

A Study on the Relationship between Field Cognitive Style and English Reading Strategy Choice

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Received: September 19, 2024

Accepted: October 20, 2024

Online Published: October 30, 2024

doi: 10.5539/elt.v17n11p113

URL: <https://doi.org/10.5539/elt.v17n11p113>

Abstract

In recent years, China has accelerated its internationalization process and made more and more achievements in cross-border exchanges and cooperation. Learning English is essential for the current generation of college students. English reading is an important means to acquire English language knowledge, understand external information, and improve English language practice skills. Since the 70s of the 20th centuries, many scholars at home and abroad have been conducting a lot of research on the correlation between reading strategies and cognitive styles, but most of them are descriptive analysis, and there are few empirical studies.

In this study, 324 first-year students majoring in science and engineering of Beijing Institute of Petrochemical Technology were selected by random sampling method, and the questionnaires of mosaic pattern test (Chinese version) and reading strategies were conducted, and data processing was carried out by SPSS 26.0, and descriptive statistics, independent samples t-test and Pearson correlation analysis were performed.

The results show that there are significant differences in the use of reading strategies among field-independent and field-dependent science and engineering freshmen. Among them, field-independent individuals are more inclined to choose metacognitive strategies, and field-dependent individuals are more inclined to choose social/emotional strategies. Teachers should give full consideration to the characteristics of students' cognitive styles in English teaching, scientifically adjust the design of activities, the selection of teaching materials and teaching methods, and provide diversified guidance to help students correctly understand themselves and improve their learning efficiency. Due to the limitation of time and sample size, there are still many shortcomings in this study, but to a certain extent, it reflects the current situation of science and engineering English learners in China, and provides empirical data support for teachers' "teaching" and students' "learning".

Keywords: cognitive style, English Reading Strategies, teaching English at the University level

1. Introduction

With globalization, learning English as a second language is becoming more and more important. The country has put forward new requirements for higher education, and the ability to read in English has become one of the key skills. Ellis points out that there are individual differences in students' language learning that influence the choice and effectiveness of reading strategies. The purpose of this paper is to explore the relationship between field cognitive style and reading strategy choice, so as to improve the English reading ability of science and engineering college students. Through research, it can provide teachers with a basis for teaching adjustments, help students identify their own cognitive styles, and improve reading effectiveness. It is of great practical significance for the theoretical development of second language acquisition and for the practice of English teaching and learning.

There are several innovations in this article:

(1) Research direction: Breaking away from the previous research on the relationship between cognitive style and English reading strategies, it focuses on the new relationship between cognitive style and English reading strategy choice.

(2) Research object: Taking science and engineering college students as the research object, this paper explores the choice of cognitive styles and reading strategies formed under scientific thinking, which fills the gap of research at home and abroad.

(3) Research tools: The use of comprehensive and innovative tools, such as the adaptation of GETF tests and the use of online questionnaires, has improved the quality and efficiency of research.

(4) Research data: use the empirical data collected within half a year to analyze quantitatively to improve the persuasiveness of the conclusions and the significance of teaching guidance.

2. Research Design

2.1 Research Questions

(1) What is the general tendency of the cognitive style of science and engineering freshmen at Beijing Institute of Petrochemical Technology?

(2) Does field cognitive style affect the choice of English reading strategies for science and engineering English learners?

(3) What are the characteristics of students with different cognitive styles in the use of English reading strategies?

2.2 Research Object

In this study, a total of 324 freshmen of science and engineering at Beijing Institute of Petrochemical Technology were selected as subjects.

2.3 Research Tools

In this study, the "Field Cognitive Style and English Reading Strategy Selection Test Paper" was used, which consisted of two parts: the GEFT test and the English Reading Strategy Questionnaire.

2.3.1 Cognitive Style Mosaic Pattern Test (GEFT)

The GEFT is used to test the cognitive style tendency of the individual field. There are 15 questions in this section. In the test, simple graphs are embedded in complex graphs. All participants have to do is determine whether a given simple figure exists in a complex shape within a limited amount of time. The test takes 10 minutes, as shown in Table 1. The test time has a significant impact on the validity of the test, and each part must be completed within the specified time.

