

The Impact of L2 Vocabulary Knowledge on Language Fluency

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ABSTRACT

While there has been ample research on the relationship between vocabulary knowledge (breadth and depth aspects) and speaking proficiency, very little attention has been given to the correlation between the four aspects of L2 lexical knowledge (receptive\productive\ breadth\depth) and L2 speaking ability, and none has focused on the moderation effect of L2 vocabulary fluency in speaking capability. The current research recruited 312 Chinese university students as participants. It used the Structure Equation Model (SEM) to assess the relative effectiveness of the four aspects of L2 lexical knowledge and the predictive power of the overall L2 lexical knowledge in L2 speaking. It also ascertained the moderation effect of L2 vocabulary fluency by using Ping's Single Product Indication Method. Results showed that of the four aspects of L2 vocabulary knowledge, productive vocabulary depth contributed the most to speaking skills. The productive vocabulary breadth ranked second, with receptive vocabulary breadth and depth showing less contribution to speaking proficiency. Regression analyses indicated that overall L2 lexical knowledge explained 47% of the variance in speaking. On the basis of these research findings, educational implications are further discussed, then limitations are identified.

Keywords: Moderation effect, speaking proficiency, structure equation model, vocabulary fluency, vocabulary knowledge

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INTRODUCTION

Vocabulary knowledge is the foundation of language capability and development (Nation, 2013). Furthermore, it is widely believed that successful language learning is inseparable from lexical knowledge, which can powerfully predict learners' language ability (Qian & Lin, 2020). Therefore, if

the learners' language proficiency improves, their vocabulary ability must increase because it effectively strengthens the memorization of newly learned words during listening, speaking, reading, and writing (Laufer, 2013).

Lexical knowledge is also a powerful predictor of academic performance and successful language ability (Laufer, 1997). For example, according to Stæhr (2008), vocabulary size accounts for 72% variance in reading, 39% in listening, and 52% in writing. Therefore, studying the association between lexical knowledge and language capability has attracted global attention. Over the past 20 years, many scholars have paid close attention to the association between lexis and reading (Cheng & Matthews, 2018; Li & Kirby, 2015; Nation, 2001; Qian, 1999, 2002) and listening (Cheng & Matthews, 2018; Matthews, 2018; Nation, 2001; Stæhr, 2008, 2009), and writing (Choi, 2017; Kilic, 2019; Olinghouse & Wilson, 2013; Webb, 2005) while a few researchers focused on the correlation between lexis and speaking ability (Alharthi, 2020; Koizumi & In'name, 2013; Uchihara & Saito, 2019). Further, few studies have ascertained the correlation between lexis and speaking in a Chinese setting. No previous studies have used vocabulary fluency as a moderation factor to explore the correlation between vocabulary and oral ability. Therefore, it would be of significance to focus on the effect of lexical knowledge on oral proficiency and the moderation effect of vocabulary fluency.

Problem Statement

Chinese university students do not have a real language learning environment and learn English only through classroom teaching. As a result, it makes it difficult for Chinese ESL/EFL learners to gain proficiency in a foreign language, which leads to a piece of insufficient vocabulary knowledge and speaking ability.

Specifically, Chinese university students do not clearly understand what effect different dimensions of vocabulary knowledge can have on speaking and the extent to which speaking proficiency can be predicted by different dimensions of vocabulary knowledge (Cheng & Matthews, 2018; Zhang & Zhang, 2020).

In addition, Chinese university students do not know the actual value of fluency development in speaking.

Research Objectives

The current study investigates the relationship between L2 vocabulary knowledge and Chinese university students' speaking proficiency. The research objectives for this study are to ascertain the effectiveness and the predictiveness of the four dimensions of vocabulary knowledge in speaking, to investigate the moderation effect of vocabulary fluency on the correlation between the four dimensions of L2 vocabulary knowledge and speaking proficiency, and to provide insights on vocabulary and L2 teaching and research for the future.

THEORY AND HYPOTHESIS

Vocabulary Knowledge

Vocabulary is complicated and multidimensional. It is not easy to hold its essence because of the complexity of lexical knowledge (Schmitt, 2014). Some researchers have proposed different frameworks to avoid confusion and multiple dimensions of vocabulary knowledge. Generally speaking, breadth and depth are the two basic dimensions of lexis (Milton, 2009; Qian, 1999; Read, 1993, 1998, 2000). Vocabulary breadth refers to the number of words a learner knows in a particular language, while vocabulary depth refers to the degree to which vocabulary has been mastered (Qian, 2002; Read, 2000, 2004; Zhang & Zhang, 2020). Nation (2013) argues that control of a word relates to knowledge of “form”, “meaning”, and “usage” (p. 39). The theoretical basis for researchers to study vocabulary depth comes from the nature of multiple components of lexis (Schmitt, 1998, 1999; Webb, 2005).

Receptivity and productivity are two aspects of both vocabulary and language. For lexis, receptive vocabulary consists of items that can only be activated by hearing or seeing their forms, while other words can activate productive vocabulary because it has many incoming and outgoing links with other words (Meara & Jones, 1990). For language, receptive skills are reading and listening; productive skills are speaking and writing. Nation (2013) noted that receptive vocabulary use involves perceiving the form of a word when listening or reading and retrieving their meaning, while productive

vocabulary use involves wanting to express meaning through speaking or writing and retrieving and producing the appropriate spoken and or written word form (p. 47).

Vocabulary fluency generally means that learners become more and more fluent in using items they already know. In this study, vocabulary fluency is defined as the speed of word retrieval, a crucial factor influencing L2 learners' language skills performance which listening, reading, speaking, and writing (Segalowitz & Hulstijn, 2005). Schmitt (2010) believes there is an urgent need to process words quickly enough to communicate smoothly; that is, the speaker needs to prepare appropriate vocabulary to improve oral fluency, and the listener needs to understand what the speaker says with sufficient word recognition speed. Segalowitz and Freed (2004) reported a positive correlation between vocabulary access speed and spoken language. Nation (2013) emphasized the importance of fluency and noted that fluency training should account for 25% of learning time in and out of class. Although vocabulary fluency plays a vital role in language performance, there is very little research on how it relates to speaking proficiency.

Based on vocabulary breadth and depth and receptive and productive vocabulary mentioned above, four aspects of vocabulary can be concluded: receptive breadth and depth, and productive breadth and depth. The first two aspects have attracted many researchers' attention, and the last two, especially the last, have received little attention. Therefore, this study will use these

four aspects of vocabulary as four constructs of the structural equation model to explore their correlation with speaking.

Vocabulary Knowledge and Speaking Proficiency

Many researchers believe that lexical knowledge can effectively predict reading, listening, and writing ability (Alharthi, 2016; Cheng & Matthews, 2018; Choi, 2017; Dabbagh & Enayat, 2019; Milton et al., 2010; Qian, 1999, 2002; Stæhr, 2008, 2009; Wolf et al., 2019). However, although the link between lexical knowledge and L2 language ability has been well established, there are relatively few studies on the correlation between lexical knowledge and oral ability (Schmitt, 2014).

