

## Learning Styles: Predictors of Foreign Language Proficiency?

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### Abstract

This study predicted English achievement of Chinese students using the Productivity Environmental Preference Survey (PEPS), a broadly focused learning style instrument. Learning style refers to “the general approach...that students use in acquiring a new language”, which “provides broad direction to learning” (Oxford, 2003, p. 273). Adopting the recommendation made by Ehrman and Oxford (1995), the participants consisted of 300 university students with non-English majors aged from 18 to 23 in the second year. Foreign language achievement was measured using the students' final grades in their English course. A Chinese version of the PEPS was adopted to measure the students' learning preferences pertaining to the following 19 modalities: noise, light, temperature, design, motivation, persistence, responsibility, structure, peer orientation, authority orientation, auditory, visual, tactile, kinesthetic, intake, evening/morning, late morning, afternoon, and mobility. The multiple regression was used to analyze whether these PEPS subscales could significantly predict English proficiency. Results showed that only Seating design (.04), Responsibility (.00), Authority orientation (.00), Kinesthetic (.01), and Mobility (.00) were significant predictors of English achievement ( $p < .05$ ), which account for 19% of variance in English Achievement ( $R^2 = .19$ , Adjusted  $R^2 = .15$ ).

*Keywords:* English achievement, Learning style

### Introduction

Many studies have been carried out on ESL/EFL learners to examine different variables associated with their language achievement, such as motivation (e.g., Gao et al., 2007), anxiety (e.g., Bailey, 1983; Horwitz et al., 1986), unwillingness to communicate (e.g.,

Liu & Jackson, 2008), language attitudes (e.g., He & Li, 2009), investment and identity (e.g., Gao et al., 2007), and learning strategies (e.g., Chen, 2007). These variables have been shown to significantly affect second/foreign language achievement.

However, relatively few researches have explored the effect of learning styles on other individual difference variables and/or on foreign language proficiency. Learning styles, a major component of personality, refer to “the general approaches...that students use in acquiring a new language or in learning any other subject”, which “provide broad direction to learning” (Oxford, 2003, p.273). Learning styles differ from learning strategies in the sense that the former describes unintentional, or automatic individual characteristics while the latter represents actions chosen by students that are intended to facilitate learning (Ehrman & Oxford, 1995). There are only a few valid and reliable instruments used to assess students’ language learning styles (Dunn et al., 1989), out of which a very broad, comprehensive one is the Productivity Environmental Preference Survey (PEPS), designed by Dunn et al. (1991, in Howard, 1996). The PEPS, a 100 item survey in seven-point Likert format, consists of the following four areas: (1) environmental preferences (sound, light, temperature, and design); (2) emotional preferences (motivation, persistence, responsibility, and structure); (3) sociological preference (learning alone or with peers); and (4) physical preferences (perception, intake, time of day, mobility). Dunn et al. (1991, in Howard, 1996) argue that each individual’s learning style reflects his/her automatic reactions to outside stimuli when the person learns in a particular context. As such, the PEPS seeks to elicit information about general conditions under which the individuals prefer to learn.

Using a self-reporting questionnaire including 50 statements, Reid (1987) investigated the perceptual preferences of 154 native English students (NES) and 1234 nonnative students of English (NNES) at several American universities. Results revealed that NNES’s learning style preferences were often significantly different from those of NES and that NNES with different languages sometimes have different perceptual preferences. Although most of NNES and NES were kinesthetic, they differed in their use of tactile learning style.

Korean students showed the most visual preference, followed by Arabic and Chinese students, who strongly like auditory approach as well. Thai, Malay, and Spanish students, however, prefer auditory condition while Japanese were the least auditory. Meanwhile, the researcher found that different perceptual preferences might relate to other variables such as sex, length of time in the United States, length of time studying English in the U. S., field of study, level of education, TOEFL score, and age, and that change in NNES's preferences would keep pace with changes in academic environment and experience.

Several studies have related isolated dimensions of learning styles to language achievement. For instance, Oxford et al. (1993) focused on a group of 107 students from 8 high schools in Alabama, Mississippi, Tennessee, New Jersey, and Illinois, respectively, who learned Japanese as their foreign language through satellite television. The researchers looked into such factors that influence language achievement as the students' motivation, learning styles (specifically, visual, auditory, and hands-on), learning strategy use, gender, previous language learning experience, and course level. Four instruments were used: the Japanese Learning Survey (JLS), the Strategy Inventory for Japanese Language Learning-by Satellite (SZJALL), the Japanese Language Achievement Test (JLAT), and the Learning Channel Preference Checklist (LCPC). Results indicated that motivation and learning strategy were the most influential determiner of achievement. Visual learning styles might be more prevalent in the satellite instruction sample than auditory or hands-on styles since visual students significantly outperformed auditory and tactile/kinesthetic students.

