



Language Teaching Research Quarterly



2022, Vol. 31, 83–100

The Roles of Language Aptitude and Online Self-regulated Learning in Foreign Language Achievements

Chun-yan Liu^{1*}, Yan Jiao², Wen-ting Qiu³

^{1&3}Foreign Languages College, Jiangxi Normal University, China

²Ganxian No.3 Middle School, China

Received 01 July 2022

Accepted 16 September 2022

Abstract

Despite extensive use of online language learning during the pandemic of COVID, there is insufficient research on what factors influence students' foreign language achievements in online learning conditions. This article investigated the roles of language aptitude and online self-regulated learning in foreign language achievement in mainland China. 76 freshmen from two classes at a university in Jiangxi participated in this study. They were required to complete an aptitude test of MLAT and a questionnaire on online self-regulated learning. The results showed that: (1) The students' language aptitude is at a relatively low level, and their online self-regulated learning is at an intermediate level; (2) A positive correlation is detected between language aptitude, online self-regulated learning, and their English achievements ($r=0.621$ & 0.583 respectively); (3) Language aptitude alone (grammatical sensitivity and associative memory ability) accounts for 38.9% variance in English achievement. Language aptitude and online self-regulated learning contributed 52.4% of the variance to their English achievements. Overall, the findings of the study confirm the high predictive power of the MLAT and predictions of the Linguistic Coding Deficit Hypothesis (LCDH) advocated by Sparks and colleagues. Pedagogical implications are also discussed.

Keywords: *Language aptitude, Online Self-regulated Learning, Foreign Language Achievements, Linguistic Coding Deficit Hypothesis (LCDH), Gaokao*

Introduction

The imperative of integrating computers and the internet in foreign language learning is undisputed today, motivated partly by the use of digital technology in education, and partly by distance learning during the pandemic of COVID. Language educators are increasingly interested in welcoming technologies into their teaching, but the efficiency of online learning and what factors affect students' foreign language achievement remain unknown. This article intends to investigate the roles of two major individual differences (IDs) factors--language aptitude and online self-regulated learning in foreign language achievement in mainland China.

Language aptitude generally refers to specific abilities that enable some people to learn a second language easier, faster, and better than others (Carroll, 1990; Wen, 2021). Among IDs variables that influence foreign language achievement, research on language aptitude is insufficient and falling behind in mainland China because many educators are concerned that it may have negative influence on students' self-esteem (especially when they scored low on the aptitude tests), which could weaken their motivation of further learning. Recently, research on language aptitude has increased, thanks to the new theoretical models and new test batteries of language aptitude (Meara, 2005; Robinson, 2007, 2012; Wen, 2015).

Different from those traditional face-to-face classrooms, the online environment requires students to rely more on themselves to take control of their own learning process. Self-regulated learning (SRL) highlights not only the role of monitoring in the self-regulatory process, but also how components or areas for regulation (e.g., cognition, motivation/affect, behavior, and context) are reflected as individuals' behavior to regulate and control their learning process. Self-regulated learning is conceptualized as "a student's efforts to manage learning processes systematically oriented to achieve goals" (Zimmerman & Schunk, 2011). Hence, students with a high level of self-regulated learning are more likely to take control of their online learning behavior.

According to previous research, language aptitude and online self-regulated learning have an impact on foreign language achievements in an online learning environment. However, less attention has been drawn to their joint influence on language achievements. This study aims to reveal the present situation of language aptitude and online self-regulated learning among students in mainland China and identify the relationship between these two ID factors and foreign language achievements.

Language Aptitude and Foreign Language Achievement

Definitions of language aptitude differ greatly ranging from product-oriented views to process-

oriented views. The fundamental divergence in these two representative definitions is whether language aptitude is static or not. The product-oriented view considers language aptitude as an endowment to learn a language. According to this view, language aptitude is conceptualized as “a set of cognitive abilities that are predictive of how well, relative to other individuals, an individual can learn a foreign language in a given amount of time and under given conditions” (Carroll & Sapon, 2002). The process-oriented view thinks otherwise. According to Robinson (2005), language aptitude is conceptualized as “cognitive abilities that information processing draws on during second-language (L2) learning and performance in various contexts and at different stages”.

These definitions are linked to different theoretical models of language aptitude. The pioneering work of Carroll (1959, 1962) is particularly profound and far-reaching. His four-factor model, which is composed of phonetic coding ability, grammatical sensitivity, inductive language learning ability, and rote memory, provides a benchmark for subsequent aptitude tests. Inspired by early studies of native language (L1) reading research investigating learning difficulties, Sparks and Ganschow (1991, 2001) propose the “Linguistic Coding Differences Hypotheses” (LCDH). The basic premise of LCDH is that L1 skills are essential for predicting L2 learning, that L1 ability is the basis of L2 aptitude, and that the primary factors in successful or unsuccessful foreign language learning are thought to be linguistic, not affective (Sparks, this issue). The more process-oriented view of language aptitude is Robinson’s aptitude model (2007, 2012) since it is sensitive to development and situation. His model combines different cognitive abilities to form integrated *aptitude complexes* that in turn dynamically adapt to different L2 learning conditions. Recent language aptitude theories incorporate a working memory component (Skehan, 1998; Wen, 2015; Wen & Skehan, 2021) in language aptitude, which results in a fundamental shift in the research paradigm. In a word, it is widely accepted that language aptitude is a multi-componential, complex, dynamic, and adaptive cognitive system which develops with the learning experience (Wen, 2021).