Based on 224 Japanese English beginning and intermediate learners, Koizumi and In'nami (2013) ascertained the extent to which L2 speaking ability can be predicted by the retrieval speed, size, and depth of L2 lexis. The results revealed that the proportion of speaking performance was explained by size (63%), depth (60%), and speed (28%), meaning that vocabulary size, depth, and retrieval speed could account for a substantial ratio of variance in speaking ability, but the explanatory power of the retrieval speed of lexis is the lowest among the three dimensions. Milton et al. (2010) verified the association between vocabulary size, including orthographic and phonological size, and speaking proficiency through an oral interview of 30 English learners with intermediate to relatively advanced levels. The results indicated

that the correlation between orthographic vocabulary size and speaking proficiency approached $r = 0.35$, and phonological vocabulary size was $r = 0.71$, indicating that orthographic vocabulary breadth has only a moderate explanatory power for speaking proficiency. In contrast, aural vocabulary size has high explanatory power for speaking proficiency. Therefore, it is reasonable to expect that vocabulary test results based on listening or dictation in a limited time should be one of the criteria for evaluating speaking proficiency. Uchihara and Clenton (2018) ascertained that the degree to which L2 speaking ability could be predicted by receptive vocabulary size based on the testing scores of 46 international students at an L2 advanced level who took part in a receptive lexicon task (Meara & Miralpeix, 2016) and a spontaneous oral picture narrative task. The findings showed that learners with large vocabulary sizes were not proportional to the production of complex L2 words when speaking.

Uchihara and Saito (2019) surveyed the extent to which manifold dimensions of spontaneous speech production could be predicted by productive lexical knowledge L2 of learners based on 39 EFL participants with different L2 levels by completing a productive lexicon task (Lex30) for examining comprehensibility, accent and fluency. The results indicated that the productive lexicon grades correlated moderately with L2 fluency ($r = 0.34$) and low correlation with comprehensibility ($r = 0.27$) but a slight correlation with an accent ($r = 0.03$). Finally, Alharthi (2020), interviewing 18 Saudi Arabia sophomore

university learners of English, investigated the degree to which productive lexical knowledge correlates with and predicts speaking ability. The results demonstrated that the correlation order of different lexical frequency levels with speaking is 3,000-word level ($r = 0.58$), 2,000-word level ($r = 0.49$), 5,000-word level ($r = 0.39$), academic word level ($r = 0.30$) and 10,000-word level ($r = 0.23$) on the interview task, showing that productive vocabulary has the most significant effect on learners with 3000-word frequency level.

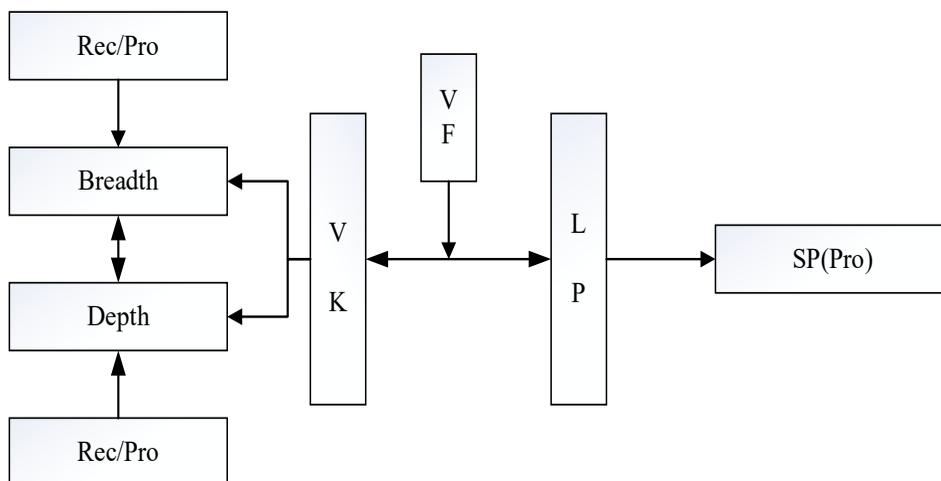
The previous studies found that most researchers focused on the association between vocabulary size only and speaking ability, some examined the correlation between vocabulary depth or speed, and some took vocabulary size, depth, and processing speed. However, there is no study on the correlation between four aspects of lexical knowledge and overall speaking proficiency

on the basis of large samples. Furthermore, the literature review found no research on the moderation role of vocabulary fluency on the relationship between L2 lexicons and speaking. Therefore, it is very necessary to bridge this gap.

Study Hypothesis and Research Questions

The current research aims to explore and discuss the effectiveness and predictiveness between the four aspects of lexical knowledge and L2 speaking capability and ascertain the moderation effect of vocabulary fluency on the relationship between L2 lexical knowledge and speaking proficiency.

This article quantitatively analyzes the relationship between the four aspects of L2 vocabulary knowledge and speaking ability, as is represented in the framework shown in Figure 1.



Note. Rec=receptive; Pro=productive; VK=vocabulary knowledge; LP=language proficiency; VF=vocabulary fluency, SP=speaking proficiency

Figure 1. A concept framework

Based on the conceptual framework, three questions are proposed.

RQ 1. To what extent can the four aspects of L2 vocabulary knowledge be correlated with speaking proficiency?

RQ 2. To what extent can speaking proficiency be predicted by the four aspects of L2 vocabulary knowledge?

RQ 3. Does vocabulary fluency have a moderation effect on speaking proficiency?

Based on the research questions above, four research hypotheses have been proposed.

H1: Receptive vocabulary breadth and depth have a positive effect on speaking.

H2: Productive vocabulary breadth and depth have a positive effect on speaking.

H3: Vocabulary knowledge has substantial predictive power on speaking.

H4: Vocabulary fluency has a moderation effect on the relationship between vocabulary knowledge and speaking.

METHOD

Participants

The participants were 312 male and female Chinese students from a teaching education university in southeastern China. They have studied English for almost ten years. The average age is 20.5 years old, and they have had no study or life experience overseas. Most of them passed CET4 (College English Test Band 4), and some students passed CET6 (College English Test Band 6) which should identify Chinese university students with a command of more than 4500 and 6000 items. CET4 and CET6 are used to check the English level of Chinese university students.

In addition, four experienced EFL teachers participated in the study as raters. They had about 20 years of English classroom teaching experience, and two had experience studying abroad.

Instruments

Test for Receptive Vocabulary Breadth (VLT). In this study, the measurement instrument of receptive vocabulary breadth is the version designed by Schmitt et al. (2001) with 5 frequency levels: 2,000, 3,000, 5,000, 10,000, and academic vocabulary. This version of Schmitt was chosen as the Cronbach alpha coefficient approached .77, indicating the high validity of the instrument.

