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The Construction of a Multilevel Assessment Model for Chinese Reading Comprehension in Language Education and Strategies for Improvement

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Abstract The article reviewed the relevant literature on the evaluation of Chinese reading comprehension ability, and also consulted the experts engaged in language comprehension research in universities. The reading comprehension ability evaluation system was designed, and the weight coefficients of each index were determined by using AHP-entropy weighting method. And a multilevel assessment model was constructed based on the multilevel fuzzy comprehensive evaluation method. By establishing the fuzzy evaluation terminology, the language literacy and thinking development level of students are analyzed. And the improvement strategy of Chinese reading comprehension is proposed, and the effectiveness of the improvement strategy is explored with the teaching experiment. Before the teaching experiment, the comprehensive reading comprehension ability of the experimental group and the control group were at a poor level, and the comprehensive scores were 2.91 and 2.88 in turn, with no significant difference. Under the strategy of this paper, there is a significant difference between the experimental group and the control group in the ability to identify and decode, generalize and integrate, analyze and reason, as well as appreciate and evaluate, and the weighted scores of each index are improved by 0.16 to 0.71 points in the experimental group compared with the control group. At the end of teaching, in a comprehensive view, the strategy of this paper makes the experimental group's comprehensive reading comprehension ability reach 3.51 points, which improves to the middle level, while the control group is still at a poor level.

Index Terms AHP-entropy weighting method, multilevel fuzzy evaluation, assessment model, reading comprehension ability, language education

I. Introduction

In the context of promoting reading for all and improving national literacy, reading education in schools is highly expected. The teaching of reading has always been regarded as the sole responsibility of language, but in language reading teaching, the core purpose of teaching “reading” is often presented as one-sided, marginalized or even invisible [1]. The widely used “fast, general, short, shallow, fragmented” reading method in the current education model makes students increasingly lack of patience for in-depth reading, resulting in the “nihilization” of the value of reading [2], [3]. This seriously affects the effect of reading teaching and hinders the development of students' reading comprehension ability [4].

The core of reading is to realize comprehension. Readers with better reading ability are able to achieve a higher level of comprehension, really gain more knowledge and experience through reading activities, and achieve higher achievements [5]. During the gradual shift from the paper-based era to the electronic information era, people have more channels to obtain information, further broadening the breadth of reading content [6], [7]. While a large amount of cognitive resources are used to receive a huge amount of fragmented information, people's way of constructing processing and understanding information is also changing, i.e., the allocation of limited cognitive resources is affected, and the cognitive resources such as time, testing, analysis and creation required for the comprehension process are relatively reduced, which in turn affects the depth of reading [8]-[10]. This requires readers to possess higher reading skills in order to achieve the desired level of comprehension and acquire knowledge [11]. Therefore, the research on reading teaching evaluation methods pointing to the development of students' reading power should be vigorously promoted, so as to optimize reading teaching practice and enhance students' reading comprehension [12], [13].

In this study, a multilevel assessment model of Chinese reading comprehension ability was constructed using a multilevel fuzzy comprehensive evaluation method. The model establishes a set of evaluation indicators based on

the established evaluation index system of reading comprehension ability. At the same time, each indicator is divided into five evaluation levels according to the evaluation needs. Then the AHP-entropy weighting method is used to determine the weights of the indicators, and a fuzzy affiliation matrix is established to finally realize the comprehensive evaluation of students' reading comprehension ability. According to the evaluation results of students' reading comprehension ability, specific improvement strategies are proposed in terms of generalization, analysis and appreciation ability, and a 12-week teaching experiment is carried out to verify the effect of this paper's strategy on the improvement of students' comprehension ability.

II. Indicator system for evaluating reading comprehension

In this section, by reviewing previous studies and consulting relevant experts, the evaluation index system of Chinese reading comprehension ability in language education was determined to provide index parameters for the construction of the assessment model below.