The studies conducted by Ehrman and Oxford (1990; 1995) might be the most influential researches investigating the relationship between isolated learning styles and foreign language achievement. Employing the Myers-Briggs Type Indicator (MBTI) and the Strategy Inventory for Language Learning (SILL), Ehrman and Oxford (1990) examined language learning styles and strategies of 20 students from the Foreign Service Institute (FSI) in an intensive foreign language training setting. Results suggested that introverts, feelers, perceivers and intuitive seemed to advance extroverts, thinkers, judgers, and

sensing students in language learning in the classroom, evidenced by their higher average grades than the latter. Thinkers, judgers, and sensing students, all of whom were more detail- and structure-oriented than their opposites, preferred a large number of identifiable, specific strategies instead of the smaller number of more sweeping strategies exploited by feelers, perceivers, and intuitive.

Ehrman and Oxford (1995), in their study of connecting a variety of variables with proficiency in speaking and reading, included 855 highly educated FSI adults in intensive foreign language training classrooms at the U.S Department of State. Independent variables included were tested cognitive aptitude, learning strategies, learning styles, personality, motivation, and anxiety. Accordingly, ten instrument served to satisfy the requirement of this study: Affective Survey, the Hartmann Boundary Questionnaire (HBQ), the National Association of Secondary Schools Principals' Learning Style Profile (LSP), the Myers-Briggs Type Indicator (MBTI), the Type Differentiation Indicator (TDI), the Modern Language Aptitude Test (MLAT), Strategy Inventory for Language Learning (SILL), Measures of Student Language Proficiency, Faculty Rating Questionnaire, and Self-report as an Issue. Ehrman and Oxford found that cognitive inflexibility, age, less education, no previous language learning experience, certain kinds of anxiety, thick ego boundaries, compliance, and preference for MBTI sensing might impose negative effect on the success of speaking and reading. On the other hand, despite the fact that language learning success at FSI strongly correlated with cognitive aptitude, several learning styles did correlate at low levels with end-of-training speaking and reading proficiency, albeit not significant. First, FSI students with thin ego boundaries seemed to achieve higher scores in reading and speaking. Then, intuition correlated at low levels with reading and speaking proficiency. However, the researchers recommended replicating the study particularly with university students because of the self-selective sample of FSI students.

Until now, very few empirical studies have examined the relationships between a combination of learning styles and foreign language achievement. Thus, adopting the recommendation made by

Ehrman and Oxford (1995), this study intends to use a broadly focused learning style instrument --- the PEPS to identify a combination of learning styles that might be correlated with English achievement of Chinese university students with non-English majors. It was hypothesized that the overall relationship of the language learning styles and the Chinese student's English achievement would be positive. It is felt that the findings of this study would present teachers a full picture of the learning style distributions of Chinese EFL non-majors and help the students to understand and compensate for their own less preferred styles.

Specifically, the present study attempts to answer the following two questions:

1. What are the learning style distributions of these Chinese English students?
2. Which among the learning styles could best predict English achievement of these students?

## **Methodology**

### **Participants**

The participants consisted of 300 non-English major students aged from 18 to 23 in the second year at a Chinese university. Thirty-two percent of the sample was female. These students were from the colleges of Engineering, Computer, and Economy and Trade. These students were required to take the English language course in their first and second years as part of a degree program. In addition, all the participants had studied a foreign language formally in high school and a majority of them (99%) had never left China. Their mother tongue is Chinese Mandarin while their foreign language is English. Approximately 99.3% of the students had immediate family members whose native language was not English. These criteria were determined through demographic questions in the instruments.

## Instrument

Two instruments were used: a Chinese version of the Productivity Environmental Preference Survey (PEPS) and the students' final English grades. The PEPS is a comprehensive approach to the identification of how the students learn best in the following four domains: (1) environment (i.e. sound, temperature, light, and seating design); (2) emotionality (e.g. motivation, responsibility, persistence, and the need for either structure or flexibility); (3) sociological preferences (i.e. learning alone or with peers); and (4) physical needs (e.g. perceptual preference(s), time of day, intake, and mobility). Specifically, the PEPS (for the 100 items, see Appendix A and for the item combination of the 19 modalities, see Appendix B) measures individuals' preferences pertaining to the following 19 modalities: noise, light, temperature, design, motivation, persistence, responsibility, structure, peer orientation, authority orientation, auditory, visual, tactile, kinesthetic, intake, evening/morning, late morning, afternoon, and mobility.