Example of VLT item

1. *consent*
2. *enforcement* _____ *total*
3. *investigation* _____ *agreement or permission*
4. *parameter* _____ *trying to find information about something*
5. *sum*
6. *trend*

Test for Receptive Vocabulary Depth (VDT). In the current study, the Word Associate Test designed by Read (1998) was used to measure the receptive depth of lexical knowledge, here called VDT, to unify the terms in this study. The test form comprises a target word and eight option words, four of which are interference items. From the perspective of testing, it was proved by Read (1998) to be reliable and valid. Example of VDT item:

adjust

(A)alter(B) belong(C) correct(D)modify	(E)continent(F) interested(G) germ(H)television
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Test for Productive Vocabulary Breadth (PLT).

The productive vocabulary breadth test is Nation’s Productive Level Test (1999) which has been widely employed and recognized (see Laufer & Nation, 1999; Schmitt et al., 2001). The participants are expected to fill in the blank in the test based on the lexical clue provided.

Example of PLT item:

Soldiers usually swear an oa of loyalty to their country.

Test for Productive Vocabulary Depth (PVDT).

A test tool for productive vocabulary depth (PVDT) was used based on the “A Definition Completion Test (DCT)” proposed by Read (1995). First, the participants are required to define the given vocabulary and make a sentence. Then, it is a conscious meta-language performance to search for the vocabulary in the semantic space of the participant’s brain and check their vocabulary ability in word parts, association, and collocation.

Example of PVDT item:

advent
Definition:
Example:

Test for Vocabulary Fluency (VFT).

A full passage dictation test derived from IELTS Listening materials was used to measure vocabulary fluency, which utilizes

the aspects of phonetics, morphology, and pragmatism related to lexis (see Appendix 1). It requires the participants to complete the missing word in a limited time as they are listening to the passage, examining the speed of retrieving vocabulary, that is, vocabulary fluency, which can be reflected by dictation because of the fleeting characteristics of listening. As Milton et al. (2010) showed, phonological vocabulary size strongly correlated with speaking. Since it is not mainly a spelling test, the minor spelling errors were not completely deductible (Matthews et al., 2017).

Example of VFT item:

Welcome to all of you...can everybody see and hear me?. Good...I’m Sally, your _____ for this _____ of the Bicenteenial Park...I hope that you’re all _____ your most _____ and that you can keep up the _____. So let’s get under _____ on our tour around this _____.

It should be answered in the following way.

Welcome to all of you...can everybody see and hear me?. Good...I’m Sally, your guide for this tour of the Bicenteenial Park...I hope that you’re all wearing your most comfortable shoes and that you can keep up the pace. So let’s get under way on our tour around this wonderful park.

Test for Speaking Proficiency.

IELTS speaking test mode is used to measure the Speaking test in which four examiners evaluate each candidate whose final score of the candidate is the average of the four

examiners. There are two steps for testing the participants' speaking proficiency. Step 1: The participant is given a task card with captions and asked to discuss a particular topic. The participant has 1 minute of preparation time, and if they wish, they can take some notes and speak within one to two minutes. Step 2: The examiners and the examinee discuss some issues related to the topic of Part 2. The discussion lasts between two and three minutes.

Example of Test for Speaking Proficiency item:

Part 1

Describe a restaurant that you enjoyed going to.

You should say:

*where the restaurant was
why you choose this restaurant
what type of food you ate in this restaurant and explain why you enjoyed eating in this restaurant.*

Part 2(omit)

Procedure

Data Collection. Six tests were arranged to be conducted in three lecture halls. The first five tests were vocabulary, and the last was the speaking test. Three hours were spent completing all vocabulary tests, with two ten-minute breaks. Speaking test data collection occurred across four days, with each speaking test taking approximately six minutes.

Scoring.

First type: One point was awarded for each correct response for the first three vocabulary measurements. Receptive vocabulary breadth had five frequency levels 2000, 3000, 5000, 10 000, and academic vocabulary. Each level has 30 points, totaling 150 points. Receptive vocabulary depth has 40 target words, and each word has 4 answers, so a total score is 160 points. Productive vocabulary breadth consists of the same five frequency levels as receptive vocabulary breadth. Each level has 18 points, totaling 90 points.

Second type: For productive vocabulary depth, participants were required to offer a definition and make a sentence for each of the 20 words. Each word has a total of 4 points, 2 points for a definition, 2 points for a sentence, and a total score of 80 points.

Third type: The total points of the speaking test are 100 over four categories used to contribute to the holistic grades of the speaking tasks: fluency and coherence (25%), lexical resource (25%), grammatical accuracy (25%), and pronunciation (25%) (see Appendix 2). Four trained examiners evaluated each candidate, and the final score of each candidate was the average of the four examiners. For the rating criteria of the speaking tasks, it was believed that the overall scoring standard has strong operability and was easier to master in line with the large-scale oral test.

Four trained teachers also evaluated all vocabulary test papers. Since all the vocabulary testing items were objective questions and the answers to every testing item were offered, no disputation existed in the assessment process.

Data Analyses. In the present study, four aspects of lexical knowledge were independent variables. Speaking as the dependent variable, and vocabulary fluency

was the moderation variable. AMOS24.0 and SPSS24.0 were used to analyze the data for statistical analysis and inferences.

RESULTS

Descriptive Statistics

A general profile of participants' performance in each test includes the range, maximum score, and mean and standard deviation of their scores (Table 1).

Table 1

Descriptive statistics

Test	MPS	Range	Mean	Std. deviation	N
A1	30	25	20.43	4.822	312
A2	30	30	18.40	6.607	312
A3	30	30	14.04	7.946	312
A4	30	30	12.88	8.087	312
A5	30	30	12.56	8.487	312
B1	35	32	19.92	5.602	312
B2	38	34	18.71	6.229	312
B3	40	40	18.88	6.327	312
B4	40	40	18.96	7.193	312
C1	18	18	10.07	4.361	312
C2	18	18	9.54	4.745	312
C3	18	18	8.79	5.148	312
C4	18	18	8.48	5.601	312
C5	18	18	7.86	5.470	312
D1	20	20	10.43	4.708	312
D2	20	20	10.27	5.144	312
D3	20	20	9.55	5.158	312
D4	20	20	9.19	5.698	312
F1	20	20	10.54	4.527	312
F2	20	19	10.77	4.067	312
F3	20	20	10.21	4.509	312
F4	20	20	9.82	5.513	312
S1	25	23	18.22	4.160	312
S2	23	19	12.97	2.933	312
S3	25	25	11.76	4.635	312
S4	23	21	11.44	3.884	312

Note. MPS = maximum possible score

In Table 1, A1–A5 stand for 2000, 3000, 5000, 10000 and academic vocabulary of receptive vocabulary breadth; B1–B4 stand for four groups of receptive vocabulary depth; C1–C5 stand for 2000, 3000, 5000, 10 000 and academic vocabulary of productive vocabulary breadth; D1–D4 stands for four groups of productive vocabulary depth; F1–F4 stand for four groups of vocabulary fluency; and S1–S4 stand for four speaking tasks: fluency and coherence, lexical resource, grammatical accuracy, and pronunciation.

