

To Explore the Influence of College Students' Empathy Ability on Attentional Bias in Reading Process

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Abstract—In recent years, the concept of "Empathy" has been widely studied in different fields of psychology. Reading teaching is regarded as a process of cultivating empathy to help readers better understand people's thoughts and emotions in the real world. In this study, we will further explore the relationship between reading and empathy, that is, the differences in the distribution of attention of subjects with different levels of empathy in the process of reading, supplemented by physiological data. This paper includes two studies. Study 1(Pretest Study): take Davis empathy scale and PISA reading quality test as measurement tools, and 118 college students from Southwest University as subjects to explore the relationship between reading and empathy. In Study 2, 17 subjects with high empathy level and 18 subjects with low empathy level were invited to do experiment through the screening of study 1. The attention bias of subjects with different empathy levels in reading was explored through the response time of reading text and biofeedback data. The research draws the following conclusions: (1) There is a significant correlation (positive correlation) between empathy level and reading ability. (2) Individuals with different empathy levels have different attentional bias in reading.

Index Terms—Reading, empathy, attentional bias, biofeedback.

I. INTRODUCTION

Empathy is a psychological concept, which refers to a kind of prosocial behavior between people. Psychological theory includes two different components: affective psychology theory and cognitive psychology theory. Cognitive empathy refers to an individual's ability to understand others' emotions and take their point of view cognitively. This process of understanding others' point of view is called cognitive empathy. Where there is a crossover with the implications of theory of mind. Affective theory of mind refers to an individual's understanding of the feelings of others, while cognitive theory of mind refers to an individual's understanding of the thoughts of others. Cognitive theory is a prerequisite for affective theory of mind and roughly corresponds to the cognitive aspects of pure empathy. Cognitive oriented researchers believe that empathy is the ability to understand and judge other people's emotions based on cognition [1]. For example, Ickes believes that empathy refers to an individual's ability to understand and judge the psychological feelings of others [2]; Feshbach and Hoffman

also believe that empathy is the ability to experience the emotions of others by recognizing the internal emotional state of others [3]. The above researchers believe that empathy is mainly to distinguish and distinguish the emotional state of others, and produce empathy on the basis of this cognition. Individual differences in empathy are an important topic in the field of psychological research.

In recent years, researchers have begun to focus on the neurobiological basis of empathy. It was found that individual differences in both affective and cognitive empathic traits were reflected in the brain's empathic response, brain structural state and resting state functional connectivity. In terms of gender, most studies at home and abroad show that women have a higher level of empathy than men. They suggest that empathy is closely related to the ability of embodied imitation, emotional processing and emotional understanding [4]. Moreover, the trait of empathy is highly heritable, with several gene types strongly associated with this ability. Differences in levels of cognitive empathy also show up in patterns of brain activation. A large number of studies based on patients with brain injury have shown that the medial prefrontal lobe is closely related to cognitive empathy [1].

Attention is the direction and concentration of psychological activities to a certain object. It is a common psychological feature accompanied by psychological processes such as perception, memory, thinking and imagination [5]. Attention has two basic characteristics. One is directivity, which means that psychological activities selectively reflect some phenomena and leave other objects. The second is concentration, which refers to the intensity or tension of psychological activities staying on the selected object [6]. Attentional bias means that individuals show different attentional allocation to threat stimuli or related stimuli relative to neutral stimuli. Eckhardt and Cohen studied the aggressive attentional bias of 88 college students and found that in the situation of being attacked, aggressive words affected the subjects with high level of trait anger, but had no effect on the subjects with low level of trait anger [7].

In reading, can you understand what the author thinks and feel the joys and sorrows of the characters in the author's works? Is it the description of the characters' emotions or the specific information that makes you understand the feelings of the author and the characters in the text [8]? Many studies have suggested that reading can help readers better understand the thoughts and emotions of people in the real world [2]. Reading literature can enhance empathy. When readers have empathy thinking for the text they read, they can interpret the text from multiple angles and levels, understand

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the author's writing intention, and further understand and comprehend the ideas conveyed by the author. Some researchers suggest that the improvement of reading ability promotes empathy and can be used as a means of positive psychological counseling. The process of developing reading skills and empathy is integrated.