The "Evaluation of Academic Achievement in Chinese Reading in the New Curriculum" elaborates the reading process into two aspects: "subjectification of text objects" and "objectification of receiving subjects": the former refers to the active participation of readers in the process of reading comprehension, so that the potential meaning and value of the text can be confirmed and recognized by the subject and reality, and the purpose of "grasping, possessing and reconstructing" is achieved. The latter refers to the fact that the subject is "infected and called" by the text's thoughts, emotions and aesthetic tendencies in the process of reading, which promotes the absorption, internalization and expansion of the individual's cognitive system. The two have a dynamic relationship of mutual transformation, revealing the symbiotic relationship between the reader and the text in the reading process. Therefore, the first-level indicators in the multi-level evaluation are determined as follows: recognition and decoding ability, generalization and integration ability, analytical reasoning ability, and appreciation and evaluation ability. The details are as follows:

(1) Recognition and decoding skills

That is, the ability to recognize and understand the basic words in the whole book. It corresponds to the basic reading ability level, which is the basic ability that most students in high school have. According to the six-stage theory of reading ability, readers at this level need to master general linguistic knowledge and concepts of print, and to recognize the content information in the book through the act of reading "glued to the text". There are four secondary indicators, including word recognition, sentence comprehension, locating surface information, and analyzing punctuation and formatting.

(2) Generalization and integration skills

The ability to summarize the main content of a book through "categorization" and "image reorganization." At this level, readers share their reading experiences, attitudes, and reflections in relation to the content of the text and summarize the book "in a compressed, concise, and understandable internal language". They also express their personalized reading results with the help of "external language forms with standard grammatical structures that can be understood by others", and gain a sense of satisfaction and achievement from them. This includes summarizing the main idea of a passage, refining the main idea of a text, categorizing and integrating information, and making contextual connections.

(3) Analytical Reasoning

That is, according to the specific context and content of the book, combined with one's knowledge base, the ability to appropriately describe and explain the behavior of the characters, plot, background, thematic ideas in a novel, or the subarguments or arguments in an academic work, and to construct a complete logic of the work in one's brain. This level is the core of reading comprehension and aims to bring the reader's "subjective perception" closer to the actual meaning of the work and to understand the original meaning of the text. It includes the analysis of cause and effect, the inference of author's intention, the inference of character/thing characteristics, and the logical evaluation of arguments.

(4) Appreciation and Evaluation

It is the ability to subjectively scrutinize, examine, evaluate and reflect on the form and content of a work based on its holistic characteristics. It includes two categories of aesthetic and critical reflection, and is more inclined to the evaluation of the internal mechanism of the work than the level of "creation" ability, with a transitional tendency. The second-level indicators are appreciation of linguistic features, expression of emotional experience, judgment of cultural values and creative criticism.

For the identified evaluation index system, five experts engaged in language education research were invited to conduct a questionnaire survey, and the weight of each index was determined by combining the AHP-entropy weighting method [14] with the combined assignment. The multilevel evaluation index system and weights of Chinese reading comprehension ability are shown in Table 1.

Table 1: Multi-level evaluation index system and weight

Primary indicators	Weighting	Secondary indicator	Weighting	Number
Identification decoding(A1)	0.18	The words are memorized,	0.25	A11
		Sentence comprehension	0.25	A12
		Surface information positioning	0.25	A13
		Punctuation and format resolution	0.25	A14
Generalized integration(A2)	0.32	Paragraph	0.25	A21
		Gist of the article	0.25	A22
		Information classification integration	0.25	A23
		Contextual correlation	0.25	A24
Analytical reasoning(A3)	0.34	Causal analysis	0.25	A31
		Intentional inference	0.25	A32
		Character/thing	0.25	A33
		Argument	0.25	A34
Appreciation evaluation(A4)	0.16	The language features appreciation	0.25	A41
		Emotional experience expression	0.25	A42
		Evaluation of cultural value	0.25	A43
		Creative criticism	0.25	A44

III. Multi-level fuzzy comprehensive evaluation modeling

The reading comprehension evaluation index system designed in this paper is a multilevel index system, and judging all the indexes at each level is a fuzzy comprehensive evaluation process. The multilevel evaluation model construction process is as follows:

(1) Constructing the evaluation index set

According to the established evaluation index system, the evaluation index set of the evaluation object is established as follows:

A1={A11, A12, A13, A14}.

A2={A21, A22, A23, A24}.

A3={A31, A32, A33, A34}.

A4={A41, A42, A43, A44}.

The evaluation index set in this paper is divided into two layers, the criterion layer and the indicator layer, containing 4 criterion layer and 20 indicator layer factors.

(2) Establishment of fuzzy evaluation terms

According to the evaluation needs, the five-level division method [15] is used to determine the evaluation level of each indicator with five evaluation levels {very good, good, medium, poor, very poor}.