Table 1. Requirements for Mosaic Pattern Testing

topic	Number of questions	Grading Criteria	Unavailable
Part I	1	No scores (Examination of the understanding of the topic)	1min
Part II	15	2 marks for each question	9min

According to the above scoring criteria, the field cognitive style score of the participants was calculated, and the students with a field cognitive style score greater than 15 points were classified as field-independent learners, and those with a score of less than 15 points were field-dependent learners.

2.3.2 English Reading Strategies Questionnaire

According to O'Malley & Chamot (2001), reading strategies are divided into three dimensions: metacognitive strategies, cognitive strategies, and social/emotional strategies. This section consists of 22 questions, the basic information of which is shown in Table 2.

Table 1. Basic information about the Reading Strategy Questionnaire

Dimension	Item
Cognitive strategies	22、24、26、27、28、30、31、32、33、34
Metacognitive strategies	23、25、29、35、36、37、38
Social/Emotional Strategies	17、18、19、20、21

2.4 Research Process

2.4.1 Questionnaire Design

This time, Tencent questionnaires were used to answer questions online. In the "Field Cognitive Style and English Reading Strategy Selection Test Paper", some of the test questions are adapted from the actual situation of the first-year science and engineering students of the university. In the early stage, 10 students were selected as the subjects of the questionnaire to test the reliability and validity of the questionnaire. Through analysis, the test volume has good reliability and validity. Finally, it will be put into service in June 2024.

2.4.2 Testing Process

In June 2024, the "Field Cognitive Style and English Reading Strategy Selection Paper" will be conducted in six first-year English teaching classes of science and engineering, and the teachers of each teaching class will supervise and discipline the whole process to maintain the rigor of the test.

The test is divided into five main steps:

- (1) The test QR code will be issued when the class bell rings, and the importance of the test paper will be mentioned;
- (2) Students read the rules and examples of the Home so that students can fully understand the rules and practices of the test paper;
- (3) Complete the first part of the test paper "Cognitive Style Mosaic Graphic Test" within 10 minutes, and in the process, one question at a time, and it is not allowed to read the next part of the content in advance;
- (4) When the time is up, an order will be issued to stop answering the first part of the question, and the second part of the test paper "English Reading Strategy Test Questionnaire" will be completed within 10 minutes;
- (5) Submit immediately after completion.

The above steps ensure that each student spends the same amount of time in each section and improves rigor. A total of 324 test papers were recovered in this study, with an effective recovery rate of 100% and an effective rate of 100%.

2.4.3 Data Analysis

Excel and SPSS 26.0 software are used. Firstly, descriptive analysis was conducted to understand students' field cognitive style tendencies and reading strategy choices. Secondly, correlation analysis was conducted to explore the relationship between field cognitive style and English reading strategy choice. Then, conduct qualitative analysis through interviews or focus groups, may provide deeper insights into the reasons students choose certain strategies and their perceptions of the connection between cognitive style and strategy use.

3. Data Analysis and Discussion

3.1 Credibility Analysis of Test Volumes

The results of the students' individual test papers were entered into the SPSS26.0 software for analysis. The overall test paper is divided into two parts, the first half (1-15 items) of the mosaic graph test to analyze the overall field cognitive style tendency, and the second half (17-38 questions) of the English reading strategy questionnaire to analyze the tendency of each reading strategy.

After that, the invalid data and reliability analysis of the data of this test volume were performed. As shown in Table 3, the missing value of the test volume is 0 and the invalid data is also 0. As shown in Table 4, the total reliability of the test paper is 0.920-, indicating that the reliability of the field cognitive style test and the English reading strategy survey is relatively high, and data analysis can be carried out.

