

# Research Progress on Cognitive Deficiencies of Specific Reading Comprehension Disorders

Xiaozhen Cheng

Wuhu Special Education Vocational College, Anhui Province, chengxz@piscomed.com

**Abstract:** Specific dyslexia is a sub-type of dyslexia, which has gradually attracted the attention of researchers at home and abroad in recent years. Research on specific dyslexia mainly comes from cognitive field and focuses on language skills, general cognitive ability and impairment of cognitive flexibility. This paper sorts out and summarizes the basic viewpoints and related researches on cognitive deficits of specific dyslexics, and analyzes the causes and effects of specific dyslexics, so as to provide references for the identification, intervention training and research of specific dyslexics.

**Keywords:** Specific Reading; Comprehension Impairment; Cognitive Deficiencies; Language Skills; General Cognitive Ability; Cognitive Flexibility

## 1. Introduction

Specific Reading Comprehension Deficit (S-RCD) refers to a specific understanding of the reader's phoneme decoding ability and intelligence, can read the text accurately and fluently but difficult to understand the text content [1-2], that is, intact Word recognition skills show difficulty in understanding. According to the "Simple View of Reading" model proposed by Hoover and Gough in 1990 [3] (see Table 1), reading comprehension is regarded as the product of the two factors of word recognition (or decoding skills) and language understanding. In the category of Specific comprehension disability, it is characterized by language understanding difficulties but has good decoding ability. In recent years, the study of specific reading comprehension disorders has focused on the cognitive field and has been extensively related to language skills, general cognitive ability, and cognitive flexibility. The article combs the basic viewpoints and related research results of cognitive deficits in specific reading comprehension patients, in order to deepen the understanding of specific reading comprehension disorders, and to identify and intervene for specific reading comprehension obstacles based on the understanding of the causes of specific reading comprehension disorders. Provide training and research for reference.

Table 1 "simple view of reading" model

	Poor decoding or word recognition	Good decoding or word recognition
Poor language comprehension	( Mixed reading disability)	( Specific comprehension disability)
Good language comprehension	( Dyslexia or Specific reading disability)	( Normally developing reading capacity)

## 2. Impaired Language Skills for Persons with Specific Reading Comprehension Disabilities

The language skills of people with specific dyslexia are mainly damaged in basic language skills and high-level language skills, among which basic language skills include semantic processing of vocabulary and grammatical processing of sentences, etc. High-level language skills include textual structure knowledge and reasoning ability[4].

## 2. 1 Impaired Basic Language Skills

### 2. 1. 1 insufficient semantic processing of vocabulary

Reading comprehension is a complicated process in which a variety of different language skills work together, among which vocabulary and its semantic processing ability are considered as the most basic language skills. Studies have shown that people with specific reading comprehension disabilities have defects in semantic processing of vocabulary, especially receptive vocabulary[5]. Researchers conducted a retrospective study on children with specific reading comprehension disorders and pointed out that their vocabulary development level had defects before formal schooling[6]. These findings indicate that vocabulary may be associated with specific reading comprehension disorders. Vocabulary includes the word shape, pronunciation and meaning, etc. What part affects specific reading comprehension disorders still needs to be further explored. For this reason, the researchers tested and compared the speech (pronunciation) and semantic (understanding) processing abilities of the vocabulary of a specific reading comprehension disorder from the two indicators of correct rate and response time.