$V=\{V1, V2, V3, V4, V5\}=\{\text{very good, better, medium, poor, very poor}\}$

(3) Determine the set of evaluation index weights

The weights of the indicators were determined using a combination of AHP-entropy weighting method. The weight coefficient of each evaluation indicator is noted as $Z=(z_1, z_2, z_3, \dots, z_m)$ and has:

$$\sum_{i=1}^m z_i = 1 \quad (1)$$

(4) Establishment of fuzzy affiliation matrix

A one-factor evaluation of each indicator of each criterion layer is performed separately to obtain a fuzzy vector R with respect to v : $R_i=(r_{i1}, r_{i2}, \dots, r_{ij}), i=1, 2, \dots, n, j=1, 2, \dots, m$. r_{ij} denotes the degree to which the factor C_i has v_j , i.e., the degree of affiliation. Experts are invited to give grade confirmation to each indicator of the candidate social capital party according to the five grades divided by the set of rubrics, and the indicators at all levels are comprehensively evaluated according to the weights of the indicators that have been formulated, resulting in a matrix of:

$$R = \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1j} & \cdots & r_{1n} \\ r_{21} & r_{22} & \cdots & r_{2j} & \cdots & r_{2n} \\ \cdots & \cdots & \cdots & \cdots & \cdots & \cdots \\ r_{i1} & r_{i2} & \cdots & r_{ij} & \cdots & r_{in} \\ \cdots & \cdots & \cdots & \cdots & \cdots & \cdots \\ r_{m1} & r_{m2} & \cdots & r_{mj} & \cdots & r_{mn} \end{bmatrix} \quad (2)$$

(5) Fuzzy comprehensive evaluation [16]

Let $B = Z * R$, the operation is carried out, the evaluation object fuzzy evaluation comprehensive evaluation results B:

$$Z * R = (z_1, z_2, \dots, z_m) * \begin{bmatrix} r_{11} & \cdots & r_{1n} \\ \cdots & \cdots & \cdots \\ r_{m1} & \cdots & r_{mn} \end{bmatrix} = (b_1, b_2, \dots, b_n) = B \quad (3)$$

After obtaining a composite assessment result B, the grade at which the student's reading comprehension skills are assessed can be determined.

IV. Strategies for improving language reading skills

The reading comprehension improvement strategies distilled in this study refer to both the teaching methods and behaviors applicable to improving students' language reading ability developed by teachers to adapt to the laws of students' cognitive development and thinking activities, as well as the learning strategies for students to use thinking tools for language reading learning. According to a large number of searches for relevant journal articles, as well as combining different dimensions of language reading ability and cognitive development characteristics, the language reading strategies based on thinking tools are summarized as follows.

(1) Generalization and extraction strategies to enhance generalization ability

The improvement of information extraction ability in this study requires students to be able to extract the information they need from the information they read, while the development of generalization ability requires students to be able to summarize the main idea of the article and summarize and integrate the main points of the article on the basis of extracting the relevant information. Summarization and refinement is to sort the fragmented information into an overall understanding of the structure, this process enables students to locate the information they need from the information they read and then summarize and summarize the information, so that the fragmented knowledge into focus, thus building a more three-dimensional schema.

Visualization is an intuitive, more easily perceived graphic representation of information and its information processing process. Mind mapping is a visualization tool that can be used to obtain information from multiple sources, and then use the information as keywords and visualize it in a variety of colors. The strategy of summarizing and refining refined in this study is that in the reading teaching of expository essays, the teacher instructs the students to identify the key words and phrases describing the objects in the process of reading, and then extracts and summarizes them through the Thinking Maps, summarizing the key information about the basic characteristics and functional significance of the objects, and promoting the students' comprehension of the contents of the essays.

(2) Comparative Analysis Strategy to Enhance Evaluation and Appreciation Skills

The comparative analysis strategy refined in this study refers to the fact that after students have made a diffuse interpretation of an article on a certain topic. On the basis of the overall understanding of the main points of the article, the teacher guides the students to compare and contrast the homogeneous text with the help of the visual thinking tool of the double bubble diagram, and make analogies to the content of the articles of similar themes in terms of the key points of expression, writing skills, etc., and appreciate the differences and similarities between them, which will stimulate the similarity and association to acquire new knowledge, and promote the transfer and application of knowledge.