Table 3. Statistics

		Number of cases	%
Cases	effective	324	100.0
	Exclusion a	0	.0
	total	324	100.0

a: Column deletion based on all variables in the process;

Table 4. Reliability statistics

Clone Bach Alpha	Number of items
0.920	37

Table 5. Total statistics

	The average of the scale after the item is deleted	Scaled variance after the item is deleted	The corrected item correlation with the total	Clone Bach alpha after deleting an item
t01	90.69	255.248	.050	.921
t02	90.63	255.640	.021	.922
t03	90.55	254.415	.097	.921
t04	90.77	255.061	.071	.921
t05	90.42	254.869	.070	.921
t06	90.67	254.186	.118	.921
t07	90.90	255.185	.093	.921
t08	90.95	255.409	.099	.921
t09	90.35	255.010	.064	.921
t10	90.73	255.192	.057	.921
t11	90.88	255.974	.012	.921
t12	90.34	255.865	.008	.922
t13	90.46	255.228	.046	.921
t14	90.60	256.073	-.007	.922
t15	90.61	255.570	.025	.922
17. Before reading in English, students will guess the general meaning of the passage through the title and pictures	88.53	237.117	.554	.917
18. Before reading, the subject matter of the material will be analyzed, and the structure of the material will be predicted and grasped	88.72	233.962	.683	.915
19. When reading an article in English, I first go through the entire text	88.79	236.998	.520	.918
20. When reading, I will use the method of expanding the visual distance to read quickly	88.74	236.366	.585	.917
21. When reading an English article, I first skim it to pay attention to its length, structure, etc., and then read it carefully	88.79	234.443	.642	.916
22. When reading, pay attention to the theme sentence and the main idea of the article	88.40	234.029	.677	.915
23. Be able to consciously control the reading time when reading in English	88.87	232.489	.694	.915
24. When reading English texts, I use what I already know	88.56	234.681	.649	.916

25. Analyze sentence components when long and difficult sentences appear in reading materials	89.03	232.742	.648	.916
26. When reading English texts, I will underline key words and sentences in the passage to help comprehension	88.44	235.406	.601	.916
27. When reading is difficult, I will read it more slowly	88.13	238.386	.574	.917
28. In reading, attention is usually very focused and not easily distracted by the outside world	88.69	237.155	.617	.916
29. When reading English texts, I discuss the content of the passage with others to better understand	89.20	234.648	.619	.916
30. According to different reading materials, I will adjust my reading method (such as skimming, precision, reading, etc.) and speed in time	88.73	233.982	.684	.915
31. When reading an article in English, I explain what I read in my own words to help with understanding	88.34	235.334	.690	.915
32. In the process of reading, you will notice transitions, transitions and other words, and judge the logical relationship of sentences	88.46	233.729	.723	.915
33. Be able to notice the central word or synonym that appears multiple times in the material during reading	88.51	233.173	.726	.915
34. When I read an article in English, I summarize the content of the article	88.81	232.454	.707	.915
35. After the reading is completed, the reading methods used will be summarized to check whether the reading goal has been achieved	88.93	231.503	.717	.915
36. Communicate reading experiences with classmates after reading	89.17	235.021	.597	.916
37. Always take the initiative to ask the teacher about reading skills after reading	89.36	235.686	.605	.916
38. Participate in English reading competitions to improve your reading skills	89.57	235.862	.564	.917

Note: T01-T15 is a mosaic figure test question

KMO samples and Bartlett test were used to test the correlation of the data. Very good at $0.9 > KMO < 0.8$, excellent at $0.8 \leq KMO < 0.7$, fair at $0.7 < KMO \leq 0.6$, poor at $0.6 > KMO \geq 0.5$, very poor at $0.5 < KMO \leq 0.4$, and not at $0.4 \leq KMO$. As shown in Table 6, the KMO of this questionnaire is 0.950, indicating that the data from this experiment can be used as factor analysis. The Bartlett test value is 0.000, and the probability of significance is less than 0.01, indicating that the data are relevant and eligible for further factor analysis.