Nation and Snowling conducted reading experiments on 16 children with specific dyslexia and 16 normal children with different frequencies and regular words (these children matched in age, decoding ability and nonverbal ability). It is found that when reading high-frequency and regular words (such as mouth, dark), the reading speed and accuracy of specific dyslexics are equivalent to that of normal children, but it is difficult to identify low-frequency words and abnormal words (such as mouse, dread), the reading speed is obviously slowed down and the reading accuracy is low, because low-frequency words and abnormal words need more support of semantic processing ability[7]. Similarly, Woollams, Ralph, and others found that children with specific dyslexia showed lower accuracy when naming pictures with low frequency words, and this ability was also related to semantic processing[8]. At the same time, in the comparative study of semantics and phonetics, it is found that the semantic processing and phonetics processing of words for people with specific reading comprehension disabilities generally present a separation phenomenon, that is, people with specific reading comprehension disabilities have defects in semantic processing but do not have phonetic tasks. For example, Nation and Snowling found that when asked to judge whether groups of high-image words (such as boat-ship, rug-mat ) or low-image words (such as fast-quick, cry-sob, angle-cross and lovely-nice ) are synonyms, children with specific dyslexia are slow and prone to errors, especially low-image word tasks; However, there is no difficulty in judging whether two words rhyme (e.g., ope-hope, rope-soap, word-cord and cash-shop )[9], because unlike rhyming tasks, the task of judging the nature of words must be supported by semantic knowledge. There is also research finding that when a child with a specific reading comprehension is asked to give an example of a category name for the three spoken language forms within 60 seconds, it is always incomplete and correct, resulting in less semantic association. For example, “animals, waysofgettingfromoneplacetanother, kindsofworkthatpeopledo”; but these specific reading comprehension children have no difficulty in the rhyming word association task, such as giving “hair”, you can correspond to the rhyme “chair” [10].

Semantic Priming Research Provides Supplementary Evidence for Semantic Processing Defects of Words for Specific Reading Comprehension Impaired Persons. Nation and Snowling found after comparing the semantic priming characteristics of phrase pairs associated with categories or functions of normal readers and specific dyslexics through semantic priming online testing methods. Specific dyslexics show a typical pattern of semantic activation in functionally related phrase pairs (e.g., “ broad-floor ”) and highly related category pairs (e.g., “ cat-dog ”). However, for low-relevance or irrelevant category matching words (such as “SHEEP-COW”, “BOTTLE-JAR”), semantic priming cannot be shown. These findings prove that “specific dyslexic readers have too superficial a semantic concept, resulting in poor semantic priming of vocabulary, making it insensitive to more abstract or semantically irrelevant phrases[11]. In order to further explore the mechanism, Landi and Perfetti classify readers into skilled comprehenders and low-skilled learners based on differences in the ability to reason and integrate information into different sentences, where high-skilled understanders can reason. Understand high-level language skills such as monitoring to obtain rich psychological representations of sentences or articles. They measured event-related potentials in semantic, speech-initiated tasks for highly

skilled learners and specific readers with impaired reading comprehension. The results show that in the semantic word pair task, the sensitivity of the N400 component and the P200 component of the high-skilled understander and the specific reading comprehension disorder are different, which is manifested by the high-skilled understander's semantically unrelated starting task target (such as bear. -truck) exhibits large event-related potentials N400 and P200, while the N400 and P200 effects of a particular reading comprehension disorder are much smaller, but high-skilled understanders and specific reading comprehension impediments in voice-activated tasks The reaction performance of event-related potentials N400 and P200 is not different [12]. This shows that high-skilled understanders can apply semantic knowledge and semantic processing to obtain the understanding of task phrases when facing semantically unrelated task phrases, while specific reading comprehension obstacles are flawed because of the semantic processing of vocabulary. Semantic initiation of semantically unrelated task phrases cannot be performed normally.

## 2. 1. 2 Inadequate Grammatical Processing of Sentences

There are two trends in the study of the relationship between specific reading comprehension disorders and grammatical processing defects: some studies point out that specific reading comprehension disorders have explicit grammatical processing defects, while others do not find. Evidence for insufficient grammatical processing mainly comes from several experimental reports. Cromer and his colleagues found through experiments that people with specific reading comprehension disorders tend to read word for word without understanding syntactic structures, lack the ability to process sentences in texts into meaningful modules, and lack the level of syntactic knowledge and grammatical understanding[13]. Catts, Adlof and Weismer are based on the revised Peabody-Turevocabulary Lexical Test-Revised and the third edition of Clinical Assessment of Language Basis. Third Edition) conducted tests on the level of receptive vocabulary and grammar understanding of children in Grade 8. It was found that, compared with normal children and children with decoding difficulties, the syntactic processing methods of children with specific reading comprehension difficulties were defective, and the researchers concluded through retrospective analysis that these defects existed as early as when the children with specific reading comprehension difficulties attended kindergarten, grade 2 of primary school and grade 4 of primary school [14]. Nation and Clarke and others also found that, compared with normal students, students with specific reading comprehension difficulties performed poorly in the recall of grammatical complex sentences, understanding and use of past tense[15]. However, due to the fact that grammar processing is likely to be influenced by vocabulary knowledge and other cognitive skills, in order to eliminate interfering factors and further explore the problem of insufficient grammar processing for specific dyslexics, some researchers have controlled the participation of other cognitive activities in grammar processing and excluded the influence of the vocabulary level of the subjects. For example, Goff, Pratt and Ong used "Acceptable Grammar Test Scale" ( Test For Receptive Grammar) to test 3 to 5 children of normal development level (IQ range is 85-143 and age is 8 years 7 months to 11 years 11 months) They found that after controlling the general cognitive ability, grammar skills are more helpful to reading comprehension than memory variables and show strong independent contribution[16]. Tong and others also found that in the sentence correction task and the word tense analogy task, the specific dyslexic children have worse grammatical application ability than the normal children[17]. The sentence correction task refers to requiring children to produce a grammatically correct sentence after hearing an ungrammatical sentence. For example, the experimenter will say an incorrect sentence " Shebrushedtheteeth " and the correct answer should be " Shebrushedherteeth "; Word temporal analogy task refers to requiring children to add morphological words of the same form based on the heard morphological phrases, such as: the experimenter said " push, pushed ", " lost, ?" and the children corresponding to the past form " lost " " lost " according to examples.