Colin Barra found that reading can help readers better understand people's thoughts and emotions in the real world; Reading literature can enhance empathy [9]. Studies have shown that there is a strong relationship between empathy and language skills, but the relationship between reading and empathy remains elusive, although a shared neural matrix (temporoparietal junction; TPJ) is related to reading and empathy [10]. Inspired by these observations, Gabay, y et al. Conducted an individual response index (IRI) test on a group of participants with dyslexia and typical readers, which distinguished the two subscales of empathy (cognitive and emotional empathy) [11]. The results show that there is a strong correlation between reading related skills and empathy, and may indicate that TPJ participates in empathy and reading.

The cultivation of adolescents' empathy ability reflects the new requirements of school mental health education in the new era, which regards development and prevention as the primary task and pays attention to the development of adolescents' psychological potential and the cultivation of positive psychological quality. The evaluation of reading ability not only provides an effective tool for the psychological and educational research and practice of children's reading, but also provides a scientific basis for the educational intervention of children's reading ability cultivation, which plays a guiding role in the planning of reading activities and the formulation of policies [3]. In recent years, with the deepening of primary school Chinese reading education research and the rise of interdisciplinary research, more and more front-line teachers have discovered the impact of emotion on cognition and tried to introduce the concept of empathy into primary school Chinese teaching.

However, in these related studies, we find that there is a lack of demonstration on the correlation between reading ability and empathy level in the existing article, and few researchers pay attention to the attention bias of readers with different empathy levels in reading. We are interested in verifying whether there is a correlation between the two, what kind of information readers with different levels of empathy prefer to pay attention to in the text, and whether these information can cause the emotional resonance between the reader and the author or the protagonist in the text. In addition, we believe that the distribution of attention mechanism is a key link in the process of empathy, the high level of empathy and the low level of empathy subjects pay attention to the differences in the reading process not only can be used as the deep mechanism in the study on the relationship between the reading ability and the level of empathy, also for researchers interested in other aspects of empathy theory provide some new ideas and experiments. Through two experiments, this study will first explore the possible correlation between empathy and reading, and then further explore the subjects' attentional bias in reading.

II. STUDY ONE (PRETEST STUDY): TO EXPLORE THE RELATIONSHIP BETWEEN COLLEGE STUDENTS' READING ABILITY AND EMPATHY

A. Study Objective

Using questionnaire to measure the subjects' empathy level and reading ability, and explore whether there is a significant correlation between reading ability and empathy level.

B. Study Method

1) Subjects

118 college students (mostly from Southwest University), including 42 male subjects. All participants were right-handed, without audio-visual impairment or attention impairment.

2) Study materials

- Davis empathy scale (IRI)

IRI The reliability of (the Second Edition) is between 0.70-0.78 and the test-retest reliability is between 0.61-0.81. The scale was composed of four subscales: empathic concern (EC), perspective taking (PT), fantasy (FS), and personal distress (PD). Each subscale had seven items for a total of 28 items. Internal correlation analysis of the subscales showed that IRI questionnaire measured four relatively independent components of individual empathy. The IRI scale has good internal consistency and cross time stability, and can score the four components of empathy separately [12].

This scale is a five-point Likert scale, and the answers are 1 (completely inconsistent), 2 (relatively inconsistent), 3 (uncertain), 4 (relatively consistent), and 5 (completely consistent). There were nine reverse questions; The full score is 140.

- PISA reading quality test question

PISA measures reading ability mainly from three aspects :

- (1) the ability to obtain information;
- (2) The ability to understand information;
- (3) The ability to think and judge.

We choose The Fair Judge as the reading test question for this time, with a full score of 8 points.

3) Experimental procedure

This experiment requires a large number of subjects. We are publishing the questionnaire through the questionnaire star platform. The subjects need to complete the IRI and Pisa reading tests. A total of 118 data are collected, of which 100 are valid data.

4) Results

Excluding the data of random answers to the questionnaire and incomplete reading questions, the final valid data was 100.

