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Study on Characteristics of Children's Long-termmemory Development in Plateau Environment

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Abstract: *By studying the characteristics of children's long-term memory development under the plateau environment, this topic aims to analyze the influence of the plateau environment on the characteristics of children's long-term memory development. I According to the characteristics of children's development and the current characteristics of children's long-term memory development, explore whether the plateau environment has an impact on children's long-term memory development, and further explore the characteristics of children's long-term memory development under the plateau environment. The theoretical significance of this study is as follows: first, to fill the gaps in the current domestic and foreign research on the characteristics of children's long-term memory development in Plateau areaan areas; Scientific and objective dialectical understanding of the characteristics of preschool children's long-term memory development; Third, to enrich the current research data on the characteristics of long-term memory development of preschool children in Plateau area . The practical significance of this research is as follows: first, to fill in the current domestic and foreign research gaps on the "characteristics of children's long-term memory development" in Plateau area , and to put forward appropriate suggestions on how preschool children should better improve their long-term memory. Second, analyze the development characteristics of long-term memory from various factors affecting preschool children's long-term memory, so as to provide sufficient theoretical basis for improving and strengthening children's long-term memory. The plateau environment may have an impact on the long-term memory of preschool children. This study can provide effective suggestions for the development and improvement of the long-term memory of preschool children in the plateau region through the research on the development of the long-term memory of preschool children.30 pre-school children (pre-school children in plateau area) and 30 pre-school children (mainland children) were tested by individual memory tests, including free recall (frequency association recall, semantic classification recall and picture recall), recognition (auditory recognition of Chinese words and visual recognition of pictures) and associative learning (word pair learning and symbol-picture learning).Compared with the pre-school children in non-plateau areas, the pre-school children in plateau areas were significantly lower than those in non-plateau areas in frequency associative recall tasks and semantic categorization recall tasks, and the pre-school children in plateau areas were significantly lower than those in non-plateau areas in picture visual recognition tasks. There was a significant difference in the index groups of word pairs in associative learning (listening channel) between pre-school children in plateau area and non-plateau area, indicating that pre-school children in non-plateau area had a better effect on learning by associative learning; Symbol-picture learning (visual channel) there was no significant difference between the indicator groups of picture learning. Compared with the preschool children in non-plateau areas, the plateau environment will have a significant impact on the memory development of preschool children, and further have a certain impact on the long-term memory development of preschool children.*

Keywords: *plateau section, preschool-age children, Long-term memory*

1. Introduction

China's plateau area is vast, the terrain is open, accounting for 26% of the country's total land area. According to Zhou Baozhu, Zhang Quanlong, Li Maoxing and Jia Zhengping et al., in the Research Progress of the Impact of Plateau Environment on Memory Function, the study shows that the high altitude of the plateau causes air pressure difference and low oxygen content, leading to acute mountain sickness, pulmonary edema, memory impairment and so on. At the same time, due to the high

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of the brain to oxygen, long-term or repeated exposure to the plateau environment can easily impair higher brain functions such as learning, memory and other cognitive activities. Studies have shown that at high altitude (3500-5500 m), mental operation ability and work efficiency are reduced, P3 latency is significantly prolonged, response error rate is increased, short-term memory disorders and other symptoms, and the degree of memory impairment is positively correlated with altitude.[1] Based on previous studies, the research team concluded that the altitude environment has a significant impact on memory function.

2. The Definition of Long-term Memory

It is generally believed that long-term memory refers to the information that has been deeply processed and retained in the brain for a long time, which can last from a few days to a few years or even a lifetime. According to Abdusalam Awuti and Huang Shihao et al., long-term memory refers to the information that is stored for a long time, and it is also the premise of individual experience accumulation and cognitive development as well as the entire psychological development (Abdusalam Awuti, Huang Shihao et al.). Declarative memory and non-declarative memory are the two main parts of long-term memory.

3. Domestic Research on Long-term Memory

Human long-term memory is a hierarchical network organized by a series of concepts with the relationship between superiors and subordinates. Such knowledge structure is hierarchical first, and the more abstract the concept, the higher the level (Liu Qiyue). In their research, Liu Zhaomin and Guo Chunyan found that long-term memory and working memory share the information representation network of the memory system, and working memory will produce neural priming for related long-term memory, and this neural priming will decrease with the increase of the number of stimulus repetitions (Liu Zhaomin and Guo Chunyan). [2] At the same time, this study also shows that attention is a key modulator in the interaction between working memory and long-term memory.

