(Constant)	-0.049	4.637		-0.011	0.992
4	RT	0.110	0.080	0.176	1.367	0.178
	LC	0.206	0.119	0.222	1.729	0.090
	MA1	0.136	0.225	0.083	0.604	0.548
	MA3	0.179	0.072	0.340	2.498	0.016
	(Constant)	-4.500	4.879		-0.922	0.361
5	RT	0.033	0.084	0.053	0.391	0.697
	LC	0.145	0.118	0.155	1.226	0.226
	MA1	0.068	0.219	0.042	0.311	0.757
	MA3	0.133	0.072	0.252	1.848	0.071
	RF	0.048	0.022	0.330	2.238	0.030

Based on **Table 9**, it can be observed that after controlling for general cognitive abilities and phonological awareness, morphological awareness and fluency still have a significant predictive effect on reading comprehension.

**Table 9.** Grade 5.

		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	S.E.	Beta		
1	(Constant)	1.768	1.870		0.946	0.349
	RT	0.366	0.048	0.730	7.700	0.000
2	(Constant)	2.068	3.830		0.540	0.592
	RT	0.367	0.049	0.731	7.525	0.000
	LC	-0.011	0.126	-0.009	-0.090	0.929
3	(Constant)	-1.540	5.085		-0.303	0.763
	RT	0.346	0.052	0.690	6.619	0.000
	LC	-0.029	0.127	-0.022	-0.228	0.821
	MA1	0.392	0.364	0.112	1.077	0.287

**Continued**

	(Constant)	6.300	5.043		1.249	0.218
	RT	0.203	0.061	0.404	3.302	0.002
4	LC	-0.097	0.115	-0.075	-0.842	0.404
	MA1	-0.033	0.346	-0.010	-0.096	0.924
	MA3	0.207	0.057	0.481	3.635	0.001
	(Constant)	-1.908	5.259		-0.363	0.718
	RT	0.167	0.057	0.333	2.926	0.005
	LC	-0.091	0.106	-0.070	-0.858	0.395
5	MA1	-0.146	0.319	-0.042	-0.458	0.649
	MA3	0.109	0.060	0.253	1.809	0.077
	RF	0.057	0.017	0.393	3.250	0.002

**4. Conclusions**

The data from third-grade students were insufficient to draw meaningful conclusions. However, when examining the data from fourth and fifth-grade students, with reading comprehension as the dependent variable and controlling for general cognitive abilities and phonological awareness, it was found that both morphological awareness and reading fluency had relatively stable predictive effects on reading comprehension. Additionally, morphological awareness also had a certain predictive effect on reading fluency. Therefore, it can be concluded that morphological awareness can influence reading comprehension through reading fluency. Morphological awareness helps children recognize different word forms corresponding to the same phoneme and differentiate multiple meanings of the same word, thereby constructing textual meaning. Moreover, morphological awareness facilitates the deconstruction of morphemes, thereby promoting reading comprehension.

Regarding the mediating role of word and character reading fluency, morphological awareness plays a crucial part in its development. Morphological awareness enhances the speed and quality of word processing by facilitating decoding at the morpheme level, thereby fostering fluency. Accuracy and automatization are pivotal aspects of fluency itself. Accurate word recognition is fundamental, supported by children with well-developed morphological awareness who demonstrate proficient word identification [23], thus promoting fluency.

Fluency in reading entails not only accurate recognition but also effortless and automatic processing. This includes swift phonological and semantic transformations, leveraging children's rapid retrieval of stored knowledge and metalinguistic skills like morphological awareness for efficient decoding. Moreover, reading fluency contributes significantly to reading comprehension. According to the

Simple View of Reading [24], proficiency in word and character reading correlates closely with comprehension skills. Swift and automatic reading processes reduce cognitive load on working memory, allowing more resources to be allocated to understanding sentences and texts, thereby enhancing overall reading comprehension abilities.

## 5. Limitations and Future Directions

This study had some flaws in data processing, leading to results that did not align with expectations. In future research, efforts should be made to strengthen data processing to arrive at more reasonable conclusions. This study mainly focused on two important variables in reading comprehension, namely, morphological awareness and reading fluency. There may be other significant factors such as rapid naming and orthographic awareness that could also impact children's reading comprehension through word and sentence reading fluency. Further exploration of these factors can be conducted in future research. Additionally, although this study statistically controlled for variables that could influence reading fluency and reading comprehension, there are still other variables to consider, such as vocabulary knowledge and Chinese character recognition. Future research should investigate and control these relevant variables further.

## Conflicts of Interest

The author declares no conflicts of interest.

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