Descriptive statistics were made on the subjects' empathy level and reading ability. The results are shown in Table I:

TABLE I: EMPATHY LEVEL AND READING ABILITY OF SUBJECTS

	M	SD
empathy level	98.82	9.835
reading ability	6.80	1.491

Correlation analysis was made on the subjects' empathy level and reading ability, and the correlation was 0.339, indicating that there was a moderate correlation between them, the significance was $p = 0.001 < 0.05$, and the result

was significant.

C. Discussion

According to Chen Siguang's experiment, we select the two dimensions of point of view selection and personal sadness as the main survey content, and make a correlation analysis between the subjects' scores in these two dimensions and their reading scores [13]. The results show that, There was a weak correlation between cognitive empathy and reading ability ($r = 0.290, P = 0.003$), while there was little correlation between emotional empathy and reading ability ($r = 0.077, P = 0.448$).

In this research, the discrimination of reading questions is still not high enough, and most subjects can achieve good results in the test. It may be that there are fewer reading questions and the difficulty of the questions is not high enough, resulting in the ceiling effect. Additionally, some subjects gave random answers, and the data of some subjects who did not give serious answers were deleted. However, it is not excluded that some subjects gave random answers in THE IRI scale, which led to the difference between the real empathy level and the experimental results, resulting in inaccurate data analysis results.

III. STUDY TWO: THE ATTENTIONAL BIAS OF SUBJECTS WITH HIGH AND LOW EMPATHY LEVEL IN READING

A. Study Objective

To explore the attentional bias of subjects with different levels of empathy in reading.

B. Study Method

1) Subjects

According to the results of Study one, 18 invalid questionnaires were deleted, and finally there were 17 subjects with high empathy level and 18 subjects with low empathy level, including 10 males.

2) Study materials

The empathy adjective scale (Batson, 1989)

Nine adjectives were scored by 7-point scoring method ($\alpha = 0.910 > 0.7$).

- Biological index detector
- Reading material

This study excerpts a news report on the moving deeds of the Wenchuan earthquake. The main contents are as follows:

Page1-summary;

Page2-mainly numbers information on time, date, amount of people etc.;

Page3-conection between people;

Page4-profile.

3) Experimental procedure

- (1) Inform the subjects to read the text materials carefully;
- (2) The subjects wear a biological index detector and read the text materials, and the researchers record the time for the subjects to read each page;
- (3) The subjects fill in the empathic adjective scale.

4) Results

(1) Descriptive statistics are made on the empathy degree of the subjects, and the results are shown in Table II:

TABLE II: EMPATHY OF SUBJECTS

	M	SD
High empathy group	45.8	10.1
Low empathy group	42.3	10

(2) Make descriptive statistics on the reading time of subjects on each page of text materials. The results are shown in Table III:

TABLE III: READING TIME

	M	SD
P1 High empathy group	32.0	10.80
Low empathy group	31.5	8.57
P2 High empathy group	22.0	6.98
Low empathy group	26.7	7.72
P3 High empathy group	25.5	7.53
Low empathy group	23.4	9.31
P4 High empathy group	21.5	6.96
Low empathy group	21.6	4.81
sum (High empathy group)	101.0	28.82
sum (Low empathy group)	103.2	27.61

It can be seen from Table III that the average time spent by the two groups of subjects on page 1 is the longest. The time spent by the subjects with high and low empathy level on reading the materials on page 2 and page 3 is more different. The subjects with low empathy level spend more time on reading page 2, while the subjects with high empathy level spend more time on reading page 3

Do one-way (Group) variance test on the reading time of P1, P2, P3 and P4. The results are shown in Table IV:

TABLE IV: ONE-WAY VARIANCE TEST ON THE READING TIME OF DIFFERENT MATERIALS

	F	df1	df2	P
P1	0.01914	1	16.3	.892
P2	2.55441	1	20.8	.125
P3	0.39281	1	22.0	.537
P4	0.00269	1	14.7	.959

TABLE V: P1 AND P2 REPEATED MEASUREMENT ANALYSIS OF VARIANCE

	F	P
P1 ∙ P2 reading time	23.42	.000
P1 ∙ P2 reading time * group	3.03	.095

TABLE VI: ANALYSIS OF VARIANCE OF REPEATED MEASURES P2 AND P3

	F	P
P2 ∙ P3 reading time	0.0121	.913
P2 ∙ P3 reading time * group	37.1239	.000

It can be seen from Table IV that the P values of reading time of the 4 pages of materials are all greater than 0.05, and the difference is not significant. However, in terms of

numerical values, the F value of P2 is still significantly greater than the other three items. Therefore, the reason for the insignificant P values is probably due to the small sample size. Compared with P1 and P4, the F value of P3 is also higher. It is speculated that the significance will be more obvious with the increase of sample size.