Domestic Gao Qiufeng and Li Xiaoqing and others used sentence violation paradigm to investigate the sentence processing characteristics of children with Chinese-specific dyslexia whose literacy reached their grade level or above and whose reading was fluent. Sentence Violation Paradigm Test mainly enables people with specific reading comprehension disabilities to make right and wrong judgments on normally expressed sentences (e.g., gardener tidied up flower beds and pulled out weeds), semantically violated sentences (e.g., workers widened roads and pulled out old

houses) and syntactically violated sentences (e.g., gardener tidied up flower beds and pulled out flowers). The results show that the correct rate of sentence processing for children with Chinese specific reading comprehension impairment is significantly lower than that of normal children, and there is a backward level of sentence processing. In addition, the correct rate of sentence processing for children with Chinese specific reading comprehension impairment is significantly lower than that of normal children under the condition of syntax violation[18].

However, some studies have found different conclusions from the above studies. Stothard and Hulme adopted “Acceptable Grammar Test Scale” to carry out grammar ability test for specific dyslexic readers and normal readers who are suitable for actual understanding age but younger in physiological age. In addition, the comprehension scores of complex grammatical spoken sentences obtained in the test were tested by Tukey, HSD, and test (Tukey’ ShonestlySignificantly Meaningful DifferenceTest ), and it was found that the grammatical processing ability of the two did not show a clear difference in the test scores[19]. Further, Cain and Oakhill, in the comparison of receptive grammar tests for specific dyslexic and highly skilled learners, there is no evidence to show that children with specific dyslexic have more common language and speech disorders. Although there is a significant difference in receptive vocabulary scores between the two groups of subjects, there is no defect in the grammatical structure of children with specific dyslexic[20]. However, Bryant and others found that although there is a correlation between sentence grammatical processing ability and reading comprehension, this correlation does not hold after intelligence and vocabulary tests are included in the analysis[21].

## 2.2 Impaired High Level Language Skills

Factors affecting reading comprehension, in addition to low-level lexical semantic processing ability, sentence grammar processing ability, high-level text structure knowledge, reasoning ability and other language skills. Some studies have found that not only are basic language skills impaired in specific reading comprehension disorders, but high levels of language skills are also flawed [22-23].

Text structure knowledge plays an important role in quick browsing and skimming. A reader with text structure knowledge can use the text structure to help him read and understand the text. Cragg and Nation found that when specific dyslexic readers and normal readers are required to describe the content of a picture book without words, normal readers can use complex syntactic knowledge to discuss the content and structure of the picture book in detail, while the text discussion of specific dyslexic readers is very simple. the description of the content and structure of the story is not only few but also one-sided. some children even have no description of the structure of the story[24]. The researchers also found in the task of describing the content of the article according to the topic that when only a simple article topic is given, the description of the content of the article by specific dyslexic readers is incomplete and lacks logic and structure. However, when giving more detailed prompts, such as the title of the article and the picture sequence of the article content, the specific dyslexic readers can make detailed and structured descriptions of the text content, which is basically the same as that of normal readers[25-26]. These findings show that people with specific reading comprehension difficulties cannot effectively use the knowledge of text structure in the reading comprehension process, and they need the help of certain materials or pictures to better express the text content.