Performance of each modality (each subscale) is expressed in standard score units, ranging from 20 points to 80 points ( $M=50$ ,  $SD=10$ ) in accordance with the seven-point Likert scale, ranging from strongly disagree to strongly agree. Strong preferences have scores that are 40 or lower or 60 or higher while scores between 40 and 60 indicate no preference. Thus, for example, a high score on the visual subscale (i.e. 60 or more) indicates that the individual strongly prefer learning language via the visual approach, whereas a low score (i.e. 40 or less) shows strong preference to learn language not via the visual mode. Based on a 504-person sample, the average reliabilities of the PEPS is .75, with the reliability of its subscales being shown as follows: sound (.86), light (.91), warmth (.86), formal design (.76), motivated/unmotivated (.65), persistent (.63), responsible (.76), structure (.71), learning alone/peer oriented (.86), authority-oriented learner (.48), auditory preferences (.81), visual preferences (.71), tactile preferences (.33), kinesthetic preferences (.67), requires intake (.88), evening/morning (.87), late morning (.84), afternoon (.88), and needs mobility (.83) (Price, 1996, in Islam, 2007). The internal consistency

reliability of the PEPS is .71, based on a 117-person stratified random sample (Howard, 1996). In Howard's (1996) study, a panel of experts reported the content validity of the instrument.

A Chinese version of the Productivity Environmental Preference Survey (PEPS) was used by Islam (2007) where the PEPS was translated into Chinese by a professional translator through all necessary steps (i.e. back translation, synonym substitution, and proof reading). This study modified this Chinese version by changing its Likert scale from six-point to seven-point and specifying its context as learning English. Thus, this resulting Chinese version of the PEPS ensured, on the one hand, that Chinese students could fully understand the 100 items, and on the other, that the seven-point Likert scale would be consistent with the standard score units, ranging from 20 points to 80 points ( $SD=10$ , thus seven intervals).

Foreign language achievement was measured using the students' final grades in their English course (the full grade is 100 points) because final course grades are by far the most common measure of foreign language achievement in Chinese universities. As all the non-major English students were taught by a same English teacher using the same textbooks and tested by the same test paper, there's no need to consider the differences in teacher characteristics (e.g. effectiveness, experience, motivation, and testing and scoring standards).

## **Procedure**

Permission was asked to the colleges of Engineering, Computer, and Economy and Trade at this university for the administration of the PEPS. After making a time schedule, the questionnaire was sent to the three colleges' counselors through email. The counselors helped make 300 copies of the questionnaire and administered the PEPS. All the students agreed to participate in the study before the distribution of the PEPS questionnaire.

During the completion of the questionnaire, the students stayed in several quiet classrooms to avoid distractions and the counselors offered some necessary help to them by explaining the instructions on

the questionnaire and asking them to provide the demographic information first. After that, the students spent 20-30 minutes to finish the 100 items in the PEPS questionnaire. The three counselors entered the questionnaire data into an Excel file and offered me these students' final grades in their English course in Excel file format too, then mailed them back to me.

### **Data Analysis**

The PEPS results of the participants were computed on the basis of the 19 modalities. For each modality, the score that is 40 or lower or 60 or higher suggests the preference for this style while the score between 40 and 60 indicates no preference.

Descriptive statistics were calculated for the PEPS distributions of the students to answer the first research question. To examine the relationship between learning styles and foreign language achievement (the second question), the statistical procedure of multiple regression was adopted, which uses scores on the 19 subscales of the PEPS to predict scores on English achievement. The contribution of the 19 modalities was determined by employing Cohen's (1988, in Onwuegbuzie et al., 2008) effect criteria for multiple regression models in the behavioral sciences. That is,  $R^2$  values between 2 and 12.99% suggest small effect sizes, values between 13 and 25.99% indicate medium sizes, and values of 26% and greater suggest large effect sizes.

### **Results**

The distribution of the 19 learning styles (light, temperature, design, motivation, persistence, responsibility, structure, peer orientation, authority orientation, auditory, visual, tactile, kinesthetic, intake, evening-morning, late morning, afternoon, and mobility), and the English achievement grades was computed. Table 1 shows the numbers, the means, the percentages (in terms of the means), the minimum and maximum scores, and the standard deviation distribution of all factors.



Table 1  
*Descriptive Statistics for the PEPS and English Achievement Grade*

	Factor	N	M	P	Minimum	Maximum	SD
English Grade	Achievement	300	61.16	63.67%	19	94	10.99
PEPS							
1)	Sound	300	39.37	51%	20	55	8.69
2)	Light	300	65.66	77.67%	45	80	9.38
3)	Temperature	300	50.54	50%	20	80	15.07
4)	Seating design	300	58.51	55.33%	44	80	9.45
5)	Motivation	300	67.57	86.67%	40	80	8.04
6)	Persistence	300	66.90	94.33%	53	78	5.59
7)	Responsibility	300	58.97	52.33%	42	80	8.45
8)	Structure	300	60.73	63.66%	32	78	8.30
9)	Peer orientation	300	40.22	50.67%	26	60	8.19
10)	Authority orientation	300	60.01	52.67%	42	76	7.89
11)	Auditory	300	61.73	59.67%	45	78	7.69
12)	Visual	300	68.26	93.33%	53	79	5.70
13)	Tactile	300	62.92	65.67%	40	77	8.10
14)	Kinesthetic	300	50.57	81%	40	80	8.29
15)	Intake	300	40.19	50.33%	20	58	9.70
16)	Evening-Morning	300	40.81	53%	30	73	7.79
17)	Late morning	300	58.27	51.33%	30	80	13.26
18)	Afternoon	300	61.88	64%	50	74	7.72
19)	Mobility	300	57.79	67.33%	42	78	9.49

*Note:* The total score for English Achievement is 100. The score for the PEPS ranges from 20 to 80 with a 7-point scale.