Measurements of language aptitude have developed with corresponding theoretical models. Carroll’s language aptitude test--the seminal Modern Language Aptitude Test (MLAT; Carroll & Sapon, 1959) is the most representative. The MLAT subsumes five major parts: number learning, phonetic script learning, spelling clues, words in sentences, and paired associates learning. It is utilized to predict L2 learning outcomes fairly reliably, with an overall correlation of around $R = 0.35\sim 0.50$ (Li, 2015). For decades, the validity and reliability of MLAT have been repeatedly confirmed, and it remains the best predictor, outperforming other candidates (Li, 2015; Wen et al., 2022). Another influential test battery--LLAMA designed by Meara (2005), has been welcomed by a growing number of SLA researchers in recent years. One major advantage of LLAMA is its “language neutrality” principle which does not bias to any language. The second advantage is that it is accessible and free online (www.lognostics.co.uk/tools/llama/), and user-friendly. But studies show that LLAMA_F might suffer from a lack of strong internal consistency (Kim, 2021), and the

validity of the LLAMA test battery needs to be further improved (Bokander & Bylund, 2020). Other theories of language aptitude fail to develop specific test batteries (e.g., Skehan, 1998), or their predictive validity (e.g., Sternberg, 2002) did not outperform that of the MLAT.

Language aptitude in the instructed SLA context is regarded as a significant predictor of L2 learners' overall success (Carroll, 1973). It is assumed that L2 learners with a higher level of language aptitude show a tendency of learning the target language faster and obtaining better learning results. A 0.4 to 0.6 correlation is detected between language aptitude and L2 achievements (Carroll, 1962). Sparks et al (2011) conducted a factor analysis of a test battery that includes early L1 achievement, L1 cognitive ability, L2 aptitude, and L2 affective measures to predict oral and written L2 proficiency. They find that 76% of the variance in ultimate outcomes could be explained by these four variables.

There are only a few empirical studies of the relationship between students' L2 aptitude and English achievement in China. Dai (2012) examines the relationship between L2 aptitude and L2 achievement of English majors and finds that L2 aptitude measured by MLAT can account for 28% of the results of L2 achievement. But his study does not analyze how the components of language aptitude contribute to L2 achievement. Ma and Wang (2011) examine the relationship between L2 aptitude measured by MLAT and reading achievement of English majors and discover rote memory ($r=0.514$) and grammatical sensitivity ($r=0.386$) are interrelated with reading achievements, but they do not mention whether phonetic coding ability is related to reading achievements. Using the LLAMA aptitude test, Li et al. (2019) finds a significant correlation between aptitude and L2 grammar attainment in EFL learners in China, and regression analyses show that language aptitude is a significant predictor of L2 grammar attainment. It is also found that implicit language aptitude is related to grammar attainment in younger learners, while explicit language aptitude is related to grammar attainment in older learners. These results are slightly different from the studies conducted in western countries. Further investigation is needed in this area.

On-Line Self-Regulated Learning and Foreign Language Achievement

According to Pintrich (2000), self-regulated learning is “an active, constructive process whereby learners set goals for their learning and then attempt to monitor, regulate, and control their cognition, motivation, and behavior, guided and constrained by their goals and contextual features of the environment”. This definition delineates not only the components involved in the process, but also the way how these components are organized and the significance of context in SRL processes.

Online self-regulated learning is measured in various ways. The three most frequently used questionnaires are the Motivated Strategies for Learning Questionnaire (Pintrich et al., 1991),

Learning and Study Strategies Inventory (Weinstein, 1988), and Online Self-regulated Learning Questionnaires (Barnard et al., 2009). Online Self-regulated Learning Questionnaires (OSLQ) is adopted in this study because the questionnaire is specifically designed for SRL assessment in an online environment. In OSLQ, six self-regulatory attributes are selected as indicators for online learning, which are goal setting, task strategies, environment structuring, time management, help-seeking, and self-evaluation.

Empirical studies show no agreement on the association between SRL components in the online learning environment and academic performance. At the initial stage, Lynch and Dembo (2004) discover that only the self-efficacy component of SRL is positively correlated with final grades, while other self-regulatory attributes like time, learning environmental management, and help-seeking are not correlated with final grades. However, the finding in the survey of Dunnigan (2018) is distinctively different from that in the research of Lynch and Dembo (2004). It's reported that a moderate correlation is spotted in the dimension of time and study environmental management ($r=0.28$). Still, no linkage is detected in the scale of help-seeking. Seeking assistance ($r=0.17$), goal setting and planning ($r=0.19$), and self-evaluation ($r=0.31$) are found to be associated with students' writing proficiency (Sun & Wang, 2020). Judging from the effect size, self-efficacy, task strategies, and self-evaluation exert a much stronger influence on students' academic performance as compared with other strategies like goal setting (Li et al., 2018). From the above, it can be noted that some dimensions of online self-regulated learning such as help-seeking are not related to academic achievements. Barnard et al. (2010) utilize latent class analysis to examine different patterns of online self-regulated strategies among online learners. Their result shows that students with different proficiency regulate their online learning in different phases of the self-regulatory process. Thus, research on this issue has turned to individualized online learning to take individual differences into consideration.