Respective and productive vocabulary knowledge are independent variables of hypotheses, vocabulary fluency is a moderation variable, and speaking stands for the dependent variable. Descriptive statistical analysis is the statistical description of data about all research variables. Smaller standard deviations mean that these values are closer to the mean, indicating that the data collected in this research is more accurate (Table 1). In order to further verify the reliability and validity of the collected data, confirmatory factor analysis was used, as shown below.

Confirmatory Factor Analysis

Confirmatory factor analysis was conducted to ascertain the pros and cons of the data. Item reliability, composite reliability, and convergence validity were first calculated based on uncorrelated variables (Table 2).

According to Fornell and Larcker (1981), the composite reliability (CR) is equal to Cronbach's α , and 0.7 is

the acceptance threshold. The average variance (AVE) extracted means the average explanatory force of the observed variables' latent variables. The higher the AVE, the better the convergence validity. According to Fornell and Larcker, the ideal value of AVE is higher than 0.5, but 0.36~0.5 can also be accepted.

The non-standardization points estimation values are all positive, the z -values exceed 1.96, and the P -value is significant, indicating hypotheses are reasonable (Table 2). The standardized points estimation is factor loadings which are all higher than 0.7. SMC is the square of the factor loading. Generally, 0.36 is acceptable, and 0.5 is the ideal value. The composition reliability is above 0.8, and the convergence validity is above 0.5, indicating good data reliability.

Discriminant validity between the various variables was calculated by correlating all variables (Table 3).

The discriminant validity is the square root calculations of the average variance extraction (AVE). For example, the AVE square roots in bold are higher than other Pearson correlation coefficients (Table 3). Thus, there is good discriminating validity in the current study.

Correlation Analysis

SEM Analysis Between VK and SP. Based on the conceptual framework, a structural equation model is built and illustrated in Figure 2.

Table 2
Convergence validity

Construct	Indicator	Significance of estimated parameter			Std.	Item reliability	Composite reliability	Convergence validity
		Unstd.	S.E.	z-value				
VLT	A1	1.000			.834	.696	.909	.666
	A2	1.347	.079	16.975	.820	.672		
	A3	1.564	.097	16.134	.791	.626		
	A4	1.730	.095	18.190	.860	.740		
	A5	1.634	.104	15.640	.774	.599		
VDT	B1	1.000			.842	.709	.914	.680
	B2	1.173	.062	19.054	.888	.789		
	B3	1.084	.065	16.755	.808	.653		
	B4	1.230	.074	16.702	.807	.651		
PLT	C1	1.000			.817	.667	.893	.626
	C2	1.058	.068	15.489	.795	.632		
	C3	1.203	.073	16.451	.833	.694		
	C4	1.262	.080	15.704	.803	.645		
	C5	1.075	.082	13.168	.700	.490		
PVDT	D1	1.000			.808	.653	.883	.602
	D2	1.093	.073	14.876	.808	.653		
	D3	1.082	.074	14.672	.798	.637		
	D4	1.139	.082	13.904	.760	.578		

Table 2 (Continue)

Construct	Indicator	Significance of estimated parameter			Std.	Item reliability	Composite reliability	Convergence validity
		Unstd.	S.E.	z-value				
VFT	F1	1.000			.773	.598	.880	.596
	F2	0.913	.067	13.719	***	.616		
	F3	1.064	.074	14.370	***	.682		
	F4	1.213	.090	13.452	***	.593		
SP	S1	1.000			.843	.711	.909	.666
	S2	0.717	.039	18.290	***	.736		
	S3	1.086	.063	17.177	***	.674		
	S4	0.941	.052	18.039	***	.721		

Note. VLT = receptive vocabulary breadth test; VDT = receptive vocabulary depth test; PLT = productive vocabulary breadth; PVDT = productive vocabulary depth test; VFT = vocabulary fluency test; SP = speaking proficiency test; *** = $p < .001$

Table 3

Discriminant validity

CONSTRUCT	AVE	PLT	PVDT	SP	VFT	VDT	VLT
PLT	.627	.792					
PVDT	.681	.146	.825				
SP	.672	.472	.307	.820			
VFT	.602	.322	.214	.575	.776		
VDT	.607	.243	.179	.537	.327	.779	
VLT	.667	.182	.205	.315	.263	.180	.817

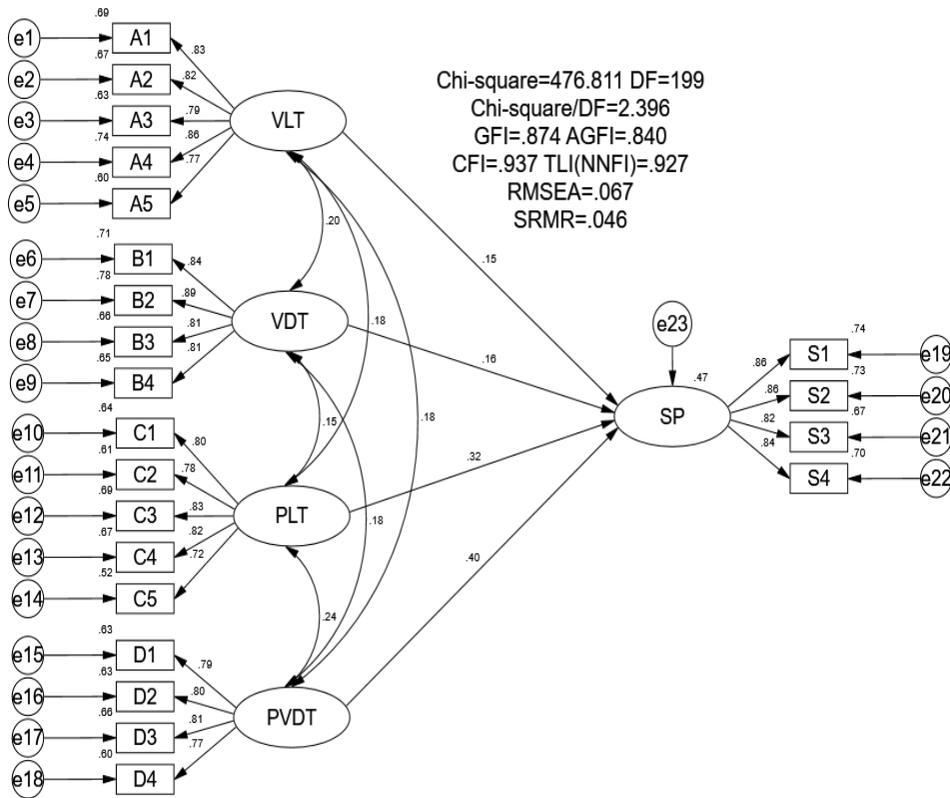


Figure 2. A research model

Figure 2 illustrates a research model of the association between the four aspects of lexical knowledge and speaking proficiency. The model shows that productive vocabulary depth has the strongest effect on speaking performance, and the regression correlation coefficient between the two is $\beta = .40$. Productive vocabulary breadth has a significant effect on speaking performance with $\beta = .32$. Receptive vocabulary breadth and depth have a lower effect on speaking with $\beta = .15$ and $\beta = .16$ respectively. Multiple regression analyses showed that overall L2

lexical knowledge explains 47% of the variance in speaking performance.