Reasoning ability is the core of reading comprehension ability. The development level of reasoning ability directly restricts whether reading comprehension ability reaches a higher level. A large number of studies show that children’s reading comprehension level is closely related to their reasoning ability[27-28]. Oakhill After comparing the results of children with specific dyslexia and normal children in solving reasoning problems and literal problems, it is found that there is no difference between the two in literal problems, but the results of children with specific dyslexia are significantly behind in reasoning problems[29]. Cain, Oak Hill and Elbro also found in the task of reasoning the meaning of new words based on the context of the article that the correct rate of word reasoning for children with specific dyslexia is significantly lower than that of normal children, and this lag is more obvious as the distance between the new words and the interpretation context increases[30]. In addition, new research also found that reasoning ability can predict reading comprehension ability, such as Oakhill and Cain. It was found that reasoning ability of eight to nine years old can

significantly predict 10 to 11 years old reading comprehension ability[31]; Lepora, etc. It was found that reasoning ability of four to five years old can directly predict listening comprehension ability of the following six years old[32].

### **3. Impaired General Cognitive Ability of Persons with Specific Reading Comprehension Disorders**

General cognitive ability (general cognitive ability, GCA) refers to various abilities applied in the process of understanding to deal with daily tasks and information and cognition, that is, the ability to quickly and effectively obtain and process information to avoid cognitive errors. At present, there are not unique methods for measuring the general cognitive ability of people with specific reading comprehension disorders, mainly including scales and cognitive assessment systems, among which the more representative ones are: British Ability Scale and Wechsler Intelligence Scale. The cognitive assessment system generally refers to DAS-Naglieri cognitive Assessment System (D-NCAS)[34-36], which is a set of standardized cognitive process assessment tools developed on the basis of PASS model. It includes 12 sub-tests, such as number matching, plan coding, plan linking, non-language matrix, speech spatial relationship, and graphic memory. Its measurement results can well predict children's performance in various cognitive processing tasks and describe the characteristics of children's cognitive development [37].

In order to explore the differences in general cognitive abilities between people with specific dyslexia and normal reading comprehension, Nation, Clarke and Snowling Three People Based on Second Edition "British Competency Scale" (British Habitability Scales) and "Neale Reading Ability Analysis" (Neale analysis of reading capabilities) after evaluating the general cognitive ability of 25 children with specific reading comprehension impairment and 24 children with normal reading comprehension level (age, decoding ability is equivalent), The general cognitive ability score of specific reading comprehension impairment group is within the normal range as a whole, but it is at the lower end of the normal level and is significantly lower than that of normal readers. The research specifically points out that in the three subscales tests of "British Ability Scale" spatial task, nonverbal reasoning task and verbal task, the scores of specific reading comprehension impairment group and normal children are different, that is, in the spatial task scale, The cognitive ability scores of the two groups were basically the same, but in the non-verbal reasoning task and verbal task scale, the cognitive ability scores of the specific dyslexic children were significantly lower than those of the normal children, indicating that the difference in cognitive ability scores between the two groups was mainly caused by non-verbal reasoning ability and verbal ability[38]. This discovery also reflects the heterogeneity of specific reading comprehension disorders, that is, although most people with specific reading comprehension disorders may have language domain defects, some people with specific reading comprehension disorders have more general cognitive disorders.

However, Georgiou and Das, from the perspective that cognitive processing may affect reading comprehension, Using the D-NCAS Cognitive Assessment System (DAS-Naglieri cognitive Assessment System), 32 college students with specific reading comprehension disabilities and 60 normal and age-matched college students were tested for their cognitive abilities of planning, attention, simultaneous processing and sequential processing in PASS model. The purpose is to understand the general cognitive abilities of the subjects and observe the performance differences between the hearing breadth task, sentence question answering task, specific reading comprehension disabilities and high-skilled interpreters in reverse repeated digital tasks. The results show that the difference between the specific dyslexic and high-skilled learners increases with the increase of cognitive processing needs in the task. Moreover, although 32 college students with specific dyslexic have normal intelligence, there are obvious obstacles in simultaneous processing and sequential processing, which indicates that the difference found between the specific dyslexic and high-skilled learners is probably due to the defective cognitive processing system of the specific dyslexic[39]. In order to further explore the relationship between general cognitive ability and specific dyslexia, Cain, Oakhill and Oak Hill tracked and investigated the development of reading comprehension of, 23 with appropriate decoding ability and 23 with high skill in stages. In the first stage, the researchers evaluated the decoding level of the subjects at the age of 8, Text Understanding, Semantic Processing of Vocabulary, Grammatical Processing of Sentences, General Cognitive Ability and Working Memory. At the age of 11, the research object reported the scores of listening comprehension, "SAT and reasoning ability in the second stage. The results show that, among the special dyslexic people, the poor semantic processing ability of