Compared with studies abroad, there are only a few studies about the relationship between online SRL and foreign language achievements in China. No correlation between time/environmental management, help-seeking, and academic achievements is spotted in Shang's (2016) study. Later qualitative analysis (Li & Zhou, 2020) shows that the difference in students' online SRL is constrained by their internal factors, social factors as well as network teaching. Inspired by that, Zheng (2020) investigates the way technology acceptance is associated with online SRL. It is reported that there is a positive significant correlation between perceived usefulness in the dimension of technology acceptance and students' online SRL. Therefore, it is necessary to examine other ID factors together with online SRL to see their combined effect on foreign language achievement.

In summary, this study is motivated by the following reasons: 1) few studies have investigated the joint influence of online SRL and language aptitude on foreign language achievements in the

online learning environment. 2) whether all the components of language aptitude have an influence on students' ultimate success is still uncertain. 3) whether all the six dimensions of online SRL exert an influence on foreign language achievements is still unknown. More specifically, there is no consensus on whether goal-setting, environment structuring, task strategies, time management, help-seeking, and self-evaluation are interrelated with students' ultimate success or not. These dimensions seem to be correlated, but how they affect students' ultimate outcomes is still uncertain.

Research Questions

RQ₁: What is the status-quo of language aptitude and online self-regulated learning among English-major students in the online learning environment?

RQ₂: What is the correlation between online self-regulated learning, language aptitude, and English achievements?

RQ₃: To what extent do components of language aptitude and online self-regulated learning predict English achievements among the students in the online learning environment?

Method

Participants

A total of 76 English-major students from two intact classes aged 17 to 19 who were enrolled in the first year in a university in Jiangxi Province of China participated in this study. Among them, 11 students were male and 65 were female. Their average English learning experience was 10 years. Before data collection in September of 2020, the participants had received online English courses in their hometowns for half a year owing to COVID-19. Among 76 students, 74 questionnaires and test papers were valid. Meanwhile, their English scores on College Entrance Examination (*Gaokao*) of 2020 were also collected as their English achievements. The total score of English in *Gaokao* was 150 points, and their average was 128.35.

Instruments

Foreign Language Aptitude Test

In order to assess the participants' language aptitude, MLAT (Carroll & Sapon, 2002) was adopted for the following reasons. 1) As pointed out in the literature review, MLAT enjoys high validity and reliability, which still outperforms other test batteries. 2) Our participants were intermediate English learners, whose language level is appropriate for this test. Research shows that it is more appropriate for low and intermediate-level students to use MLAT, compared with "High-level Language Aptitude Battery"(Hi-LAB) for high proficiency students (Wen, 2021). MLAT and Hi-LAB are complementary to each other, and they could predict basic and advanced L2 proficiency respectively. 3) Although MLAT is not "language neutral", its validity in predicting success in non-

Indo-European languages has been confirmed, for example, English native speakers learning Chinese, Japanese, and Korean (Carroll & Sapon, 2002), although the data shows lower validity (.27) than students learning other Indo-European languages (.42).

The short version of MLAT was used in this study, which consisted of three parts: 1) spelling clues test (Phonetic coding ability), 2) words in sentences test (Grammatical sensitivity), and 3) paired associates test (Associative memory). The test was administered during class time and lasted about 40 minutes with the prerecorded cassette tape. Altogether 74 valid test papers were collected.

Questionnaire

The questionnaire used to measure the participants' online SRL was adapted from Online Self-regulated Learning Questionnaire (OSLQ) (Barnard et al., 2009). The questionnaire was made up of two sections. The first section was to obtain demographic information about participants like gender, age, years of English learning, and their scores on *Gaokao* in 2020. The second section was to assess online SRL. This section was further divided into six parts: goal setting (Item 1-5), environment structuring (Item 6-9), task strategies (Item 10-14), time management (Item 15-17), help-seeking (Item 18-22) and self-evaluation (Item 23-26). Item 14 and 19 were added in by the author according to the problems occurring within online language learning in the EFL context in China. The content of item 14 was "I will use some digital resources in the online environment to help me acquire the content". The content of item 19 was "When I meet technical difficulties, I will turn to classmates who are proficient in information technology".

All the items were translated into Chinese so that participants could better understand the meaning of these items and make judgments according to their actual online learning experiences. The 26 items were scored on a five-point Likert scale where 1 stands for "*not at all very true of me*" and 5 stands for "*very true of me*". Item 12 and 23 were negatively worded and their scores were reversely coded.

To further ensure the validity and reliability of the questionnaire, 74 questionnaires were analyzed through SPSS 20.0. The KMO value of overall OSLQ was 0.761. Moreover, the KMO value of each category was 0.723, 0.728, 0.772, 0.721, 0.793, and 0.741 respectively. It could be noted that all these six dimensions scored above 0.70. That is to say, good construct validity could be found in all these six dimensions. The reliability of OSLQ was reported in Table 1. The Cronbach's coefficient of overall OSLQ was 0.827, revealing its good reliability.