Receptive and productive vocabulary knowledge positively affects speaking, verifying that H1 and H2 are valid (Figure 2). Forty-seven percent variance means that vocabulary knowledge has substantial predictive power on speaking, indicating that hypothesis H3 is accepted, offering support for verifying the hypotheses, and answers to RQ1 and RQ2.

Based on the analysis of SEM, the model fit index was calculated (Table 4).

Table 4

Model fit

Index	Criteria	Model fit	Result
Chi-square	lower, better	476.811	
DF	higher, better	199	
Chi-square/DF	<5	2.396	meet criteria
GFI	>0.9	0.874	may accept
AGFI	>0.9	0.840	may accept
RMSEA	<0.08	0.067	meet criteria
SRMR	<0.08	0.046	meet criteria
CFI	>0.9	0.937	meet criteria
TLI(NNFI)	>0.9	0.927	meet criteria

The model fit index accords with the criterion proposed by scholars MacCallum et al. (1996), indicating that the SEM assumption is valid.

Pearson Correlations Analysis. For a clear illustration of the correlation between lexicon knowledge and speaking, more succinct data (Table 3) is shown below (Table 5).

Table 5

Pearson correlations between different variables and speaking

Study measures	VLT	DVKT	PLT	VDT
Speaking proficiency	.315***	.307***	.472***	.537***

Note. *** = $p < .001$

In the overall view, the correlation between productive vocabulary depth and speaking is the strongest with ($r = 0.537$, $p < .001$); productive vocabulary breadth ranks the second with ($r = 0.472$, $p < .001$); and the correlation between receptive vocabulary breadth and depth are ($r = 0.315$, $p < .001$) and ($r = 0.307$, $p < .001$), respectively.

Moderation Effect

The moderation variable may affect the strength of the relationship between the two variables. The moderation variable has an interactive effect. The relationship between the variables X and Y depends on the third variable. Ping's (1995) single product indication was adopted to check whether vocabulary fluency would affect the relevance of the various aspects of L2 lexical knowledge and speaking ability.

Moderation Effect of Vocabulary Fluency (VLT vs. SP). Two steps were followed to investigate the moderation effect of vocabulary fluency.

Step 2: The value obtained in Step 1 is fixed by the interaction item's factor loading and residual error. If the analysis result is significant, the interaction exists.

Step 1: Estimate the factor loading and residual of the main effect.

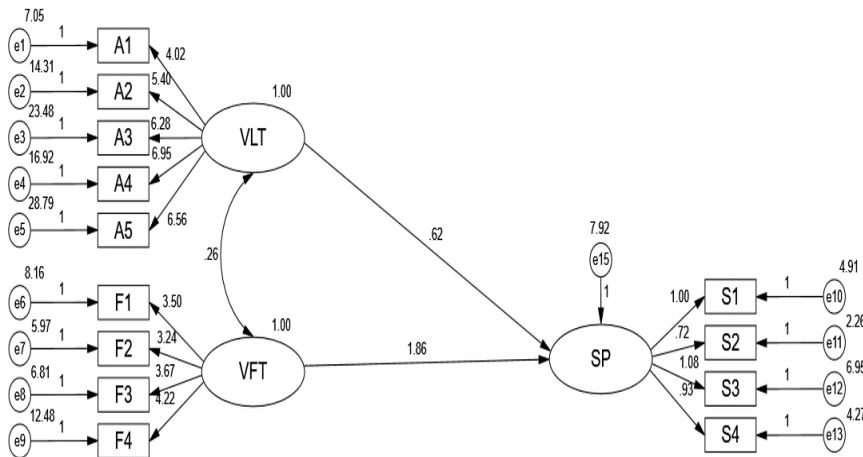


Figure 3. The main effect model

In the main effect model (Figure 3), the loading value is run out and substituted into Ping's Single Indicator Interaction, calculating the residual and loading,

which will be substituted (Figure 4) to check whether the interaction item and the endogenous variable is significant.

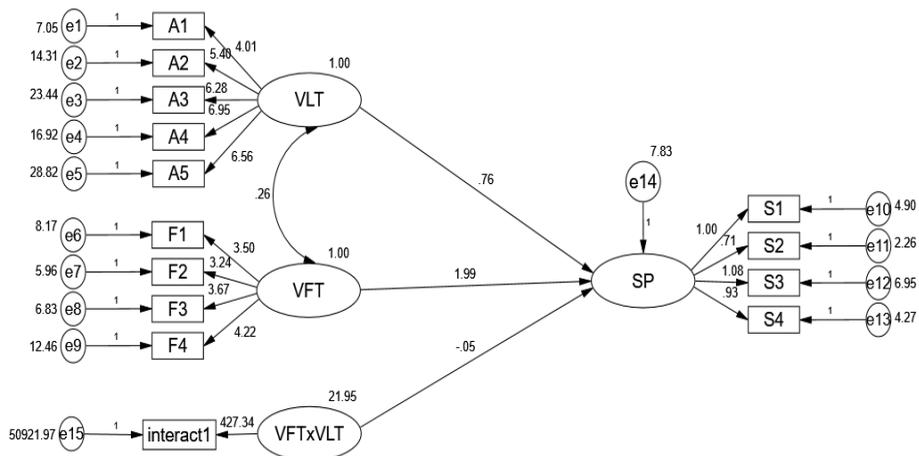


Figure 4. Non-linear setting and interaction

Table 6
Moderator of VFT on the relationship between VLT and SP

Dependent variable	Interaction	Unstd.	S.E.	z-value	P
SP	VLT	.763	.197	3.875	***
SP	VFT	1.994	.129	9.127	***
SP	MO	-.048	-.038	-1.258	.208

Note. *** = $p < .001$

The P value is not significant, so interaction does not exist, indicating that vocabulary fluency has little moderation effect on the relationship between the receptive breadth of lexical knowledge and speaking proficiency (Table 6).

Moderation Effect of Vocabulary Fluency (VDT vs. SP). Two steps were also followed to investigate the moderation effect of vocabulary fluency.