The mean of Chinese non-English major college students in English Achievement Grade is 61.16 showing their pass or average English proficiency because the pass level in English course in China is 60. The mean scores in the PEPS modalities range from 39.37 to 68.26, suggesting a wide spread as evidenced by the standard deviations especially for Temperature (15.07) and Late morning (13.26).

The students with the percentage of 94.33%, 93.33%, 86.67%, 77.67%, 65.67%, 64%, 63.66%, 59.67%, 52.67% in turn (arranged in descending order) have the preference of condition of Persistence (mean=66.90), Visual (mean=68.26), Motivation (mean=67.57), Light (mean=65.66), Tactile (mean=62.92), Afternoon (mean=61.88),

Structure (mean=60.73), Auditory (mean=61.73), Authority Orientation (mean=60.01), respectively. In contrast, 51% of the students prefer not the Sound condition in English learning, as indicated by the mean of 39.37.

For English Achievement, the minimum score is 19 and the maximum is 94, such large range of scores producing a considerable standard deviation (10.99). Furthermore, the 19 modalities of the PEPS display the full score range from 20 to 80 with the former occurring in Sound while the latter in Light, Temperature, Seating design, Motivation, Responsibility, Kinesthetic, and Late morning. Moreover, the relationship of the 19 modalities of the PEPS and the English Achievement grades were determined using the Pearson  $r$ . Multivariate correlation was used to establish the correlation matrix of these factors as shown in Table 2.

**Table 2**  
***Correlation Matrix of the PEPS and English Achievement Grade***

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
1. English Grade	---																		
2. Sound	-.05	---																	
3. Light	.07	.03	---																
4. Temperature	.04	.02	-.04	---															
5. Seating design	.18**	.01	-.07	.03	---														
6. Motivation	.02	.01	.08	.03	.07	---													
7. Persistence	.16**	.01	.03	.02	.03	.03	---												
8. Responsibility	.36**	-.04	-.02	.00	.10	-.05	.07	---											
9. Structure	.08	.07	.10	-.03	-.02	-.01	.03	.03	---										
10. Peer orientation	.04	.02	.00	.14*	.07	.06	.06	-.04	.06	---									
11. Authority orientation	.36**	.36	.36	.36	.36	-.08	.13*	.16**	.05	-.05	---								
12. Auditory	-.05	.03	.19*	.04	-.11	-.06	.01	.01	-.01	-.03	.09	---							
13. Visual	.03	-.09	.03	.08	.02	.03	.01	.044	.19	-.03	.07	.07	---						
14. Tactile	.06	-.07*	.14	-.02	.01	.01	.01	.08	.19**	-.04	.12*	.02	.17*	---					
15. Kinesthetic	.25**	-.13*	-.02	.02	.06	-.15*	.01	.14*	.10	.00	.13*	-.09	.09	-.08	---				
16. Intake	-.01	-.09	.02	.16**	.03	.00	.02	-.02	.08	-.06	-.00	.00	.02	.03	-.03	---			
17. Evening-Morning	-.07	.10	.03	.02	-.04	.04	.018	.00	-.16**	-.07	-.04	.14*	.02	.02	-.22**	.13*	---		
18. Late morning	-.02	-.08	-.08	.12*	-.01	.09	.064 5	.0788	-.12*	.07	-.12*	.09	.03	-.05	-.01	.38*	.03	---	

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19. Afternoon	-.09	.03	-.05	-.20**	.05	-.02	.01	-.05	.01	.10	.02	-.13*	-.07	-.08	-.12*	-.15*	-.15*	-.17**
20. Mobility	.47**	-.06	.02	.01	.11	-.00	.11	.20**	.10	-.05	.33*	.01	.06	.06	.14*	.07	-.06	-.06

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\*  $p < .05$ \*\*  $p < .01$

As can be seen from Table 2, the six modalities: Seating design (.18), Persistence (.16), Responsibility (.36), Authority orientation (.36), Kinesthetic (.25), Mobility (.47) are significantly related to the English Achievement Grades. The magnitudes of all the six subscales are positive with marked (.40-.59) to negligible (.00-.19) strengths, indicating that when they increase, the English Achievement grades increase too. However, Mobility presents the substantial relationship with English Achievement, followed by Responsibility, Authority orientation, and Kinesthetic.

As far as the correlation among the 19 subscales is concerned, it is worthwhile to note that Mobility is associated with Responsibility (.20) and Authority orientation (.33) while Intake might correlated with Late morning (.38) though both to a low degree. Temperature has a negative relationship with Afternoon with a weak coefficient value (-.20) whereas Kinesthetic to Evening-Morning (-.22) reveals the same property.