Table 1*Reliability of OSLQ and Its Six Components*

Categories	Number of Items	Cronbach's Coefficient
Goal Setting	5	0.795
Environment Structuring	4	0.740
Task Strategies	5	0.741
Time Management	3	0.726
Help-Seeking	5	0.739
Self-evaluation	4	0.790
Overall	26	0.827

English Achievements in Gaokao

Since the participants had had online English courses for half a year in high school owing to COVID-19, their foreign language achievements were measured by their scores on *Gaokao* in June 2020. Our data were collected 3 months later. Admittedly, the time interval was relatively long. But compared with course scores, scores on *Gaokao* were preferred because they had superiority over other exams in their organizing and marking processes. As one of the high-stake examinations in China, it is believed that *Gaokao* is of high validity and reliability.

Data Collection and Analysis

The participants' scores on *Gaokao* were obtained from the section of background information in the questionnaire. Data of online SRL were collected through OSLQ in September of 2020 in a face-to-face classroom based on their memories of the previous term in high school. Students' scores on language aptitude were gained from MLAT during class time. The complete test of MLAT lasted for 40 minutes.

The collected data were analyzed in SPSS 20.0 and descriptive statistics were used to reveal the general picture of online SRL and language aptitude among English-major students. Pearson correlation analysis was adopted to identify the possible relationship between online SRL, language aptitude, and foreign language achievements. Multiple regression analysis was employed to explore the effect of online SRL and language aptitude on foreign language achievement among English-major students.

Results

Table 2 shows the descriptive results of MLAT, which indicates the present situation of the students' language aptitude. The scores of their language aptitude range from 33 to 79 with a standard deviation of 11.098. Its mean value is 51.85, occupying 43.58% (51.58/119) of the total

score. Judging from that, the level of language aptitude among English-major students is at a relatively low level. The mean scores among all these three sub-tests (28.6%, 52.98%, 57.12%) fail to reach over 60% of the total scores. The mean of the Spelling Clues Test (14.30, 28.6%) is the lowest, implying that the students' phonetic coding ability is the poorest. The highest average is found in paired associates test (13.72, 57.12%), which indicates that participants are best at rote memory.

Table 2*Descriptive Statistics of Students' Language Aptitude (N=74)*

Categories	Total Scores	Minimum	Maximum	Mean	Std. Deviation
Spelling Clues Test	50 (100%)	6	26	14.30 (28.6%)	3.919
Words in Sentences Test	45 (100%)	14	34	23.84 (52.98%)	5.961
Paired Associates Test	24 (100%)	8	24	13.72 (57.12%)	4.015
Overall	119 (100%)	33	79	51.85 (43.58%)	11.098

The descriptive statistics of online SRL are reported in Table 3. As displayed in Table 3, the mean score of overall online SRL is 2.873 with a standard deviation of 10.866. Given that its average (M=2.873) is within the range of 2.4 and 3.5, students' overall online SRL is at an intermediate level.

Table 3*Descriptive Statistics of the Students' Online Self-Regulated Learning*

Categories	Numbers of Items	N	Mean	Std. Deviation
Goal Setting	5	74	3.178	4.437
Environment Structuring	4	74	2.733	2.451
Task Strategies	5	74	2.570	3.342
Time Management	3	74	2.963	2.181
Help-Seeking	5	74	2.794	3.600
Self-evaluation	4	74	3.038	2.351
Overall Online SRL	26	74	2.873	10.866

Concerning the six dimensions of online SRL, task strategies show the lowest mean score (M=2.570), and goal setting shows the highest (M=3.178). The mean scores of six dimensions all fall in the range of 2.4 and 3.5, which means the frequency of implementing all the six strategies is moderate.

The second research question concerns the correlation between online SRL, language aptitude, and English achievements. Their English scores on *Gaokao* ranged from 113 to 140, and their mean score is 128.35 (the full score is 150). In this vein, it indicates that the participants' English proficiency has reached the upper level ($M=128.35>120$). Their standard deviation is 6.397, indicating their English achievements are relatively scattered.

The results concerning the correlation between language aptitude and the students' foreign language achievements from Pearson correlation analysis are presented in Table 4.

Table 4

Pearson Correlation Between Language Aptitude and Foreign Language Achievements

Categories	Academic Achievements
Spelling Clues Test	.407**
Words in Sentences Test	.545**
Paired Associates Test	.510**
Overall MLAT	.621**

Note: **. The correlation is significant at the 0.01 level (2-tailed).

As displayed in Table 4, participants' scores on MLAT are positively correlated with their foreign language achievements on *Gaokao* ($r=0.621$). And each subcategory of phonetic coding ability ($r=0.407$), grammatical sensitivity ($r=0.545$), and rote memory ($r=0.510$) are all positively correlated, which means that the higher their language aptitude, the more likely they are to score high in *Gaokao*.

An overview of the relationship between online SRL and academic achievements in online English courses is shown in Table 5 below. According to Table 5, a positive correlation between online SRL and foreign language achievements among the students in online learning is detected ($r=0.583$). That is to say, students exhibiting a higher level of online SRL tend to score high. All these six dimensions of online SRL positively correlate with the participants' foreign language achievements. Except for environment structuring ($r=0.404$), the correlation of other five dimensions from goal setting to self-evaluation are all weak ($r=0.377, 0.263, 0.292, 0.359, 0.367<0.40$).