It is found that the processing of working memory can also affect the retrieval of episodic long-term memory, and the effect of working memory processing on the retrieval of episodic long-term memory is material non-specific (Liu Rong). Compared with late processing, early processing of working memory has a greater impact on episodic long-term memory retrieval. In their research on the activation mechanism of Chinese original target information in long-term memory, Leng Ying and Morey found that the activation of target information in long-term memory during reading does not need to resonate with the current reading information, and the target healing situation is the key factor affecting the access of target information in long-term memory (Leng Ying and Morey).

Long-term memory not only has a very close relationship with working memory, but also has a very close relationship with general liquid intelligence. Although there is no significant path between long-term word memory and working memory and liquid intelligence, there is a significant path between long-term number memory and working memory and liquid intelligence (Wu Xiaodong). At the same time, Wu Xiaodong also found in his research that the structural relationship between long-term memory, working memory and liquid intelligence is related to the type of material or test used. In addition, information retained in long-term memory can also have an impact on consciousness. Specifically, information consistent with long-term memory can be seen faster than inconsistent information in b-CFS paradigm, and this promoting effect still exists after information in long-term memory is extracted into working memory (Liu Mengjiao).

4. Foreign Research on Long-term Memory

Low family income during childhood is associated with a range of enduring negative outcomes, including diminished cognitive function in adulthood, as revealed by a longitudinal multimediating analysis investigating the link between adolescent family income and working memory and long-term memory in adulthood. When families with limited education experience low-income circumstances, it engenders less favorable attitudes towards education, heightened stress levels, increased inflammation, among other factors. These factors collectively predict inferior cognitive performance in adulthood; however, intervening in each of these aspects may alleviate the detrimental cognitive consequences stemming from low income during adolescence (Hunter Colton L.&Shields Grant S.).

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The behavior of children, known as mutual exclusive deviation or MEB, involves the tendency for children to assign unique labels to new objects encountered in their daily lives. However, experimental findings examining the impact of MEB on word map retention in children indicate that none of the words associated with MEB exhibited a higher retention rate compared to words linked through alternative citation selection strategies during testing. Furthermore, it was observed that interference from multiple words led to a faster forgetting of word maps when employing MEBs (Bredemann Catherine A.&Vlach Haley A.). These empirical results suggest that while MEB may facilitate initial word mapping, it does not confer an advantage for long-term retention.

This study mainly focuses on the characteristics of children's long-term memory development in the plateau environment and discusses how to improve children's long-term memory before school in the plateau environment.Comparative Study on Memory of Children with Learning Disabilities by Cheng Zhihuo and Gong Yaoxian et al., Medical Psychology Research Center of the Second Affiliated Hospital of Hunan Medical University.Long-term memory function in children with learning disabilities.

5. Research Object and Method

5.1 Research object

(1) Frequency-associated recall: A total of 21 randomly arranged double-character Chinese words can be categorized into 7 groups, with each group consisting of 3 words. These three words frequently occur in daily life, such as teacher - blackboard - chalk, China - Beijing - Forbidden City, sea - spray - beach, etc.

(2) Semantic classification memory: It is composed of 21 randomly arranged double-character Chinese words, including 7 categories.3 words for each category, such as city name (Kunming, Beijing, Changsha), animal category (tiger, peacock, turtle), daily necessities category (towel, water cup, toothbrush), etc.

(3) Picture memory: It consists of 25 randomly arranged picture groups, including 5 categories. Each category has 3 to 6 pictures, such as fruit (bananas, apples, watermelons, oranges, pears, peaches), clothing (shoes, dresses, hats), animals (tigers, rabbits, dogs, cats, etc.).

The three methods for free recall testing are identical. Firstly, the participant is instructed to remember a total duration of 90 seconds upon recognition. Subsequently, the participant is asked about their memorization technique and then given the freedom to recall it.

5.2 Recognition function

(1)Auditory recognition of Chinese words: The learning card contains 30 simple double-character Chinese words, presented audibly to the participant at a rate of one word per second, and subsequently memorized for a duration of 60 seconds. Additionally, a list of 30 words is provided, including 10 target words for memorization, 10 related words that share similarities in pronunciation or semantics (e.g., soldier → soldier, moonlight → moon, happy → happy, mother → mother), and 10 irrelevant interference words. After each word presentation, the participant is required to determine whether it corresponds to one of the recently learned items.