The statistical technique, multiple regression, hypothesizes that there is a linear relationship between the independent variables (the 19 modalities in the PEPS) and the dependent variable (English Achievement). Thus, multiple regression was used to determine the predictive significance of the 19 subscales of the PEPS and a proportion of the variance in English Achievement in a significant level. In the multiple regression analysis, the 19 factors functions as predictors of English Achievement and the contributions of them were then assessed. The predictors are considered significant if the p-value is less than .05.

Table 3 displays the multiple regression model of the PEPS as predictors of English Achievement.

In this model, Seating design (.04), Responsibility (.00), Authority orientation (.00), Kinesthetic (.01), and Mobility (.00) are significant predictors ( $p < .05$ ) and the remaining are not. The data accounts for 19% of variance in English Achievement ( $R^2 = .19$ ), suggesting a moderate effect according to Cohen's (1988, in Onwuegbuzie et al., 2008) effect criteria. The five subscales, namely Seating design, Responsibility, Authority orientation, Kinesthetic, and Mobility are all positively related to English Achievement, increasing by 0.10, 0.24, 0.19, 0.13, and 0.32 for every point in English Achievement, respectively. The effect of Seating design, Responsibility, Authority

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orientation, Kinesthetic, and Mobility to English Achievement is also significant,  $t(300)=2.10$ ,  $p<.05$ ,  $t(300)=4.80$ ,  $p<.05$ ,  $t(300)=3.75$ ,  $p<.05$ ,  $t(300)=2.51$ ,  $p<.05$ , and  $t(300)=6.29$ ,  $p<.05$ , separately.

Table 3  
*Multiple Regression Model of the PEPS as Predictors of English Achievement*

	Beta	SE of Beta	B	t	p
Sound	-0.01	0.05	-0.02	-0.27	0.79
Light	0.07	0.05	0.09	1.49	0.14
Temperature	0.04	0.05	0.03	0.84	0.40
Seating design	0.10*	0.05	0.12*	2.10	0.04*
Motivation	0.05	0.05	0.06	0.98	0.33
Persistence	0.09	0.05	0.17	1.83	0.07
Responsibility	0.24*	0.05	0.31*	4.80	0.00*
Structure	0.05	0.05	0.07	1.08	0.28
Peer orientation	0.06	0.05	0.08	1.19	0.23
Authority orientation	0.19*	0.05	0.27*	3.75	0.00*
Auditory	-0.07	0.05	-0.11	-1.49	0.14
Visual	-0.05	0.05	-0.09	-0.93	0.35
Tactile	0.00	0.05	0.00	0.03	0.98
Kinesthetic	0.13*	0.05	0.17*	2.51	0.01*
Intake	-0.06	0.05	-0.07	-1.09	0.28
Evening-Morning	0.01	0.05	0.01	0.18	0.86
Late morning	0.03	0.05	0.03	0.64	0.52
Afternoon	-0.06	0.05	-0.08	-1.09	0.28
Mobility	0.32*	0.05	0.37*	6.29	0.00*

\*  $p<.05$

Note:  $R= .43$ ,  $R^2= .19$ , Adjusted  $R^2= .15$ ,  $SE=8.86$

## Discussion

Descriptive statistic analysis shows that ten subscales of the PEPS have their respective mean score (above 60) indicating preference: Visual, Motivation, Persistence, Light, Tactile, Afternoon, Auditory, Structure, Authority Orientation, and Sound (arranged in

descending order of the mean). The students preferring Visual and Auditory modes confirms Reid's (1986) argument that Chinese students strongly liked visual and auditory approach to learn. The preference of Afternoon, Structure, and Authority orientation provides support for the study of Harrelson et al. (1998) that the athletic training students tended to favor structured learning and the presence of authority figures, and male students preferred learning in the afternoon. Noteworthy is that English course in this Chinese university is mainly instructed in the morning while the students being receptive to new information occurs in the afternoon, as the present study shows. Thus, it is important for the school administrator to keep in mind the students' effective teachable moment and reconsider the appropriate time schedule.

Based on the multiple regression model, it's found that Seating design, Responsibility, Authority orientation, Kinesthetic, and Mobility have a stronger effect than other modalities on English achievement of these Chinese students with non-English majors, which account for 19% of variance in English Achievement. In other words, at least in this study, Chinese higher achievers in English class appear to like formal classroom design and the kinesthetic mode. They prefer more mobility for English learning and are more responsible in completing English tasks. The moderate proportion (19%) suggests that the learning styles may not be strong predictors of English achievement of these Chinese students. This is in accordance with the finding of Ehrman and Oxford (2005) that learning styles were only weakly or indirectly related to foreign language proficiency.