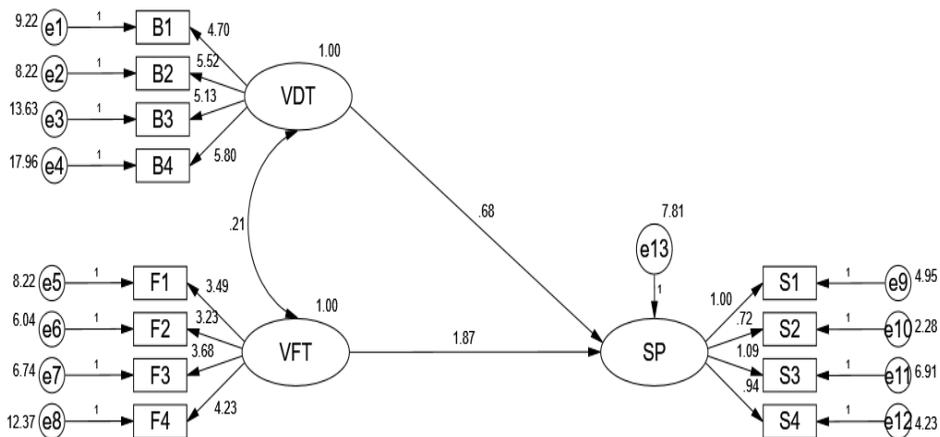


Figure 5. The main effect model

In the main effect model (Figure 5), the loading value is run out and substituted into Ping's Single Indicator Interaction, calculating the residual and loading,

which will be substituted (Figure 6) to check whether the interaction item and the endogenous variable is significant.

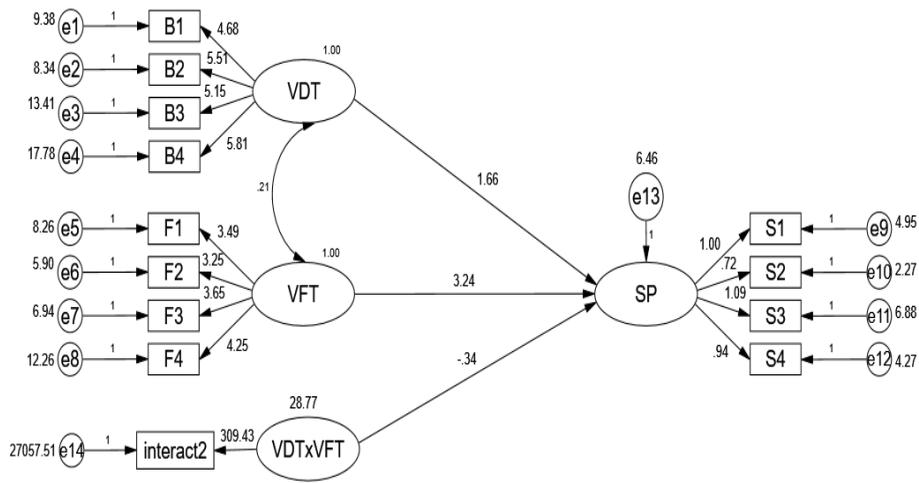


Figure 6. Non-linear setting and interaction

Table 7

Moderator of VFT on the relationship between VDT and SP

Dependent Variable	Interaction	Unstd.	S.E.	z-value	P
SP	VDT	1.664	.202	8.232	***
SP	VFT	3.242	.233	13.899	***
SP	MO	-0.337	.033	-10.088	***

Note. *** = $p < .001$

The P value is significant (Table 7). Hence, interaction exists, indicating vocabulary fluency has a significant moderation effect on the association between the receptive depth of vocabulary knowledge and speaking proficiency.

Moderation Effect of Vocabulary Fluency (PLT vs. SP). Two steps were also followed to investigate the moderation effect of vocabulary fluency.

In the main effect model (Figure 7), the loading value is run out and substituted into Ping’s Single Indicator Interaction, calculating the residual and loading, which will be substituted (Figure 8) to check whether the interaction item and the endogenous variable is significant.

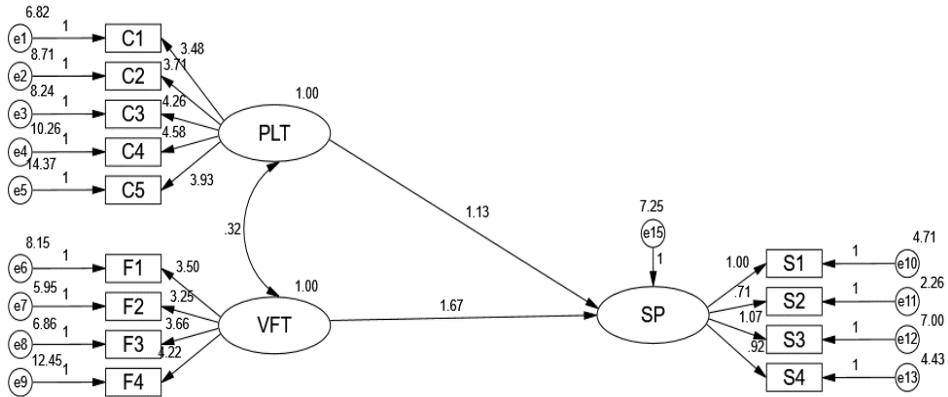


Figure 7. The main effect model

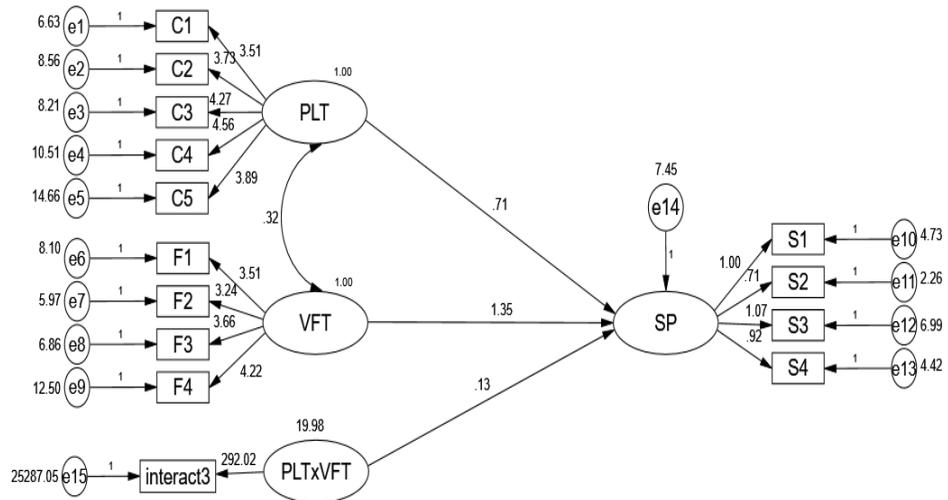


Figure 8. Non-linear setting and interaction

Table 8

Moderator of VFT on the relationship between PLT and SP

Dependent variable	Interaction	Unstd.	S.E.	z-value	P
SP	PLT	.715	.196	3.648	***
SP	VFT	1.349	.206	6.536	***
SP	MO	.132	.039	3.427	***

Note. *** = $p < .001$

Table 8 shows that the P value is significant, so interaction exists, showing vocabulary fluency has a moderation effect on the association between the productive breadth of vocabulary knowledge and speaking proficiency.