(2) Picture visual recognition: The learning card utilizes familiar common objects as materials, encompassing a total of 30 pictures. The subject is given 90 seconds to memorize the images, and in case of any failure to recognize a picture, they can inquire about and identify its corresponding name. The recap card also comprises 30 pictures, including 10 target pictures, 10 related pictures (with the same name but different visuals), and 10 unrelated pictures (with differing names and visuals). Subsequently, the subject is prompted to individually determine whether each picture corresponds to those previously learned.

5.3 Associative learning

pair learning.(1) Word pair learning: a total of 12 pairs of two-word words (such as school → teacher, fruit → apple, dad → mom, hospital → doctor, police → thief), including three attempts and one delayed recall. In the learning stage of the three attempts, the subject read a pair of words to the subject every 3 seconds, and after presenting the first word of each pair, the subject should speak the

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last word, that is, the dual recall method. Delayed recall is when the subject is asked to say the last word after reading the previous word without learning it after 5 minutes.

(2) Symbol-picture learning: A total of 12 learning cards, 48 reaction cards (12×4). Above each learning card is a meaningless and difficult to name symbol, below is a familiar picture for children, and only symbols are on the reaction card. The test method is the same as word

5.4 Calculation of statistical analysis indicators

5.4.1 Reporting accuracy

In recognition memory, recognition ability (d ') and response criteria (β) can be distinguished by signal detection, and recall ability and intrinsic response criteria have not been distinguished in free recall and associative learning tests.In this study, report accuracy was used to approximate the internal supervision, control process and response criteria of the subjects.

$$\text{Report accuracy} = \text{Total number of reports recalled correctly} * 100\% \quad (1)$$

5.4.2 Association (classification) index

In the three free recall tests, we tried to use a certain index to reflect how well the subject organized the material while recalling it. First evaluate the association score or classification score according to the original record. For example, when the subject recalls the 2 items that are expected to belong to a group (class) together, count 1 point, 3 items together count 2 points, and so on. The cumulative association score or classification score is obtained, and the cumulative score is divided by the number of correct recalls.

$$\text{Association (classification) index} = \text{Association score (or classification score)}/\text{Number of correct recalls} \quad (2)$$

6. Results

6.1 Comparison of free recall of preschool children in non-plateau areas and plateau areas

In this study, three free recall tasks of frequency association word, semantic category word and picture were used, and the analysis index included correct recall number and recall accuracy rate. The analysis of variance found that there were significant differences between the two groups of children in the frequency associative recall task and the semantic categorization recall task, and the significance was smaller in the picture recall task. Covariance analysis with FIQ as covariate showed significant differences in the correct recall numbers of the three tasks (p< 0.05).[*Table 1*]

Table 1:Comparison of free recall of preschool children in non-plateau area and plateau area.

	Control group	Experimental group	f-number	p-value
Frequency associative recall				
Recall correct number	8.77±1.50	4.13±2.61	9.95	0.000
Recall accuracy rate	41.76±7.15	19.68±12.43	9.95	0.000
Semantic categorization recall				
Recall correct number	8.87±1.89	3.33±2.43	3.94	0.000
Recall accuracy rate	42.22±8.10	15.87±11.55	3.94	0.000
Pictorial recall				
Recall correct number	12.40±2.09	6.60±1.89	0.56	0.000
Recall accuracy rate	49.60±8.38	26.40±7.55	0.56	0.000

6.2 Comparison of recognition results between non-plateau areas and plateau areas

In the two tasks of word recognition auditory recognition and picture recognition visual recognition,

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each task included an analysis index: the significance of correct recall number analysis was smaller in word recognition auditory task and larger in picture recognition visual task. Covariance analysis using FIQ as a covariate showed significant differences between the correct numbers of the two tasks (p< 0.05).[*Table 2*]

Table 2: Comparison of recognition achievement between non-plateau area and plateau area.

	Control group	Experimental group	f-number	p-value
Auditory word recognition				
Correct recall number	22.17±2.12	17.13±2.53	0.64	0.000
Picture visual recognition				
Correct recall number	25.20±1.88	22.27±2.68	6.337	0.000

6.3 Comparison of associative learning between preschool children in non-plateau areas and plateau areas

Associative learning includes two tasks: word pair learning (listening channel) and symbol-picture learning (visual channel), each task includes three attempts and one delayed recall. The variance shows that the words have significant difference between the learning indicator groups, but the difference between the picture learning indicator groups does not have significant difference. Through covariance analysis with FIQ as covariable, it is concluded that there are significant differences in associative learning between preschool children in non-plateau areas and plateau areas (P< 0.05).[*Table 3*]

Table 3: Comparison of associative learning between preschool children in non-plateau areas and plateau areas.