The result of this study concerning kinesthetic preference runs parallel to the studies of Reid (1987), who suggested that most American university students preferred kinesthetic learning, and Felder and Henriques (1995), who reported that sensory modes (e.g. physical sensations) were preferred by kinesthetically oriented students to receive information. These students tended to be methodical, relied on memorization, and followed rules and standard procedures. The use of memorization and rule following by the students may indicate a cultural habit indicated by Swden (2005) that Chinese students "faithfully copy and reproduce" (p. 227) what their authorities (e.g. teachers or textbooks) say and take it "as transmission, before any independence of mind or creativity in a field can be

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expected" (Cortazzi & Jin, 1997, p. 78, in Sowden, 2005, p. 227). This also counts for why the students in this study are authority-oriented. However, such predictive power of kinesthetic found contrasts with the result of Harrelson et al. (1998) that the athletic students did not have a kinesthetic, which clashed with the idea that students in the medical and allied health fields prefer hands-on learning. This led Harrelson et al. to suggest that a more stringent definition of kinesthetic and tactile activities was needed in the PEPS, which could explain the discrepancy.

Responsibility and formal seating functioning as predictors could possibly be attributed to Chinese culture and educational system. In Chinese collectivism culture, the students from childhood are educated to be responsible for the family, group, and society, and there's no seat choice in the English classroom at the Chinese university as all the seats are arranged already when the students enter the class. Thus, they are accustomed to this kind of atmosphere.

English major and level of the participants may help explain the modest proportion of the variance. In the present study, the majority of the participants are not very interested in English (reflected by the English teacher), as compared to those majoring English in other studies. On the other hand, they have relatively limited knowledge and skills in English, as evidenced by the English Achievement mean grade, 61.16. Another reason might be that the questionnaire distributed may need more carefulness and more guidance since the 100 items set are sometimes positive and sometimes negative.

That only a modest proportion of the variance in foreign language achievement has emerged may be accounted for by the fact that learning styles do not contain information about factors that are related to foreign language proficiency, such as anxiety (e.g., Horwitz et al., 1986). To maximize the effect of learning styles on English achievement, a possible way is through their relationship with learning strategies, as Ehrman and Oxford (1990, 1995) show. That is, learning styles may determine, to some extent, students' choice of learning strategies, which, in turn, may modulate levels of foreign language achievement. Thus, future research should continue to investigate the relationship among learning styles, learning strategies, and foreign language proficiency at the college level. It is also reasonable to assume that learning styles, precursors of attitudes



toward the learning environment, may affect the motivation of the learner. The finding that the modality, motivation, appears to have negative relationship with responsibility in the multivariate correlation analysis suggests exploring the interaction in the context of Gardner's socio-educational model, where motivation has repeatedly been found to strongly affect foreign language achievement (Gao et al., 2007).

Overall, there is great diversity in learning styles among the non-English major second-year students, despite of the four subscales of the PEPS as predictors found. This could produce implications for general teaching and learning and English teaching and learning in China. It's hypothesized that learning style can be expressed very closely in the form of teaching style when an educator teaches (Harrelson et al. 1998). In reality there exists the phenomenon that certain dominant teaching style might not match students' preferred style. As a result, their learning becomes worse. In other words, it's not tolerable for educators to hope to satisfy all students if they employ only one teaching style. Therefore, it is very important for educators not only to be aware of the diversity of their students but to correspond to their own learning styles, i.e. their teaching style.

This enables the educators to encompass all possible instructional methods suitable for all groups of students (e.g., low vs. middle vs. high achievers, peer-oriented vs. non peer-oriented, authority-oriented vs. non authority-oriented), not just for one group. For example, the likelihood that the Chinese high achievers prefer kinesthetic learning could encourage Chinese educators to consider whether the curriculum and their teaching style accommodate non-kinesthetic learners. Keeping in mind the non-kinesthetic students' individual advantages can affect them effectively. On the other hand, using role playing, discussion, and simulation aside from traditional teaching methods for the educators might enhance the kinesthetic experience of the non-kinesthetic students.

Moreover, it is also necessary and critical to expose students to a variety of teaching methods appropriate for all learning styles so as to make them to further develop those learning areas where they are not as strong. For instance, students learning alone can become more peer-oriented by demonstrating examples or models set by their classmates who prefer learning through peer orientation. Furthermore,

having learning styles of high achievers in mind may help low achievers understand and compensate for their own less preferred styles. Importantly, students and educators have to know that students should have experience of each of the learning styles in order to grow to be more balanced or flexible learners.

As the learning situation may influence learners' reports of their learning styles (Ehrman, 1996), the PEPS, a global learning style instrument, may not elicit enough subtle responses. Skehan's (1991, p. 285) suggestion "to go beyond questionnaires" to adopt "more open-ended and ethnographic techniques" might be recommended. In this connection, in-depth interviews like those conducted by Ehrman (1996) may illustrate more clearly the students' learning style differences associated with foreign language achievement. The present study is limited to the college sophomores with non-English majors, so research with participants at more advanced levels might yield more significant results. Future research could also examine its interaction with other personality variables to determine foreign language achievement.