V. Results and analysis of reading comprehension assessment

Forty students were randomly selected from two classes in the second year of high school in a general secondary school in a city. There were 20 boys and 20 girls in each class, and these students were divided into two groups of the same level according to their Chinese reading comprehension ability. Before the teaching experiment, a reading comprehension survey was conducted on the two groups of students, and the improvement strategies described above were designed to respond to the results of the survey. The two groups of students were then divided into an

experimental group (Class 1) and a control group (Class 2) for a 12-week reading comprehension improvement experiment. In the experiment, the two groups of students were taught in different ways, with the control group being taught traditionally and the experimental group being taught with the improvement strategies proposed in this paper incorporated. These subject students met the following conditions:

- (1) Both groups of students were randomly selected.
- (2) There was no significant difference in the reading comprehension levels of the two groups of students.
- (3) These 80 students had an IQ ≥ 90 on the Raven Reasoning Test.

V. A. Analysis of the Comprehensive Reading Comprehension Pre-test

This subsection focuses on analyzing the reading comprehension level of the sampled 80 students using the reading comprehension evaluation model constructed above. The results of the descriptive statistics of the pre-test of reading comprehension ability of the experimental group and the control group are shown in Table 2. The data in the table show that the average scores of students in the experimental group on identification and decoding, generalization and integration, analytical reasoning, and appreciation and evaluation abilities are 3.37, 2.49, 3.14, and 2.73 respectively, and those of the control class are 3.34, 2.47, 3.09, and 2.75 respectively, and the scores of the two groups on each index are smaller. The weighted calculations yielded a combined reading comprehension level of 2.91 and 2.88 for the two classes, with a significance coefficient of $P=0.842>0.05$, which means that there is no significant difference between the Chinese reading comprehension levels of the two classes.

It is worth mentioning that on the indicators for evaluating the reading comprehension level, the scores of recognizing decoding and analyzing reasoning are above 3. According to the fuzzy judgment grading standard, it is a medium level, while the other 2 indicators are at a poor level. Therefore, improvement strategies in generalization and appreciation skills are proposed, and the analysis of improvement effects is carried out in the following section.

Table 2: Descriptive statistical results before reading comprehension

Primary indicators	Class 1		Class 2		P Value
	Mean	SD	Mean	SD	
Identification decoding	3.37	1.126	3.34	0.989	0.658
Generalized integration	2.49	1.033	2.47	1.236	0.651
Analytical reasoning	3.14	1.251	3.09	1.176	0.723
Appreciation evaluation	2.73	0.915	2.75	1.062	0.618
Integrated level	2.91	0.874	2.88	0.967	0.842

V. B. Impact on reading comprehension skills (generalization and integration)

This subsection focuses on analyzing how the strategy proposed in this paper affects students' ability to generalize and integrate in reading comprehension, and discusses the changes and comparisons between the two classes' levels of this part of the posttest. Figure 1 shows the results of the comparison of the level of students' generalization and integration ability between the two classes at the end of the teaching, and "***" in the figure indicates that the comparison between the two passed the significance test at the 0.01 level. As can be seen from the figure, the weighted scores of the four secondary indicators under the generalization and integration ability of the experimental class, namely, paragraph generalization, article main idea refinement, information classification and integration as well as contextual correlation, range from 3.28 to 3.64, while the scores of the control class range from 2.45 to 2.95. The comprehensive generalization and integration ability of the experimental class and the control class were 3.50 and 2.79, respectively, and both classes improved over the pre-test, but the experimental class had a more significant improvement. This is because the application of Thinking Maps in language reading teaching not only hones students' language use skills, but also transforms their way of thinking in an invisible way. Students can learn to sort out the structure of the article correctly and form a preliminary understanding of the main content of the discourse. With the assistance of multimedia equipment, teachers can make the corresponding mind map, show the content of the mind map while teaching, and introduce the text content, so that students gradually rationalize logical thinking in reading, thus deepening the understanding of the text, and at the same time, improve the ability to analyze and generalize.