vocabulary leads to the development of their vocabulary reading comprehension ability, while the poor general cognitive ability leads to the development of their understanding ability. The general cognitive ability and the semantic processing ability of vocabulary play different promoting roles in the process of reading and understanding. This shows that cognitive ability seems to affect the reading comprehension ability of specific dyslexics in different ways, that is, the development level of semantic processing ability of vocabulary restricts the reading and understanding of words, while general cognitive ability affects the overall performance and development of reading comprehension ability of specific dyslexics.

#### **4. Impaired Cognitive Flexibility of Persons with Specific Reading Comprehension Disabilities**

Cognitive flexibility refers to the ability of individuals to construct their own knowledge in various ways and to make appropriate responses when the situation fundamentally changes. Some researchers found a correlation between cognitive flexibility and reading comprehension, and pointed out that appropriate intervention and training can effectively promote the improvement of children's reading comprehension level[41-42]. For example, Cartwright and Coppage and other two studies evaluated the impact of cognitive flexibility on reading comprehension.

In the first study, Coppage and its colleagues tested the cognitive flexibility of 24 specific dyslexic readers and 24 normal level readers at the end of the first and second grades using “ pronunciation - semantics ” conversion task. It is found that although the decoding ability, language ability, non-verbal matrix reasoning ability and vocabulary level are clearly controlled in the experiment, the cognitive flexibility performance of reading comprehension of the specific reading comprehension disabled person is still significantly lower than that of the peers with normal development level, and the specific reading comprehension disabled person has obstacles between the phonetic and semantic conversion of vocabulary. “ Voice - Semantics ” Conversion Task Refers to Train, Trunk, Tractor, TU from Bird, Bear, Bunny, Bike, Bus, Boat, Train, Tractor, RKEY, TOAD, TIGER and other words select four words at a time to form a 2×2 matrix. The two words arranged horizontally in the matrix are related in meaning or category, and the two words arranged vertically in the matrix are related in pronunciation. Similarly, the second cognitive flexibility intervention study also found that the cognitive flexibility intervention training provided by the teachers in the later period promoted the reading comprehension ability of 18 students with specific reading comprehension disabilities to be significantly improved. These students' reading comprehension level did not increase before the intervention, but after the intervention, they could reach the 21 personal reading comprehension level[43] in the control group. Cartwright, BOCK and Coppage tested 48 adults with high skills and specific dyslexia on meta-language ability (pronunciation, syntax) and cognitive flexibility (pronunciation - semantics, syntax - semantics). The two groups of subjects matched in non-word decoding ability and general cognitive ability. The study found that when speech and decoding abilities are controlled, there are significant differences in the measurement scores of phonological awareness, syntactic awareness and cognitive flexibility between specific dyslexics and highly skilled comprehension. Even after further controlling meta-language related skills, the difference in cognitive flexibility between the two groups was still significant[44]. These findings emphasize the important role of cognitive flexibility in helping to identify specific dyslexia.

The Wisconsin Card Sorting Test (Wisconsin Card Sorting Test ) was used by Pinky Cheung and others in China to study the reading level of scientific and technological articles of college students. It was also found that there was a significant correlation between cognitive flexibility, working memory and reading comprehension. The reading performance of scientific and technological articles of college students with high cognitive flexibility was significantly higher than that of college students with low cognitive flexibility[45]. Yan Rong and Yu Guoliang compared the difference in cognitive flexibility between children with specific reading comprehension impairment and children with normal reading comprehension development level through literacy and text reading comprehension level. The results show that the cognitive flexibility level of children with specific reading comprehension disorders is significantly lower than that of normal children as a whole, and the development of cognitive flexibility also shows heterogeneity with normal children. The trend of cognitive flexibility with age is significantly lower than that of normal children[46]. These research results

show that not only cognitive flexibility has an impact on reading comprehension ability, but also reading comprehension ability has a constraint on cognitive flexibility, i.e. understanding disorder may hinder the normal development of children's cognitive flexibility to some extent.