Table 6. KMO and Bartlett test

The number of KMO sampling appropriateness		.950
Bartlett sphericity test	Approximate chi-square	4447.469
	degree of freedom	231
	Distinctiveness	.000

3.2 Statistics and Analysis of Cognitive Styles

According to the score of the participant's field cognitive style, the total score of this study was 30 points, and the score above 15 was classified as the propensity field independent individual, and the score below 15 was the propensity field dependent individual. The field cognitive style distribution of first-year science and engineering students is as follows:

Table 7. Field cognitive style distribution

	Number of cases	average value	standard deviation	Standard error mean
field independence	259	19.81	3.000	.186
Field dependent	65	13.26	1.035	.128

According to the data in Table 7, among the 324 subjects, 259 were field-independent, accounting for 79.94%. There were 65 field-dependent individuals, accounting for 20.06%. This indicates that the overall field cognitive style of science and engineering freshmen of Beijing Institute of Petrochemical Technology is more inclined to field independence. It can be seen that teachers should fully consider the differences in students' individual field cognitive styles in teaching, and teach students according to their aptitude, and adopt the teaching strategy of promoting their strengths and avoiding weaknesses for students with different field cognitive styles. Help students and teachers identify individual cognitive styles and find better learning and teaching methods.

3.3 Statistics and Analysis of English Reading Strategies

Twenty-two questions on the reading strategy test were analyzed for factors. The data obtained is as follows:

Table 8. Maximum value reversal table

	ingredients		
	1	2	3
26. When reading English texts, I will underline key words and sentences in the passage to help comprehension	.740		
32. In the process of reading, you will notice transitions, transitions and other words, and judge the logical relationship of sentences	.735		
33. Be able to notice the central word or synonym that appears multiple times in the material during reading	.735		
31. When reading an article in English, I explain what I read in my own words to help with understanding	.730		
27. When reading is difficult, I will read it more slowly	.702		
22. When reading, pay attention to the theme sentence and the main idea of the article	.654		
24. When reading English texts, I use what I already know	.631		
30. According to different reading materials, I will adjust my reading method (such as skimming, precision, reading, etc.) and speed in time	.589		
34. When I read an article in English, I summarize the content of the article	.562		
28. In reading, attention is usually very focused and not easily distracted by the outside world	.480		
37. Always take the initiative to ask the teacher about reading skills after reading		.851	
36. Communicate reading experiences with classmates after reading		.843	
38. Participate in English reading competitions to improve your reading skills		.807	
29. When reading English texts, I discuss the content of the passage with others to better understand		.697	
35. After the reading is completed, the reading methods used will be summarized to check whether the reading goal has been achieved		.635	
23. Be able to consciously control the reading time when reading in English		.599	
25. Analyze sentence components when long and difficult sentences appear in reading materials		.582	
17. Before reading in English, students will guess the general meaning of the passage through the title and pictures			.828
18. Before reading, the subject matter of the material will be analyzed, and the structure of the material will be predicted and grasped			.684
19. When reading an article in English, I first go through the entire text			.554
20. When reading, I will use the method of expanding the visual distance to read quickly			.492
21. When reading an English article, I first skim it to pay attention to its length, structure, etc., and then read it carefully			.427

According to Table 8 Maximum Inversion Table, the survey questions of this reading strategy survey are classified into three factors, and then named cognitive strategy, metacognitive strategy, and affective strategy according to the classification of reading strategies.

(1) T22, T24, T26, T27, T28, T30, T31, T32, T33, and T34 are the first factor "cognitive strategies".

(2) T23, T25, T29, T35, T36, T37, and T38 are the second factors of "metacognitive strategy".

(3) T17, T18, T19, T20, and T21 are the third factor, "social/emotional strategies".