V. C. Impact on reading comprehension skills (Appreciative Evaluation)

This section explores whether this paper's strategy improves students' Chinese reading comprehension appreciation and evaluation skills based on evaluative reading comprehension test questions. The changes and comparisons of the post-test of reading comprehension (Appreciative Evaluation) in the two classes are summarized and the reasons for them are explored and discussed. Figure 2 presents the results of the comparison of students' Appreciative Evaluation skills in the two classes. The data in the figure show that there are significant differences

in the levels of appreciation of linguistic features, expression of emotional experience, judgment of cultural values, and creative criticism under the Appreciative Evaluation Ability of the students in the two classes. The weighted scores of the experimental class on the above indexes are 3.74, 3.17, 3.63, 3.34, respectively, while those of the control class are 2.93, 2.54, 3.04, 2.81, respectively. The comprehensive appreciation and evaluation ability is 3.48, 2.83, respectively, which is significantly higher than that of the control class in the experimental class. The reason for this is that the strategy of this paper is beneficial to the development of learners' higher-order thinking skills by arranging collaborative group learning, group discussion, case study, role-playing, project research, simulated decision-making, and problem-solving learning activities.

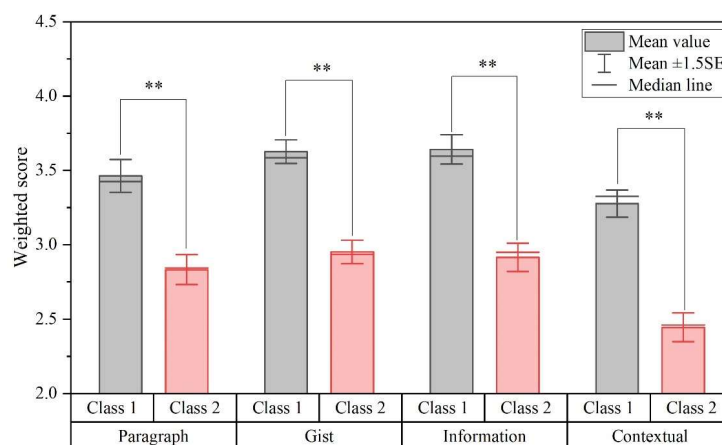


Figure 1: The students summarized the results of the integration ability level

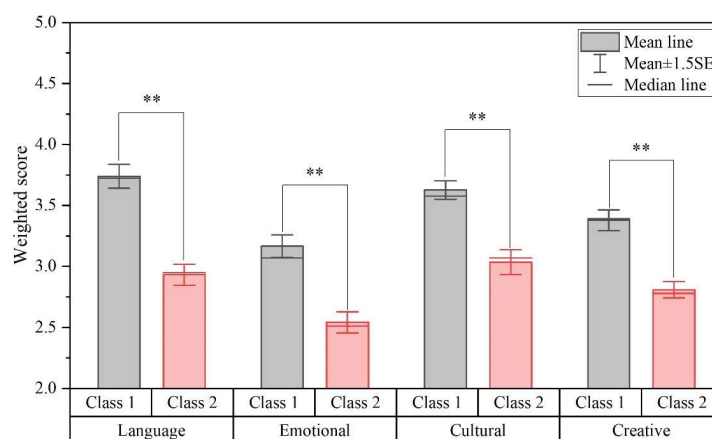


Figure 2: The students' evaluation ability was compared

V. D. Comprehensive Reading Comprehension Posterior Side Analysis

In order to verify the effects of the improvement strategies proposed in this study on students' Chinese reading comprehension, the reading comprehension of the experimental and control classes was tested through a reading comprehension test paper at the end of the teaching experiment. To investigate whether there was a significant change in the English reading comprehension skills of the two classes at the end of the experiment. After completing the data collection, a paired sample t-test was conducted on the reading comprehension skills of the experimental and control classes. The results of the analysis will be specified separately below.

Figure 3 shows the comparative results of the posttest evaluation of the first-level indicators of reading comprehension ability, with “**” indicating that the test of significance at the 0.05 level was passed. In addition to the generalization and appreciation evaluation abilities analyzed above, which showed significant differences in the evaluation results between the two classes, the same significant differences were found in the recognition decoding and analytical reasoning abilities. The weighted scores for recognition decoding and analytical reasoning abilities were 3.68 and 3.43 for the experimental group and 3.27 and 3.11 for the control group, respectively.