	Control group	Experimental group	f-number	p-value
Word pair learning				
First try	5.67±1.18	2.93±1.84	7.34	0.000
Second try	8.20±1.57	4.40±1.74	7.63	0.000
Third try	11.36±1.79	5.97±1.35	3.58	0.000
Sum of three trials	25.23±2.97	13.30±4.63	8.34	0.000
Symbol-picture learning				
First try	2.37±1.30	1.87±1.13	0.74	0.118
Second try	7.43±1.07	5.07±1.23	0.25	0.000
Third try	9.30±1.06	7.63±0.10	0.01	0.000
Sum of three trials	19.10±2.13	14.57±2.86	0.22	0.000

7. Discuss

7.1 Characteristics of long-term memory of pre-school children in plateau environment

Long-term memory refers to memories that encode semantic features and retain information for more than 1 minute. The essential difference between long-term memory and short-term memory is that long-term memory needs to use past experience or knowledge to organize memorized materials and use semantic coding. Long-term memory and distant memory are two different concepts in clinical practice. In this sense, associative learning, recognition and free recall in this study are mainly used to measure subjects' long-term memory ability.

In this study, fixed-length randomly arranged word lists and pictures were used as free recall

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materials, and the results showed that the correct number of free recall in the experimental group (except for the difference between picture learning and the control group was not significantly significant) was lower than that in the control group, indicating that there were some problems in the long-term memory of pre-school children in the plateau environment, and the memory level of pre-school children was lower than that in the control group.

In the process of recognition experiment, children in the control group and the experimental group showed a certain gap between the control group and the experimental group in the auditory recognition of words and visual recognition of pictures. In particular, the difference between the two groups was significant in visual recognition of pictures, while the difference between the two groups was small in auditory recognition of words. It can be concluded that preschool children in the control group and the experimental group have less difference in memory of more complex words, and more difference in memory of more simple pictures. These results indicate that preschool children in plateau environment have different levels of problems in their long-term memory function due to the unique influence of plateau altitude.

7.2 Measures of long-term memory development of preschool children in plateau environment

Through research and data collection, the research team found that it is very important to cultivate children's ability to remember and organize information. In addition to semantic memory, which relies on abstract symbols, there is episodic memory for details of event scenes. [3]

Based on this study, the research team believes that by creating interesting life episodic memories that preschool children are interested in, the memory is closer to real life, and the children in plateau areas are helped to improve the breadth, depth and capacity of memory. At the same time, rich learning and memory strategies and the creation of attention situations and rich presentation forms are adopted to avoid the decline of children's attention:

(1)Support young children to recall meaningful events in their lives that they have experienced or observed.

(2)In the daily life, games or learning process, timely help children comb and review, form the corresponding cognitive experience, so that children can better remember and deepen the impression.

(3)According to the unique plateau environment, the research team suggests that the education program can be adjusted according to the unique terrain conditions and the physical conditions of preschool children, and the local characteristics can be combined to create conditions for the development of preschool children's long-term memory.

8. Conclusion

8.1 Research conclusion

This study mainly uses the experimental research method to study the long-term memory of preschool children in plateau and non-plateau areas and draws conclusions:

Compared with preschool children in non-plateau areas, preschool children in plateau areas were significantly lower than those in non-plateau areas in frequency associative recall tasks and semantic categorization recall tasks, and preschool children in plateau areas were significantly lower than those in non-plateau areas in visual recognition tasks. There was significant difference between the two groups in the learning of the word pairs in the associative learning (listening channel), indicating that the associative learning of the word pairs in the preschool children in the plateau area and the preschool children in the non-plateau area had better learning effect; Symbol-picture learning (visual channel) There is no significant difference between each indicator group of picture learning. The results show that preschool children in plateau environment have different degree problems in their long-term memory function because of the unique influence of plateau altitude.

8.2 Underresearch

First of all, there are some limitations in the object of study. Some pre-school children in plateau areas and non-plateau areas are selected, so they are not widely universal and representative. In the future research, the selection of research objects needs to be carefully considered.

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There are some deficiencies in the research content. This study has obtained some empirical conclusions, but due to its limited level, there is a certain subjective awareness of the elaboration of research conclusions and contents, and the processing ability of sample data needs to be strengthened. In addition, in the study and analysis of the characteristics of long-term memory of preschool children in plateau areas and non-plateau areas, it stays on the surface of the problem and does not dig out the deeper characteristics. I hope that in the future research, the shortcomings of this paper can be improved.

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