3.4 Differences in the Use of Field-independent and Field-dependent English Reading Strategies

Table 9. Differences in the three factors of field-independent and field-dependent reading strategies

		Levine variance equivalence test		Mean equivalence t-test						
		F	Distinctiveness	t	degree of freedom	Significance (bilateral)	Mean difference	Standard error difference	Difference lower limit	95% confidence interval upper limit
Cognitive strategies	Equal variance is assumed	.587	.444	.023	322	.008	.01598	.69498	-1.35130	1.383250
	Equal variance is not assumed			.022	92.472	.007	.01598	.73471	-1.44312	1.475072
Metacognitive strategies	Equal variance is assumed	1.461	.228	-.776	322	.002	-.42088	.54230	-1.48777	.646027
	Equal variance is not assumed			-.719	90.497	.006	-.42088	.58511	-1.58321	.741461
Social/Emotional Strategies	Equal variance is assumed	.151	.698	-.412	322	.001	-.13689	.33190	-.78985	.51607
	Equal variance is not assumed			-.397	94.158	.003	-.13689	.34518	-.82223	.54845
Overall strategy	Equal variance is assumed	.774	.380	-.096	322	.009	-.03629	.37988	-.78364	.71107
	Equal variance is not assumed			-.089	91.326	.006	-.03629	.40630	-.84332	.77075

In this study, the independent-samples t-test was used to analyze the differences in the use of different reading factors by field-independent and field-dependent individuals. According to the data in Table 9, the value of the overall reading strategy was 0.006 in the significance (bilateral), which was less than 0.05, indicating that the different field cognitive styles of science and engineering freshmen would lead to differences in their choice of reading strategies. Among them, the significance (bilateral) of cognitive strategies, metacognitive strategies, and social/emotional strategies was less than 0.05, indicating that there were significant differences in the use of reading strategies among the field-independent and field-dependent science and engineering freshmen.

3.5 Analysis of the Propensity of Field-independent and Field-dependent Reading Strategy Selection

3.5.1 Statistics and Analysis of Cognitive Style and English Reading Strategy Selection

Table 10.

	Cognitive style	Number of cases	average value	standard deviation	Standard error mean
Cognitive strategies	field independence	259	23.0846	4.91120	.30517
	Field dependent	65	22.0686	5.38827	.66833
Metacognitive strategies	field independence	259	23.8772	3.80140	.23621
	Field dependent	65	22.2981	4.31584	.53531
Social-emotional strategies	field independence	259	9.8717	2.35990	.14664
	Field dependent	65	23.0086	2.51930	.31248
Overall strategy	field independence	259	14.0007	2.67224	.16604
	Field dependent	65	14.0370	2.98970	.37083

From Table 10, it can be concluded that the frequency of using reading strategies in field-dependent individuals (14.0370) is higher than that in field-independent individuals (14.007). For field-independent individuals, the frequency of metacognitive strategy selection (23.8772) was greater than that of cognitive strategy selection (23.0864) and greater than that of social/emotional strategy selection (9.8717). For field-dependent individuals, the frequency of social/emotional strategy selection (23.0086) was greater than that of metacognitive strategy selection (22.2981) and greater than that of cognitive strategy selection (22.0686). In summary, field-independent individuals are more inclined to choose metacognitive strategies and are not good at choosing social/emotional strategies. Field-dependent individuals are more likely to choose social/emotional strategies than cognitive strategies.

3.5.2 Analysis of Field-Independent and Field-Dependent Cognitive Strategy Tendency

Table 11. Correlation between cognitive styles and cognitive strategies

		Field cognitive style score	Cognitive strategies
Field cognitive style score	Pearson correlation	1	.299
	Significance (bilateral)		.006
	Number of cases	324	324
Cognitive strategies	Pearson correlation	.299	1
	Significance (bilateral)	.006	
	Number of cases	324	324

From Table 11, the significance (bilateral) value of field cognitive style score and cognitive strategy of science and engineering freshmen was 0.006, less than 001, indicating that there is a linear relationship between field cognitive style and cognitive strategy. The correlation coefficient between field cognitive style score and cognitive strategy was 0.299, indicating that the correlation between the two was low. If the R value is greater than 0, there is a positive correlation between the two, and the higher the field cognitive style score, the more often this reading strategy is chosen.