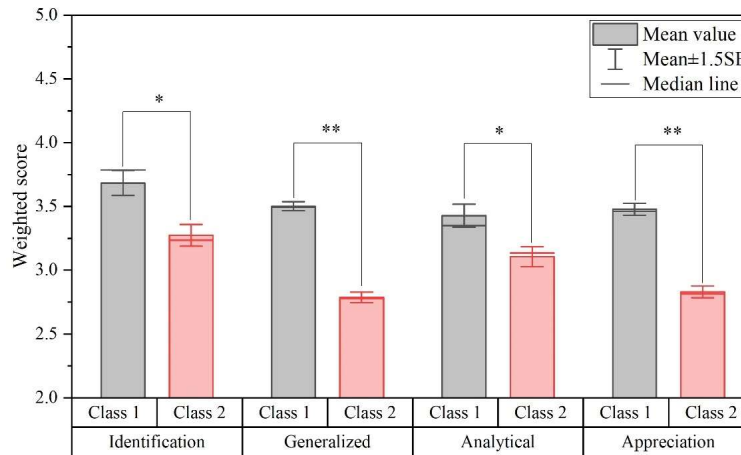


Figure 3: The comparison results of the evaluation price after reading comprehension

Figure 4 shows the results of the comparison of the comprehensive reading comprehension ability of the two classes. As can be seen from the figure, the comprehensive reading comprehension ability of the students in the experimental group is distributed between 3.0 and 4.0, and the average reading comprehension ability is 3.51 points. In comparison, the comprehensive reading comprehension ability of the students in the control group is distributed between 2.6 and 3.4, and the average reading comprehension ability is 2.98 points. The reading comprehension ability of students in both groups has been improved compared with the results of the pre-test, and according to the fuzzy comprehensive evaluation grade, the reading comprehension ability of the teaching experiment group has reached a medium level, while the control group is still at a poor level. It can be seen that the application of the strategy in this paper can effectively improve the reading comprehension ability of the experimental group, enhance the students' ability to extract details, reasoning and judgment, structural analysis, and summarization and induction in reading comprehension, and then enhance the students' reading comprehension ability.

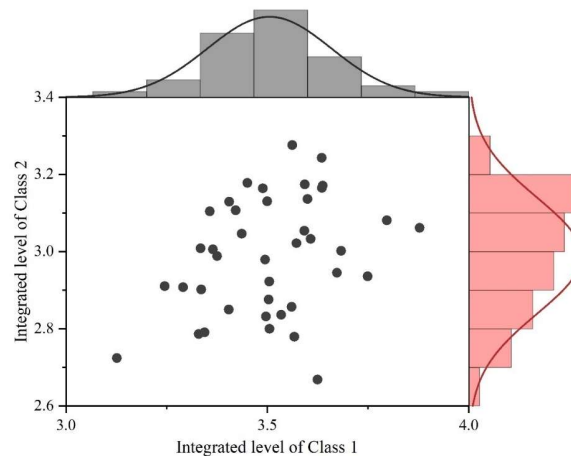


Figure 4: The two shifts in the comprehension ability of reading comprehension

VI. Conclusion

In this paper, we designed a reading comprehension level assessment model for Chinese reading comprehension ability. The model takes four first-level indicators of recognition and decoding, generalization and integration, analytical reasoning, and appreciation and evaluation as the evaluation object, and establishes a set of rating indexes containing 20 index level factors. Using the five-level division method, the evaluation level is divided into {very good, good, medium, poor, very poor}. Then according to the weight of each index, a fuzzy affiliation matrix is established, and the evaluation level of students' reading comprehension ability is obtained through fuzzy operation. For the students' reading comprehension ability level, the reading comprehension ability improvement strategy is designed, and the application effect is analyzed through teaching experiments.

In the pre-test survey of reading comprehension ability, the comprehensive reading comprehension ability of the experimental group and the control group is 2.91 and 2.88 respectively, in which the weighted scores on

generalization and integration and appreciation and evaluation ability are lower. Under the improvement strategy of this paper, the experimental group's generalization and integration ability and appreciation and evaluation ability increased to 3.50 and 3.48, respectively, reaching a medium level. While the control group under traditional teaching was 2.79 and 2.83 respectively, still at a poor level. After the end of teaching, the comprehensive reading comprehension ability of the experimental group and the control group was 3.51 and 2.98 respectively, and the experimental group's reading comprehension ability was more significantly improved.

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