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### Appendix A

#### Productivity Environmental Preference Survey (PEPS)

#### Instructions:

The purpose of this survey is to identify adult's individual productivity and learning style preference. This instrument can be an important and useful first step toward analyzing the conditions under which an adult is most likely to produce, achieve, create, solve problem, make decisions or learn.

Please give your immediate reaction to each question by putting a circle in the given box according to your answer. (1: strongly disagree; 2: slightly disagree; 3: disagree; 4 neutral; 5: agree; 6: slightly agree; 7 strongly agree.

Items	Scale						
1. I prefer studying in bright light.	1	2	3	4	5	6	7
2. I like to study alone.	1	2	3	4	5	6	7
3. It is easy for me to concentrate late at night.	1	2	3	4	5	6	7
4. I like to draw or use diagrams when I study.	1	2	3	4	5	6	7
5. I often have to be reminded to complete certain tasks or assignments.	1	2	3	4	5	6	7
6. The one job I like doing best, I like to do with an expert in the field.	1	2	3	4	5	6	7
7. I can think better lying down than sitting.	1	2	3	4	5	6	7
8. I prefer cool temperatures when I need to concentrate.	1	2	3	4	5	6	7

9. I can block out noise or sound when I study.	1	2	3	4	5	6	7
10. People keep reminding me to do things	1	2	3	4	5	6	7
11. It is difficult for me to concentrate when I am warm.	1	2	3	4	5	6	7
12. The job I like doing best, I do with two or more people.	1	2	3	4	5	6	7
13. I prefer to study or read when the lights are shaded.	1	2	3	4	5	6	7
14. When I concentrate I like to sit on a soft chair or couch.	1	2	3	4	5	6	7
15. I usually finish what I start.	1	2	3	4	5	6	7
16. The things I remember best are the things that I hear.	1	2	3	4	5	6	7
17. I enjoy tasks that allow me to take breaks.	1	2	3	4	5	6	7
18. I can study more effectively in the afternoon than in the morning.	1	2	3	4	5	6	7
19. I like to take "snack" when I'm concentrating.	1	2	3	4	5	6	7
20. When I have a lot of study to do I like to study with colleagues.	1	2	3	4	5	6	7
21. Noise or extraneous sound usually keeps from concentrating.	1	2	3	4	5	6	7
22. I often forget to do things I've said I would do.	1	2	3	4	5	6	7
23. I take lots of notes in a lecture, to help me remember.	1	2	3	4	5	6	7
24. I like to study or analyze an assignment with another individual.	1	2	3	4	5	6	7
25. I prefer cool temperatures when I'm studying.	1	2	3	4	5	6	7
26. The one job I like doing best, I do with several people.		2	3	4	5	6	7
27. I concentrate best in the late afternoon.	1	2	3	4	5	6	7
28. The things I remember best are the things that I read.	1	2	3	4	5	6	7
29. I usually complete tasks that I start.	1	2	3	4	5	6	7

30. I can concentrate better when I sit up rather than when I recline.	1	2	3	4	5	6	7
31. I like to learn or study with a person in authority.	1	2	3	4	5	6	7
32. I study best early in the morning.	1	2	3	4	5	6	7
33. I get a lot done when I study on my own.	1	2	3	4	5	6	7
34. When I study I turn all the lights on.	1	2	3	4	5	6	7
35. I prefer that others share responsibility for a task we're doing.	1	2	3	4	5	6	7
36. I really enjoy television.	1	2	3	4	5	6	7
37. I like either a teacher or supervisor to outline tasks I've to complete.	1	2	3	4	5	6	7
38. I like to sit on straight-back chair when I concentrate.	1	2	3	4	5	6	7
39. I study or study best by myself.	1	2	3	4	5	6	7
40. I can remember things best when I study them in the evening.	1	2	3	4	5	6	7
41. I remember best that things I read in a book or magazine.	1	2	3	4	5	6	7
42. I always finish tasks that I start.	1	2	3	4	5	6	7
43. If I have to learn something new, I prefer to learn about it by hearing a record, tape, or lecture.	1	2	3	4	5	6	7
44. I am most alert in the evening.	1	2	3	4	5	6	7
45. The one job I like doing best, I do with a group of people.	1	2	3	4	5	6	7
46. I'm uncomfortable when I study or try to study in a warm room.	1	2	3	4	5	6	7
47. I prefer to have teachers or supervisors set deadlines for my study.	1	2	3	4	5	6	7
48. I like to eat while I am concentrating.	1	2	3	4	5	6	7
49. I prefer completing one thing before I start something else.	1	2	3	4	5	6	7
50. It is difficult for me to start a new task before I finish the task I am doing.	1	2	3	4	5	6	7
51. I really enjoy movies.	1	2	3	4	5	6	7
52. I have to be reminded to do things I have	1	2	3	4	5	6	7