Moderation Effect of Vocabulary Fluency (PVDT vs. SP). Two steps were also followed to investigate the moderation effect of vocabulary fluency.

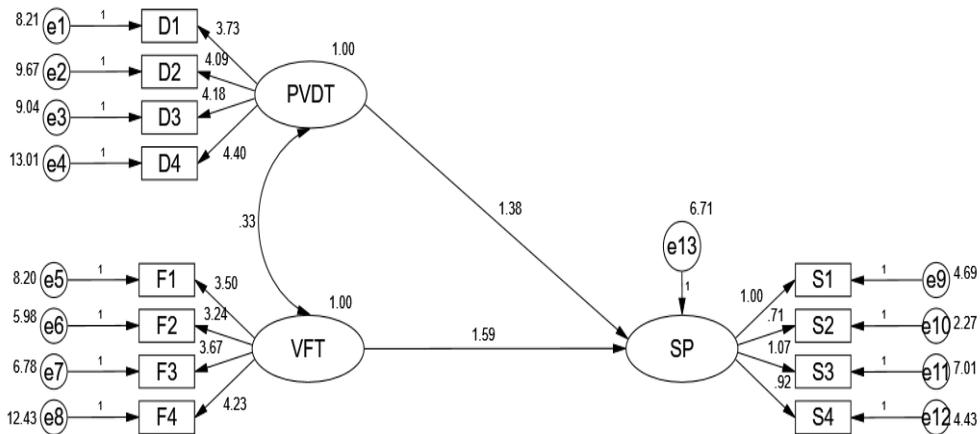


Figure 9. The main effect model

In the main effect model, as shown in Figure 9, the loading value is run out and substituted into Ping's Single Indicator Interaction, calculating the residual and

loading, which will be substituted into the position shown in Figure 10 below to check whether the interaction item and the endogenous variable is significant.

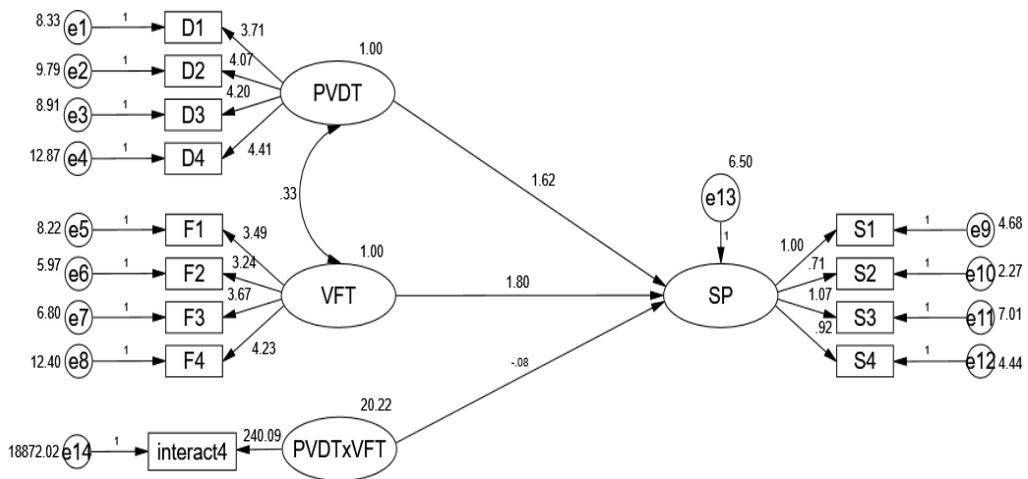


Figure 10. Non-linear setting and interaction

Table 9

Moderator of VFT on the relationship between PVDT and SP

Dependent Variable	Interaction	Unstd.	S.E.	z-value	P
SP	PVDT	1.624	.205	7.934	***
SP	VFT	1.802	.208	8.674	***
SP	MO	00-.081	.037	-2.187	.029

Note. *** = $p < .001$

The P value is significant, so interaction exists, showing vocabulary fluency has a moderation effect on the association between the productive depth of lexical knowledge and speaking proficiency (Table 9).

Results based on the analysis above show vocabulary fluency has certain moderation effect on the correlation between the other three dimensions of lexical knowledge and speaking proficiency, but not for the receptive breadth of lexical knowledge. The findings indicate that the moderation role of vocabulary fluency exists.

So, hypothesis H4 is accepted, offering support for verifying the hypothesis and answering RQ3.

DISCUSSION

This research aims to ascertain the association between L2 lexis and oral proficiency of 312 participating Chinese university students. It was found that L2 vocabulary knowledge can substantially explain L2 proficiency in speaking. These results indicate that Chinese university students with a larger vocabulary in breadth, depth, and speed may have higher oral levels, making them produce more fluent, accurate, and appropriate vocabulary in

their oral performance. This finding suggests that overall L2 lexical knowledge can largely predict L2 speaking competence in speaking, $R^2 = 0.47$ (47%), which is generally consistent with some previous research into L2 speaking, particularly previous studies using SEM (De Jong et al., 2012; Koizumi & In'nami, 2013). Koizumi and In'nami (2013) declare that vocabulary knowledge can predict 84% of spoken language.

Receptive vocabulary knowledge measured via VLT designed by Schmitt et al. (2001) and VDT, that is, WAT designed by Read (1998), have a low correlation on speaking proficiency with $r = 0.315$, $p < .001$ and $r = 0.307$, $p < .001$ respectively based on Pearson correlation. As an independent variable, receptive vocabulary knowledge also has a lower influence on the dependent variable oral ability, that is, VLT with $\beta = .15$ and DVKT with $\beta = .16$. This finding suggests that the association between receptive vocabulary knowledge and L2 speaking reveals the lower association between the two in assessing learners' speaking capability from receptive vocabulary test scores, that is, compared to productive vocabulary knowledge, the contribution of

receptive vocabulary knowledge to speaking might be smaller.

Productive vocabulary knowledge measured via PLT explored by Laufer and Nation (1999) and PVDT chosen by us from IELTS has a medium correlation on speaking proficiency: PLT with $r = 0.472$, $p < 0.001$ and $r = 0.537$, $p < 0.001$ based on Pearson correlation, and the effect of productive vocabulary breadth and depth on oral ability are $\beta = .32$ and $\beta = .40$ respectively. The finding indicates that productive vocabulary knowledge has a medium correlation with oral performance. That is, it is of relative significance for L2 learners to develop productive vocabulary knowledge for advancing their productive speaking proficiency.

Mehmet Kilic (2019) showed that the association effect of RVLT (receptive breadth of vocabulary knowledge) with speaking is $r = 0.40$, and that of WAT (receptive depth of vocabulary knowledge) with speaking is $r = 0.34$, and that of PVLT (productive breadth of vocabulary knowledge) with speaking is $r = 0.39$. Mehmet Kilic's results suggested the strongest correlation between RVLT (receptive vocabulary breadth) and speaking. However, in our study, speaking should have a closer relationship with productive vocabulary knowledge as a productive language skill. So, our results may be more reasonably based on the language nature.