Table 5

Pearson Correlation between Online Self-regulated Learning and Foreign Language Achievements

Categories	Academic Achievements
Online SRL	.583**
Goal Setting	.377**
Environment Structuring	.404**
Task Strategies	.263*
Time Management	.292*
Help-Seeking	.359**
Self-evaluation	.367**

Note: **. The correlation is significant at the 0.01 level (2-tailed).

*. The correlation is significant at the 0.05 level (2-tailed).

A two-step multiple regression analysis was carried out to explore the relationship between the sub-tests of MLAT, the dimensions of online SRL, and foreign language achievements, as shown in Table 6.

Table 6

The Effects of Online Self-Regulated Learning and Language Aptitude on the Students' Foreign Language Achievements

Variables	Academic Achievements		
	Step 1 Beta	Step 2 Beta	95% CI
Step 1: MLAT Variables			
Words in Sentences Test	0.399***	0.342***	(0.168, 0.568)
Paired Associates Test	0.336***	0.303***	(0.187, 0.779)
Step 2: Online Self-regulated Learning Variables			
Goal Setting		0.262**	(0.167, 0.765)
Self-evaluation		0.243***	(0.203, 1.125)
Model Summary Statistics			
R ²	0.389	0.524	
F	22.570***	18.999**	
ΔR ²		0.135	
ΔF		3.571***	

Note: ***p<0.001, **p<0.01

From Table 6, the words in sentences test and paired associates test both enter the model successfully, but phonetic coding ability fails to enter the regression model. In other words, grammatical sensitivity and rote memory can both serve as the most important indicators of the students' foreign language achievements, and they could explain 38.9% of the variance of English academic achievements. When the students' scores in grammatical sensitivity raise a unit of standard deviation, the students' foreign language achievements would raise 0.399 units accordingly. Likewise, the increase of a unit of standard deviation in the students' scores in rote memory results in a 0.336 unit increase in the students' foreign-language performance.

In Step two, all the dimensions of online SRL were added. This model has also reached a significant level. Among all these six dimensions of online SRL, only two dimensions (goal setting and self-evaluation) enter the regression model successfully. They account for 13.5% of the variance of the participants' English achievements. The total adjusted R^2 ($R^2 = 0.524$) in step two suggests that these four factors could account for a 52.4% variance in the participants' total scores. And the effect size of this regression model is large ($R^2 = 0.524 > 0.26$).

Discussion

We conducted a regression analysis of factors that influence foreign language achievements in the online learning environment and found 4 factors in these two IDs account for 52.4% variance in the participants' foreign language achievements. Those factors are grammatical sensitivity, associative memory, goal setting, and self-evaluation. Such findings provide support for the importance of language aptitude and other IDs in foreign language achievements.

The results show that the students' language aptitude is at a relatively low level (51.58, 43.58%). The findings are consistent with the results of Ma and Wang (54.3 %) (2011), and the results of Dai (47.1%) (2012). But this result conflicts with the findings in other studies (e.g., Hummel & French, 2016; Carroll & Sapon, 2002). Hummel and French (2016) discover that the level among French-English bilinguals is intermediate. It is reasonable to assume that such difference is associated with different participants. French-English bilinguals in their study differ from Chinese-English bilinguals in the present study. Chinese belongs to the morpho-syllabic language system, whereas English and French both belong to the alphabetic language system. Languages differ in difficulty for the distance between them. In other words, the difficulty of a language is a function of how different it is from the learner's native language--in the sound system, grammar, vocabulary, and orthography. For Chinese native speakers, English is much more difficult than for French native speakers. That explains why Chinese students' foreign language aptitude is at a relatively low level.

One puzzling result from this study is that the results of the Spelling Clues Test (14.30, 28.6%) are the lowest, and the paired associates test (13.72, 57.12%) is the highest for our participants.

This indicates that the students' phonetic coding ability is the poorest, but they are good at associative memory and grammatical sensitivity. The possible reasons may be the roles of associative memory and grammatical sensitivity in learning English for Chinese students. They depend on these strategies to learn English instead of phonetic coding ability because of the linguistic difference between Chinese and English. The second reason is that associative memory and grammatical sensitivity are practiced continuously in both L1 and L2 skills. Therefore, teachers spend more time and effort on cultivating these abilities. Additionally, students are more familiar with this type of question than spelling clue tests owing to examination-oriented education in China. Take *Gaokao* for example, grammatical sensitivity is assessed through multiple choice questions, cloze, and error correction and occupies a larger proportion in every English examination. On the other hand, the oral English test is not included in the total grades of *Gaokao*. Consequently, the students' associative memory and grammatical sensitivity are much higher than their phonetic coding ability.