said I would do.							
53. I study best when the lights are shaded.	1	2	3	4	5	6	7
54. I prefer that persons in authority stay away until I have completed my study.	1	2	3	4	5	6	7
55. I keep trying to accomplish a task even if it appears that I may not succeed.	1	2	3	4	5	6	7
56. I like to learn about something new by hearing a tape or a lecture.	1	2	3	4	5	6	7
57. I feel I am self-motivated.	1	2	3	4	5	6	7
58. The job I like best. I prefer doing alone.	1	2	3	4	5	6	7
59. Eating something would distract me when I'm studying.	1	2	3	4	5	6	7
60. My performance improves if I know my study will be checked.	1	2	3	4	5	6	7
61. I prefer to study with music playing.	1	2	3	4	5	6	7
62. I stay at a task until it is finished, even if I don't like what has to be done.	1	2	3	4	5	6	7
63. I learn best by being directly involved in what I'm doing.	1	2	3	4	5	6	7
64. I always do the best I can.	1	2	3	4	5	6	7
65. I prefer to learn how to do a new task by actually doing it.	1	2	3	4	5	6	7
66. I often read in dim light.	1	2	3	4	5	6	7
67. If I have to learn something new, I like to learn about it by reading.		2	3	4	5	6	7
68. I prefer to learn how to do a new task by actually doing it.	1	2	3	4	5	6	7
69. I would rather start study in the morning than in the evening.	1	2	3	4	5	6	7
70. I constantly change positions in my chair.	1	2	3	4	5	6	7
71. The things I remember best are the things that I hear.	1	2	3	4	5	6	7
72. I like my instructor(s) or supervisor(s) to recognize my efforts.	1	2	3	4	5	6	7
73. I learn better by reading than by listening to someone.	1	2	3	4	5	6	7
74. I get more done in the afternoon than in	1	2	3	4	5	6	7

the morning.							
75. I can block out most sound when I study.	1	2	3	4	5	6	7
76. I really like to build things.	1	2	3	4	5	6	7
77. I prefer to study under a shaded lamp with the rest of the room dim.	1	2	3	4	5	6	7
78. I chose to eat, drink, smoke or chew only after I finish studying.	1	2	3	4	5	6	7
79. I remember things better when I study in the evening.	1	2	3	4	5	6	7
80. If I have to learn something new, I like to learn about it by seeing a movie.	1	2	3	4	5	6	7
81. I feel good when my spouse, colleague or supervisor praises me for doing well at my job.	1	2	3	4	5	6	7
82. I prefer a cool environment when I try to study.	1	2	3	4	5	6	7
83. It's difficult for me to block out sound (music, T.V, talking,) when I study.	1	2	3	4	5	6	7
84. I would rather learn by experience than by reading.	1	2	3	4	5	6	7
85. I like being praised for a "job well done".	1	2	3	4	5	6	7
86. It is difficult for me to sit in one place for a long time.	1	2	3	4	5	6	7
87. I like to have something to drink when I study.	1	2	3	4	5	6	7
88. I enjoy doing experiments.	1	2	3	4	5	6	7
89. If a task becomes very difficult, I tend to lose interest in it.	1	2	3	4	5	6	7
90. I like to learn new thing.	1	2	3	4	5	6	7
91. I can sit in one place for a long time.	1	2	3	4	5	6	7
92. I can concentrate best in the evening.	1	2	3	4	5	6	7
93. I prefer to study with someone who really knows the material.	1	2	3	4	5	6	7
94. I often change my position when I study.	1	2	3	4	5	6	7
95. I would study more effectively if I could eat while I'm studying.	1	2	3	4	5	6	7
96. If I can go through each step of task I	1	2	3	4	5	6	7



always remember what I learn.							
97. I learn better when I read the instructions than when someone tells me what to do.	1	2	3	4	5	6	7
98. I only begin to feel wide awake after 10.00 A.M.	1	2	3	4	5	6	7
99. I often complete unfinished study on a bed or couch where I can recline.	1	2	3	4	5	6	7
100. I often wear a sweater or jacket indoors.	1	2	3	4	5	6	7

### Appendix B Item Combination of 19 Modalities

Modalities	Items
1. Sound	21,83,9,75
2. Light	1,34, 13,53,66,77
3. Temperature	8,11,25,46,82,100
4. Seating design	30,38,7,14,99
5. Motivation	57,72,90,81,85
6. Persistence	15,29,42,49,50,55,62
7. Responsibility	5, 64, 10,22,52,89
8. Structure	37,60,68,76,96
9. Peer oriented	2,33,39,58,12,20,24,26,35,45
10. Authority oriented	6,31,47,54,93
11. Auditory	16,23,43,56,61,71
12. Visual	28,36,41,51,67,73,80,97
13. Tactile	4,84,88
14. Kinesthetic	63,65
15. Intake	19,48,87,95,59,87
16. Evening-Morning	3,32,69
17. Late morning	98
18. Afternoon	18,27,40,44,74,79,92
19. Needs modality	17,70,86,94,91