3.5.3 Analysis of the Propensity of Field-independent and Field-dependent Metacognitive Strategies

Table 12. Correlation between Cognitive Styles and Metacognitive Strategies

		Field cognitive style score	Metacognitive strategies
Field cognitive style score	Pearson correlation	1	.301
	Significance (two-tailed)		.003
	Number of cases	324	324
Metacognitive strategies	Pearson correlation	.301	1
	Significance (two-tailed)	.003	
	Number of cases	324	324

From Table 12, the significance (bilateral) value of field cognitive style score and metacognitive strategy of science and engineering freshmen was 0.003, less than 001, indicating that there is a linear relationship between field cognitive style and cognitive strategy. The correlation coefficient between field cognitive style score and cognitive strategy was 0.301, indicating that the correlation between the two was low. If the R value is greater than 0, there is a positive correlation between the two, and the higher the field cognitive style score, the more often this reading strategy is chosen.

3.5.4 Analysis of Field-Independent and Field-Dependent Propensity to Social/Emotional Strategies

Table 13. Cognitive Styles and Social/Emotional Strategies relevance

		Field cognitive style score	Social/Emotional Strategies
Field cognitive style score	Pearson correlation	1	-.332
	Significance (two-tailed)		.002
	Number of cases	324	324
Social/Emotional Strategies	Pearson correlation	-.332	1
	Significance (two-tailed)	.002	
	Number of cases	324	324

From Table 13, the significance (two-sided) value of field cognitive style score and social/emotional strategy of science and engineering freshmen was 0.002, less than 001, indicating that there is a linear relationship between field cognitive style and cognitive strategy. The correlation coefficient between field cognitive style score and cognitive strategy was 0.332, indicating that the correlation between the two was low. If the R value is less than 0, there is a negative correlation between the two, and the higher the field cognitive style score, the less often this reading strategy is chosen.

4. Results and Limitations

The proportion of midfield independent individuals among the first-year science and engineering freshmen of Beijing Institute of Petrochemical Technology is large, close to 80%. There were significant differences in the use of reading strategies among field-independent and field-dependent science and engineering college students, with field-independent individuals more inclined to choose metacognitive strategies and field-dependent individuals more inclined to choose social/emotional strategies. Among them, the characteristics of field-independent individuals determine that people with this type of cognitive style will pay more attention to their own internal factors and are not easily influenced by the outside world. This requires that in the process of second language acquisition, teachers should strengthen guiding instructions, give full play to their advantages in reasoning and deduction, and focus on the use of social/emotional strategies by independent students, and encourage them to learn to use the external environment to improve themselves.

The relationship between the choice of English reading strategy and cognitive style is very complex, and although this study was conducted after a multi-faceted study, there are still shortcomings in the process:

- (1) Sample limitations: The study is based on the freshmen of science and engineering in our university, although it is representative, but due to the limitation of sample size, it may affect the universality of the study.
- (2) Limitations of the test method: Although the mosaic pattern test is common, the online test may lead to deviations in the description and communication, which affects the accuracy of the test results.
- (3) Limitations of questionnaire design: The reading strategy questionnaire is not comprehensive in terms of question setting, and the number and proportion of questions may not fully reflect the real situation of students.

Through the analysis of the results and limitations, this study provides useful insights into English teaching practices and points to the direction of future research improvements.

5. Conclusion

The relationship between field cognitive style and reading strategy choice discussed in this paper has a profound impact on the development of learners' abilities and the improvement of educators' skills in today's rapid development of psychology and language education. In the future, it will provide a theoretical basis for teachers to carry out teaching reform in teaching activities. It also provides suggestions for educators on how to consider course design and material preparation. For students, they can be clear about their own cognitive style, and clarify the reading strategies they are good at and the reading strategies they are not good at. And clarify the connection between cognitive style and the choice of previous learning methods, such as motivation, language competency, or previous learning experiences. It is hoped that this study can enable more individuals to become efficient readers and users of strategies, to be able to flexibly switch between different strategies, to effectively avoid the rigidity of their own field cognitive style, and to make a qualitative leap between teachers' "teaching" and students' "learning".

Acknowledgement

Funded Project: The research is financed by Beijing Institute of Petro-Chemical Technology Undergraduate Research Training Project - (No. 2024J00254).

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