The results also showed their online self-regulated learning is at an intermediate level, and goal setting ($M=3.178$) and self-evaluation ($M=3.038$) are the two strategies most frequently used by English-major students in their online learning. Practically speaking, students need to take control of learning by themselves in online learning conditions, which is embodied in these two strategies. A low average is found in environment structuring (2.733) in the present study. The reason may be that environment structuring is interfered with motivation, family environment, and learners' conception (Li & Zhou, 2020). The family environment in online learning is detrimental for learners to stay focused on their learning. Task strategies are the lowest on average (2.570). This is because students in the present study were not fully prepared for online learning, and naturally, they failed to adapt to the new environment and implement appropriate strategies to regulate their online learning.

The results concerning the correlation between language aptitude and language proficiency are similar to a number of studies (Gu, 2008; Shang, 2012). The result above exhibiting varied correlation coefficients in these three sub-tests proves that the nature of language aptitude is componential (Skehan, 1989; Robinson, 2005). The comparatively low correlation in spelling clues test may be related to language difficulty. It is not surprising that the stronger predictive power is spotted in the words in sentences test and paired associates test. Similar results have been found in a variety of former studies (Ehrman & Oxford, 1995).

As indicated in Table 7, language aptitude alone (grammatical sensitivity and associative memory ability) accounts for 38.9 % variance in English achievement. The large effect size of the present study is congruent with the findings in previous literature (Erlam, 2005; Winke, 2013). The meta-analysis of Li (2015) lends strong support to MLAT's supreme predictive power between language aptitude and general L2 proficiency. Indeed, conventional tests of language

aptitude predict roughly 25% of the individual-differences variation in school performance (Sternberg, 2002). Similar results have also been found in the studies of Dai ($R^2=0.28$, 2012) and Hummel & French ($R^2=0.29$, 2016). This study again confirms the high predictive power of MLAT and also confirms Sparks et al's prediction of LCDH that the primary factors in successful or unsuccessful foreign language learning are thought to be linguistic, not affective.

The result of the Pearson correlation between online SRL and foreign language achievements concurs with the findings that a moderate correlation is spotted in a series of studies (Barnard et al., 2008; Zimmerman & Martinez-Pons, 1986). From Table 6, online SRL causes 13.5% variance in subjects' academic achievements, whose effect size is medium. A similar result has also been obtained in the study of Ekhlas and Shangarffam (2013). These results show again the importance of SRL in the online learning environment.

In conclusion, language aptitude (grammatical sensitivity and associative memory) and online SRL (goal setting and self-evaluation) account for 52.4% of the variance in their English achievements. That further affirms the importance of language aptitude and SRL in the online L2 learning environment, and is consistent with Sparks et al's (2011) finding that 4 factors (Language Analysis, Phonology/Orthography, IQ/Memory, and Self-Perceptions of Language Skills) explained 76% of the variance in oral and written L2 proficiency. However, looking into the detailed components in our regression model, we find the factor Phonology/Orthography missing. Perhaps it is necessary to investigate similarities and differences between Chinese and English and to include an orthographic decoding skill that is crucial for predicting L2 reading (Sparks & Ganschow, 2001).

Conclusion

This study has some limitations that restrict the generalization of the findings. First, the small sample size limits the power of the statistical analyses. Second, the short version of MLAT is used in the study. MLAT is specifically designed for participants from English-speaking countries, but the participants chosen in the present study are Chinese students learning English. Considering the great orthographic differences between Chinese and English, the test battery may not be appropriate for Chinese English learners and in turn affect the accuracy of its measurement. But at present, there is no language aptitude test available that is specially designed for Chinese-English bilinguals, although scholars in China are trying to develop a test measuring adult Chinese foreign language learners' inductive language learning ability and grammatical sensitivity (Li, 2013).

However, several implications can be drawn from this study. First, the findings provide additional support for the high predictive power of MLAT and also confirm Sparks et al's (2011) hypothesis that the differences between stronger and weaker L2 learners are largely language-related and that L2 learning problems are due to learners' strengths and weaknesses in the

subcomponents of language aptitude. Second, for students in the online learning environment, the design of online courses needs to increase class activities to enhance the students' engagement and collaboration in online conditions. The teacher needs to give students some explicit instructions to induce online self-regulated learning behavior. Third, language aptitude tests such as MLAT can be used efficiently to predict, diagnose and assess students' learning, and instructors need to make some modifications to syllabus and curriculum design according to the profiles of language aptitude among Chinese English learners.

Future research may consider orthographic differences between Chinese and English in applying aptitude tests, and introduce new elements such as working memory into the test battery. Since language aptitude and online SRL are the most important factors in the online learning environment, more individual difference variables can be explored, and a structural model can be constructed to reveal how these individual difference variables altogether impact students' foreign language achievements.