## **5. Summary and Enlightenment**

### **5.1 Summary**

Through a simple review of relevant researches on specific reading comprehension disorders, it is not difficult to find that, as a subcategory of reading disorders, the researches on cognitive deficits of specific reading comprehension disorders show the characteristics that foreign researches are far more than domestic researches, and have gone through an in-depth process from paying attention to insufficient language skills in the early stage to paying attention to general cognitive deficits and then to paying attention to impaired cognitive flexibility.

First of all, in the aspect of language skills deficiency research, it is mainly focused on basic language skills and high-level language skills, among which the basic language skills deficiency focuses on semantic processing defects of vocabulary and grammatical processing defects of sentences. The semantic processing defects of vocabulary in basic language skills and the significant role of textual structure knowledge and reasoning ability in high-level language skills in specific reading comprehension disorders have been consistently confirmed in the research. However, the role of grammatical processing defects of sentences in specific reading comprehension disorders is divided: some researches have found that specific reading comprehension disorders have definite impairment in sentence grammatical processing, while others have not found. Therefore, in the following research, we should not only continue to further explore the role of grammatical processing defects of sentences in the reading comprehension process of specific dyslexics, but also conduct a comprehensive study on the influencing factors of specific dyslexics with basic language skills and high-level language skills, and more importantly, we should conduct verification among different language users to confirm its universality.

Second, in the research on impairment of general cognitive ability, many studies have shown that there is a close relationship between general cognitive ability and reading comprehension. Existing researches have not only made a detailed analysis of general cognitive abilities such as spatial tasks, verbal tasks and non-verbal reasoning tasks, but also made an overall discussion of general cognitive abilities based on PASS theory. The former found that some specific dyslexics have general cognitive abilities in addition to language skills defects, while the latter shows that general cognitive abilities affect the overall development level of reading comprehension abilities of specific dyslexics. This shows that most people with specific reading comprehension disorders have general cognitive deficits. Therefore, it is necessary to explore the role of specific cognitive links such as attention, memory in general cognitive abilities in specific reading comprehension disorders through delicate research. Furthermore, the relationship between general cognitive abilities and reading comprehension should be systematically explored through comprehensive research and design based on the ideas of PASS and PASS.

Third, in the research on impairment of cognitive flexibility, studies at home and abroad have found that there are defects in cognitive flexibility of children with specific dyslexia, and domestic studies have pointed out that children with specific dyslexia have heterogeneous characteristics with normal children in the development of cognitive flexibility. In view of the lack of research on cognitive flexibility of people with specific reading comprehension disabilities, researchers need to conduct a large number of studies to find out whether the cognitive flexibility defect of people with specific reading comprehension disabilities is the difference between “ quality ” or “ quantity ” or both.

### **5.2 Inspiration**

According to the findings of the research on specific dyslexia, “ People with specific dyslexia can read an article

fluently, but they do not know the meaning of the article” . The core features combined with its research results in the three major areas of language skills, General Cognitive Ability and Cognitive Flexibility, can at least find the following enlightenment: First of all, In the early identification process of specific reading comprehension disorders, “ cognitive flexibility ” needs to be integrated into the past index system including language skills or (and) general cognitive ability identification as an index, and the weight of the three indexes in specific reading comprehension disorders can be determined through in-depth research, so that specific reading comprehension disorders can be diagnosed more accurately. Secondly, in the education and intervention training for people with specific reading comprehension disabilities, we should consider not only a single delicate intervention from the various dimensions of language skills, general cognitive ability and cognitive flexibility, but also a comprehensive intervention that integrates two two combination or three dimensions. Thirdly, in the study of specific reading comprehension disorders, it is necessary to consider selecting subjects with different language backgrounds to conduct cross-cultural studies to confirm the universality of the role of language skills, general cognitive ability and cognitive flexibility in specific reading comprehension disorders.