Continue to carry out repeated measurement variance test on P2 and before and after (P1 and P3 reading time), and the results are shown in Table V and VI.

(3) Statistical results of skin electrical data

Three instantaneous skin electrical values are randomly selected from the image according to the time periods P1, P2, P3 and P4, and their average is taken as the skin electrical value in this period for descriptive statistics

TABLE VII: TESTED SKIN ELECTRICAL DATA (UNIT: F)

	M	SD
P1 High empathy group	3.18	1.50
P1 Low empathy group	3.23	1.26
P2 High empathy group	2.67	1.34
P2 Low empathy group	4.63	4.54
P3 High empathy group	2.91	1.53
P3 Low empathy group	3.28	1.28
P4 High empathy group	2.83	1.41
P4 Low empathy group	3.60	1.35

It can be seen from Table VII that the average value of skin electricity of low empathy level subjects is higher than that of high empathy level subjects when reading the text materials on the second page; In the low-level subjects, the value of reading the second page was higher than that of reading the other three pages; There was no significant bias in the distribution of skin electrical value in the high empathy group.

IV. DISCUSSION.

(1) As can be seen from the results, both groups spent a relatively long time on page1, indicating that there was no deviation in the empathy ability of the overall cognitive level of the content in reading. On subsequent pages, the high empathy group spent significantly longer reading page3 than the other two, while the low empathy group showed a preference for page2. Considering the contents of each page of text materials: the second page is mainly about information content, and the third page is mainly about interaction between characters, it can be concluded that subjects with low empathy pay more attention to information in the text, while those with high empathy pay more attention to the description of events and characters. This conclusion is consistent with our experimental hypothesis, which proves that readers with different levels of empathy do have different attentional bias in reading. This is consistent with Xie Fangzhou et al.'s research, that empathy helps people better understand what others are thinking and build connections between people[14].

(2) There are two basic features of attention. One is directivity, which means that mental activities selectively reflect some images and leave other objects; The second is concentration, which refers to the intensity or tension of mental activity remaining on the selected object [6]. GSR, Skin electrical response, also known as "skin electrical

response", "skin electrical property", is an emotional physiological indicator, representing the changes in skin electrical conduction when the body is stimulated. Generally, resistance value and its logarithm or conductance and its square root are expressed, which can reflect the intensity of individual tension. The use of GSR to measure the subjects' attention can only reflect the concentration of attention, but not the directivity of attention[15]. The lack of proficiency in TPJ in this study resulted in poor utilization of the electrodermal data of the subjects. According to other studies on attention, EEG, eye movement and other data may be used for multi-dimensional detection [16].

(3) According to the scores of empathy adjective scale, the subjects have a high degree of empathy for reading materials, and the degree of empathy of low empathy level is generally lower than that of high empathy level group; however, In terms of reading duration, the total reading duration of subjects with low empathy level is higher than that of subjects with high empathy level. This may also be the experimental support for the conclusion of study 1, that is, low empathy subjects may spend more time and attention resources in the process of text reading, and consume more cognitive resources in the cognitive processing of information text, resulting in empathy awakening due to their relatively high reading ability (mainly cognitive empathy) is low, so it shows the above experimental phenomenon.

V. CONCLUSION

(1) There is a significant correlation (positive correlation) between empathy level and reading ability;

(2) There are differences in attention distribution among individuals with different empathy level.

The practical implications of this study are also worth considering. Due to its important and positive significance for social harmony and individual healthy development, empathy has been a concept of great concern in the field of psychology and social education. Many studies on empathy, including this one, have proposed many factors that affect the level of empathy. While it's not clear that empathy and reading promote each other, these studies suggest a range of empathy interventions, educational programs, (For example, how to establish screening standards for teenagers' reading materials), and more that might help academic research get off the page.

CONFLICT OF INTEREST

The author declares no conflict of interest.

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