References

- Barnard, L., Paton, V., & Lan, W. (2008). Online self-regulatory learning behaviors as a mediator in the relationship between online course perceptions with achievement. *International Review of Research in Open and Distance Learning*, 9(2), 1-11. <http://dx.doi.org/10.19173/irrodl.v9i2.516>
- Barnard, L., Lan, W., To, Y. M., & Paton, V. O. (2009). Measuring self-regulation in online and blended learning environment. *The Internet and Higher Education*, 12(1), 1-6. <http://dx.doi.org/10.1016/j.iheduc.2008.10.005>
- Barnard, L., Lan, W., Y., & Paton, V. O. (2010). Profiles of self-regulated Learning in the online environment. *International Review of Research in Open and Distance Learning*, 11(1), 62-80. <http://dx.doi.org/10.19173/irrodl.v11i1.769>
- Bokander, L., & Bylund, E. (2019). Probing the internal validity of the LLAMA language aptitude tests. *Language learning*, 70(1), 11-47. <https://doi.org/10.1111/lang.12368>
- Carroll, J. B. (1959). Use of the Modern Language Aptitude Test in secondary schools. *The Yearbook of the National Council on Measurements Used in Education*, 16, 155-159. <https://www.jstor.org/stable/41862843>
- Carroll, J. (1962). The prediction of success in intensive foreign language training. In R. Glaser (Ed.), *Training Research and Education*. Pittsburgh, PA: University of Pittsburgh Press.
- Carroll, J. (1973). Implications of aptitude test research and psycholinguistic theory foreign language teaching. *International Journal of Psycholinguistics*, 2, 5-14. <https://doi.org/10.1515/ling.1973.11.112.5>
- Carroll, J. B. (1990). Cognitive abilities in foreign language aptitude: Then and now. *Language aptitude reconsidered*, 11-29.
- Carroll, J., & Sapon, S. (1959/2002). *Modern Language Aptitude Test*. Washington, DC: Second Language Testing Incorporated.
- Dai, Y. (2012). *Individual differences in second language acquisition: Foreign language aptitude and working memory* (pp84-87). Fudan University Press.
- Dunnigan, J. E. (2018). *The relationship of self-regulated learning and academic risk factors to academic performance in community college online mathematics courses* (Doctoral dissertation, Seattle Pacific University).

- Ehrman, M., & Oxford, R. (1995). Cognition plus: Correlates of language learning success. *Modern Language Journal*, 79(1), 67-89. <https://doi.org/10.2307/329394>
- Ekhlas, N. N., & Shangarffam, N. (2013). The relationship between determinant factors of self-regulation strategies and main language skills and overall proficiency. *Procedia-Social and Behavioral Sciences*, 70, 137-147. <https://doi.org/10.1016/j.sbspro.2013.01.049>
- Erlam, R. (2005). Language aptitude and its relationship to instructional effectiveness in second language acquisition. *Language Teaching Research*, 9(2), 147-171. <https://doi.org/10.1191%2F1362168805lr161oa>
- Gu, W. L. (2008). Language aptitude—an important component of individual differences in foreign language learning. *Foreign Languages in China*, 6, 62-67.
- Hummel, K. M., & French, L. M. (2016). Phonological memory and aptitude components: Contributions to second language proficiency. *Learning and Individual Differences*, 51, 249-255. <http://dx.doi.org/10.1016%2Fj.lindif.2016.08.016>
- Kim, P. (2021) Concurrent Validity of LLAMA_F: Measure of Language Analytic Ability as a Predictor of Morphosyntax Knowledge. *Language Teaching Research Quarterly*, 24, 23-43. <http://dx.doi.org/10.32038/ltrq.2021.24.02>
- Li, H., Ma, L., & Zhang, X. (2019). On the relationship between age of onset, language aptitude and L2 grammar attainment. *Modern Foreign Languages*, 42(4), 527-539. <https://kns.cnki.net/kcms/detail/detail.aspx?FileName=XDWY201904008&DbName=CJFQ2019>
- Li, J., Ye, H., Tang, Y., Zhou, Z., & Hu, X. (2018). What are the effects of self-regulated phases and strategies for Chinese students? A meta-analysis of two decades research of the association between self-regulation and academic performance. *Frontiers in Psychology*, 9, 1-13. <https://doi.org/10.3389/fpsyg.2018.02434>
- Li, L. (2013). Developing, piloting and validating a language analytic ability test. *Shandong Foreign Language Teaching*, 1, 68-74. <https://doi.org/10.1648 2/j.s dwy37- 1026. 2013.01.019>
- Li, S. (2015). The associations between language aptitude and second language grammar acquisition: A meta-analytic review of five decades of research. *Applied Linguistics*, 36(3), 385-408. <https://doi.org/10.1093/applin/amu054>
- Li, Y., & Zhou J., Z. (2020). Learners' self-regulation in online English learning. *Foreign Languages and Their Teaching*, (5), 45-54.
- Lynch, R., & Demo, M. (2004). The relationship between self-regulation and online learning in a blended learning context. *The International Review of Research in Open and Distance Learning*, 5(2), 1-16. <https://doi.org/10.19173/irrodl.v5i2.189>
- Ma, Z., & Wang, T. (2011). The effects of language aptitude and working memory on L2 reading comprehension. *Shandong Foreign Language Teaching*, (3), 41-47.
- Meara, P. (2005). *LLAMA language aptitude tests: The manual*. Swansea: Lognostics.
- Pintrich, P. (2000). The role of goal orientation in self-regulated learning. In M. Boekaerts, P. Pintrich & M. Zeidner (Eds.), *Handbook of Self-regulation, Research, and Application*. Orlando, FL: Academic Press.
- Pintrich, P., Smith, D., Garcia, T., & McKeachle, W. (1991). *A Manual for the Use of the Motivated Strategies for Learning Questionnaires (MSLQ)*. Ann Arbor, Michigan: The University of Michigan Press.
- Robinson, P. (2005). Aptitude and second language acquisition. *Annual Review of Applied Linguistics*, 25, 46-73. <http://dx.doi.org/10.1017/S0267190505000036>
- Robinson, P. (2007). Aptitudes, abilities, contexts, and practice. In R. DeKeyser (Ed.), *Practice in Second Language* (pp. 256-286). Cambridge: Cambridge University Press. <https://doi.org/10.1017/CBO9780511667275.015>