## References

1. Stothard S E, Hulme C. A comparison of phonological skill sin children with reading comprehension difficulties and children with decoding difficulties. *Journal of Child Psychology*, 1995, 36(3):399-408.
2. Kate N, Margaret J S. Semantic processing and the development of word-recognition skills: Evidence from children with reading comprehension difficulties. *Journal of Memory and Language*, 1998, 39(1):93-101.
3. Hoover W A, Gough P B. The simple view of reading. *Reading and Writing*, 1990, 2(2):127-160.
4. Landi N, Ryherd K. Understanding specific reading comprehension deficit: A review. *Language and Linguist Compass*, 2017, 11(2):4-8.
5. Catts H W, Adlof S M, Ellis W S. Language Deficit sin Poor Comprehenders: A Case for the Simple View of Reading. *Journal of Speech Language and Hearing Research*, 2006, 49(2):278-293.
6. Catts H W, Adlof S M, Ellis W S. Language Deficit sin Poor Comprehenders: A Case for the Simple View of Reading. *Journal of Speech Language and Hearing Research*, 2006, 49(2):278-293.
7. Kate N, Margaret J S. Semantic processing and the development of word-recognition skills: Evidence from children with reading comprehension difficulties. *Journal of Memory and Language*, 1998, 39(1):93-101.
8. Woollams A M, Ralph M A, Plaut D C, et al. SD-squared: On the association between semantic dementia and surface dyslexia. *Psychological Review*, 2007, 114(2):316.
9. Kate N, Margaret J S. Semantic processing and the development of word-recognition skills: Evidence from children with reading comprehension difficulties. *Journal of Memory and Language*, 1998, 39(1):93-101.
10. Kate N, Margaret J S. Semantic processing and the development of word-recognition skills: Evidence from children with reading comprehension difficulties. *Journal of Memory and Language*, 1998, 39(1):93-101.
11. Nation K, Snowling M J. Developmental differences insensitivity to semantic relations among good and poor comprehenders: Evidence from semantic priming. *Cognition*, 1999, 70(1):10-11.
12. Landi N, Perfetti C A. An electro physiological investigation of semantic and phonological processing in skilled and less-skilled comprehenders. *Brain and Language*, 2007, 102(1):1-4.
13. Oskan R, Wiener M, Cromer W. Identification, organization, and reading comprehension for good and poor readers. *Journal of Educational Psychology*, 1971, 62(1):71-78.
14. Landi N, Ryherd K. Understanding specific reading comprehension deficit: A review. *Language and Linguist Compass*, 2017, 11(2):4-8.
15. Nation K, Clarke P, Marshall C M, et al. Hidden language impairment sin children: Parallels between poor reading comprehension and specific language impairment. *Journal of Speech, Language, Hearing Research*, 2004, 47(1):199-211.
16. Goff G A, Pratt C, Ong B. The Relations Between Children’s Reading Comprehension, Working Memory, Language Skills and Components of Reading Decoding in a normal sample. *Reading and Writing*, 2005, 18(7-9):606-612.
17. Tong X, Deacon S H, Cain K. Morphological and syntactic awareness in poor comprehenders: An other piece of the puzzle. *Journal of Learning Disabilities*, 2014, 47(1):16-27.
18. Gao Qiufeng, Xie Yijun, Li Xiaoqing. Sentence Processing Characteristics of Children with Chinese Reading Difficulties. *Special Education in China*, 2016, (8):56.
19. Stothard S E, Hulme C. Reading comprehension difficulties in children. *Research in Higher Education*, 1992, 4(3), 245-256.
20. Cain K E, Oakhill J V. Profiles of children with specific reading comprehension difficulties. *The British Journal of Educational Psychology*, 2011, 76(4):683-696.
21. Oakhill J V, Cain K E, Bryant P E. The dissociation of word reading and text comprehension: Evidence from component skills. *Language and Cognitive Processes*, 2003, 18(4):443-468.



22. Cain K E, Oakhill J V, Lemmon K. Individual difference in the inference of word meaning from context. *Journal of Educational Psychology*, 2004, 96(4):671-681.
23. Hogan T P, Bridges M S, Justice L M, et al. Increasing higher level language skills to improve reading comprehension. *Focus on Exceptional Children*, 2011, 44(3):1-20.
24. Cragg L, Nation K. Exploring written narrative in children with poor reading comprehension. *Educational Psychology*, 2006, 26(1):55-72.
25. Cain K E. Text comprehension and its relation to coherence and cohesion in children's fictional narratives. *British Journal of Developmental Psychology*, 2003, 21(3):335-351.
26. Cain K E, Oakhill J V. The nature of the relationship between comprehension skill and the ability to tell a story. *British Journal of Developmental Psychology*, 1996, 14(2):187-20.
27. Li Yuqiu, Zhang Houcan. Research on Reading Comprehension Ability of Students from Grade 4 of Primary School to Grade 1 of Junior High School. *Psychological Science*, 2001, 24(1):29-31.
28. Cain K E, Oakhill J V. Inference making ability and its relation to comprehension failure in young children. *Reading and Writing*, 1999, 11(5):489-503.
29. Oakhill J V. Inferential and memory skills in children's comprehension of stories. *British Journal of Educational Psychology*, 1984, 54(1):31-39.
30. Cain K, Oakhill J V, Elbro C. The ability to learn new word meanings from context by school-age children with and without language comprehension difficulties. *Journal of Child Language*, 2003, 30(3):681-694.
31. Oakhill J V, Cain K E. The precursors of reading ability in young readers: Evidence from a four-year longitudinal study. *Scientific Studies of Reading*, 2012, 16(2):91-121.
32. Lepola J, Lynch J, Laakkonen E, et al. The role of inference making and other language skills in the development of narrative listening comprehension in 4-6-year-old children. *Reading Research Quarterly*, 2012, 47(3):259-282.
33. Yuill N, Oakhill J V. Children's problems in text comprehension: An experimental investigation. *Child Language Teaching and Therapy*, 1992, 21(8):241.
34. Nation K, Clarke P, Snowling M J. General cognitive ability in children with reading comprehension difficulties. *British Journal of Educational Psychology*, 2011, 72(4):549.
35. Georgiou G K, Das J P. University student with poor reading comprehension: The hidden cognitive processing deficit. *Journal of Learning Disabilities*, 2015, 48(5):535-538.
36. Cain K E, Oakhill J V. Profiles of children with specific reading comprehension difficulties. *The British Journal of Educational Psychology*, 2011, 76(4):683-696.
37. Jinye. *Art Therapy for Special Children*. Nanjing: Nanjing Normal University Press, 2015. 153.
38. Nation K, Clarke P, Snowling M J. General cognitive ability in children with reading comprehension difficulties. *British Journal of Educational Psychology*, 2011, 72(4):549.
39. Georgiou G K, Das J P. University student with poor reading comprehension: The hidden cognitive processing deficit. *Journal of Learning Disabilities*, 2015, 48(5):535-538.
40. Cain K E, Oakhill J V. Profiles of children with specific reading comprehension difficulties. *The British Journal of Educational Psychology*, 2011, 76(4):683-696.
41. Arlin P K. Piagetian tasks as predictors of reading and math readiness grades K-1. *Journal of Educational Psychology*, 1981, 73(5):712-721.
42. Cohen S A, Hyman J S, Battistini E E. Effects of teaching Piagetian decenteration upon learning to read. *Reading Improvement*, 1983, 20(2):96-104.
43. Cartwright K B, Coppage E A, Lane A B, et al. Cognitive flexibility deficits in children with specific reading comprehension difficulties. *Contemporary Educational Psychology*, 2016, 50:33-44.
44. Cartwright K B, Bock A M, Coppage E A, et al. A comparison of cognitive flexibility and metalinguistic skill in adult good and poor comprehenders. *Journal of Research in Reading*, 2017, 40(2):139.
45. Pinky Cheung, Bai Xuejun. Comparison of College Students' Working Memory and Reading Achievements of Scientific and Technological Papers with Different Cognitive Flexibility. *Psychological Science*, 2005, 28(2):329-331.
46. Yan Rong, Yu Guoliang. Study on the Development Characteristics of Cognitive Flexibility of Children with Reading Difficulties. *Chinese Journal of Clinical Psychology*, 2006, 14(1):35.
47. Liu Xiangping. *Psychology and Education of Children with Learning Disabilities*. Beijing: China Light Industry Press, 2010. 102-103.