- Robinson, P. (2012). Individual differences, aptitude complexes, SLA processes, and aptitude test development. In *New perspectives on individual differences in language learning and teaching* (pp. 57-75). Springer, Berlin, Heidelberg. http://dx.doi.org/10.1007/978-3-642-20850-8_4
- Shang, J. (2012). The effects of language aptitude on foreign language reading ability. *Journal of Donghua University (Social Science)*, 12(2), 134-141. doi:10.19883/j.1009-9034.2012.02.012.
- Shang, J. (2016). Research on the relationship between college students' self-regulation learning strategies and English academic achievements in the network environment. *Foreign Languages Research*, (4), 57-62. doi:10.13978/j.cnki.wyyj.2016.04.011.
- Skehan, P. (1989). *Individual Differences in Second Language Learning*. London: Edward Arnold.
- Skehan, P. (1998). *A Cognitive Approach to Language Learning*. Oxford: Oxford University Press.
- Sparks, R., & Ganschow, L. (1991). Foreign language learning differences: Affective or native language aptitude differences? *The modern language journal*, 75(1), 3-16. <http://dx.doi.org/10.1111/j.1540-4781.1991.tb01076.x>
- Sparks, R., & Ganschow, L. (2001). Aptitude for learning a foreign language. *Annual Review of Applied Linguistics*, 21, 90-111. <https://doi.org/10.1017/S026719050100006X>
- Sparks, R. L., Humbach, N., Patton, J., & Ganschow, L. (2011). Subcomponents of second-language aptitude and second-language proficiency. *Foreign Language Annals*, 95(2), 253-273. <https://doi.org/10.1111/j.1540-4781.2011.01176.x>
- Sternberg, R. J. (2002). The theory of successful intelligence and its implications for language aptitude testing. In P. Robinson (Ed.), *Individual differences and instructed language learning* (pp. 13-43). John Benjamins. <https://doi.org/10.1075/llt.2.04ste>
- Sun, T., & Wang, C. (2020). College students' writing self-efficacy and writing self-regulated learning strategies in learning English as a foreign language. *System*, 90, 1-17. <https://doi.org/10.1016/j.system.2020.102221>
- Weinstein, C. (1988). Assessment and training of student learning strategies. In P. Schmeck (Ed.), *Learning Strategies and Learning Styles*, New York, NY: Plenum.
- Wen, Z. (2015). Working memory in second language acquisition and processing: The Phonological/ Executive model. In Z. Wen, M. B. Mota & A. McNeill (Eds.), *Working memory in second language acquisition and processing* (pp. 41-62). Multilingual Matters. <https://doi.org/10.21832/9781783093595>
- Wen, Z. (2021). Language aptitudes. In T. Gregersen & S. Mercer (eds.), *The Routledge Handbook of Psychology of Language Learning and Teaching* (pp. 389-403). Routledge. <https://doi.org/10.4324/9780429321498>
- Wen, Z., & Skehan, P. (2021). Stages of acquisition and the P/E Model of working memory: Complementary or contrasting approaches to foreign language aptitude? *Annual Review of Applied Linguistics*, 41(2), 6-24. <https://doi.org/10.1017/S0267190521000015>
- Wen, Z., Skehan, P., & Sparks, R. (2022). *Language aptitude theory and practice*. Cambridge: Cambridge University Press (Applied Linguistics Series).
- Winke, P. (2013). An investigation into second language aptitude for advanced Chinese language learning. *The Modern Language Journal*, 97(1), 109-130. <https://doi.org/10.1111/j.1540-4781.2013.01428.x>
- Zheng, C., & Wang, L. (2020). The structural relations between technological acceptance and online self-regulation among English language learners in a higher education setting. *Foreign Language Education*, 41(2), 64-70. DOI:10.16362/j.cnki.cn61-1023/h.2020.02.012.

Zimmerman, B., & Martinez-Pons, M. (1986). Development of structured interview for assessing students' use of self-regulated learning strategies. *American Educational Research Journal*, 23(4), 614-628. <http://dx.doi.org/10.3102/00028312023004614>

Zimmerman, B. (2011). Motivational sources and outcomes of self-regulated learning and performance. In B. J. Zimmerman, & D. H. Schunk (Eds.), *Handbook of Self-regulation of Learning and Performance*. New York, NY: Routledge.

Acknowledgements

Not applicable.

Funding

This article is funded by 2020 postgraduate education and instruction reform project of Jiangxi Province (JXYJG-2020-046)

Ethics Declarations

Competing Interests

No, there are no conflicting interests.

Rights and Permissions

Open Access

This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. You may view a copy of Creative Commons Attribution 4.0 International License here: <http://creativecommons.org/licenses/by/4.0/>.