Regarding the correlation between vocabulary breadth with the five different frequency levels and spoken language, according to the benchmark of Plonsky

and Oswald (2014), there is a moderate correlation between the two ($r = 0.55$), which seems to be much lower than that of vocabulary size of correlations found in receptive language skills such as reading at $r = 0.83$, $p < .01$; and listening at $r = 0.69$, $p < .01$ (Stæhr, 2008). As indicated by Nation (2001), the spoken English coverage rate needs to reach 3,000 words, the spoken English coverage rate needs to reach 98%, and the 7,000-word family needs to reach 98%, which is in line with the vocabulary of 5,000 words found in current research. A consistent frequency level of 10,000 is as important as reading or listening for improving L2 speaking, indicating that the larger the vocabulary, the higher the oral ability. Nation (2001) showed that a 3,000-word family needed to reach 95% coverage for spoken English and 7,000-word family needed to reach 98% coverage for spoken English, which is consistent with the finding in the current study that vocabulary size with the 5,000–10,000 frequency level might be more significant for enhancing L2 speaking ability, just as for reading or listening, indicating the larger vocabulary, the higher speaking ability. However, Alharthi (2020) found that the participants with 2,000 and 3,000-word frequency levels can gain high speaking scores in their study. Therefore, it is reasonable that some scholars agree that 2,000 and 3,000-word families enable L2 learners to deal with daily conversation (Adolphs & Schmitt, 2003; Milton, 2013; Read, 1998; Stæhr, 2009), and it is noted that for L2 learners need to acquire much more vocabulary for successful and satisfying oral communication.

Vocabulary fluency in this study, the speed of retrieval of words, unlike from other scholars' research perspectives, has had only its moderation effect explored in the association between vocabulary and speaking. Based on the analysis result of Ping's Single Product Indication Method (see Table 5), *p* values of lexical knowledge (excluding receptive breadth of vocabulary knowledge) are less than .05, showing that vocabulary fluency has a certain moderation effect in examining the correlation between receptive vocabulary depth, productive vocabulary breadth, and productive vocabulary depth and oral ability. Although the *p*-value of receptive vocabulary breadth is lower than .05 based on the analysis result of Ping's Single Product Indication, its foundation role for speaking could not be denied. That is, vocabulary fluency has an important impact on L2 learners in improving their speaking ability by having a good command of lexis.

In addition, it is necessary to develop some other strategies for cultivating the speaking ability of EFL and ESL learners, such as motivational teaching practices, training, and anxiety control.

CONCLUSION

This study found that overall L2 lexical knowledge accounts for 47% of the variance in oral performance capability, indicating that lexical knowledge is a significant predictor of speaking proficiency. Also, whichever the Pearson correlation coefficients or multiple regression coefficients result, productive vocabulary knowledge is higher than

receptive vocabulary knowledge, indicating productive lexis creates a relatively more significant effect on speaking proficiency. Therefore, L2 learners should pay greater attention to productive lexical knowledge based on well-balanced vocabulary knowledge to improve their productive oral skills. In conclusion, the role of vocabulary knowledge on speaking ability should be emphasized, especially productive lexical knowledge. However, it should not be overestimated because many other aspects are related to oral ability. Therefore, we believe the relationship between L2 lexical knowledge and speaking ability should be given attention.

Implications

The present study was conducted to bridge the research gap on the association between the multiple dimensions of L2 lexical knowledge and speaking ability and fill the gap in research on the moderating effect of vocabulary fluency on the association between L2 lexical knowledge and speaking. This study had three main strengths. Firstly, SEM was used to analyze the relationship of the variables to control measurement error. Secondly, except for four aspects of vocabulary knowledge, the moderator effect of vocabulary fluency on speaking performance was also examined. Lastly, unless different types of lexical knowledge are taught for developing different language skills, it is unlikely that a successful and satisfactory conversation could be held by only having a command of high-frequency word level.

Limitations

There are two project limitations. First, the participants were only from the university in this research, so future studies should recruit participants at different levels of ESL. Second, all the participants' scores were analyzed in this research, and future studies should analyze the difference between males and females.

There is also a research design limitation in this study. All the data came from vocabulary and speaking test scores, which belongs to objective results. Questionnaire surveying should be considered in future studies to understand the participants' subjective attitudes toward English learning.

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APPENDIX 1

Student instruction sheet for the Vocabulary Fluency Test.

Please complete the missing words while you are listening to the passages. Here is an example.

Welcome to all of you...can everybody see and hear me? Good...I'm Sally, your _____ for this _____ of the Bicentennial Park...I hope that you're all _____ your most _____ and that you can keep up the _____. So let's _____ under _____ on our tour around this _____.

It should be answered in the following way.

Welcome to all of you...can everybody see and hear me? Good...I'm Sally, your guide for this tour of the Bicentennial Park...I hope that you're all wearing your most comfortable shoes and that you can keep up the pace. So let's get under way on our tour around this wonderful park.

Now, let's begin.

I'll start today with some _____ background _____. There used to be a lot of _____ in this _____ until the 1960s. Creating the park required the _____ of lots of derelict _____ on the _____, so most of the _____ park _____ all around you was originally _____ and _____. The idea of building a _____ park here was first _____ when a property _____ proposed a high-rise _____ development, but the local _____ wasn't happy. If the land was to be cleaned up, they wanted to use the site for _____. Residents wanted open space for _____ activities, rather than housing or even an _____ complex.

Now to the Bicentennial Park itself. It has two areas, a _____ and a formal park with _____ features and _____. The tall _____ buildings in front of us is called The _____ and is the _____ point for the _____ gardens. It stands _____ high, so follow me up the _____ to where we can take advantages of the fantastic _____. Well, here we are at the top of The Tower, and we're going to look at the view from each _____. Out to the east, the _____ buildings about a _____ away are on the _____ site. There's an indoor _____ for _____, a stadium for _____ and _____ and a swimming pool for races and synchronized swimming and also diving.

If you look carefully down there, you can see the _____. The Olympic site has its own station to _____ the use of _____. There is also a _____ park, but it only holds a _____ number of cars. The formal park has some specially-created water features. If you look out here to the south, you can see a _____ ornamental pond. And around to the west, you can _____ and sit on a _____ to smell the flowers in the _____ garden, and

finally up to the north, if you look in front of you now, there's a lake with a small _____ in the center, you can hire rowing _____ at the boat _____, which you can't see from here, but if you look through the _____, you can see the _____, which has lovely views across the water. Ok, let's _____ down now. We will go now and have a look at the _____ section of the park, which has opened up natural _____ to the public.

The mangroves have been made more accessible to _____ by the boardwalk built during the park's _____. You'd think that people would come here to look at the unusual _____ of the area, but in fact it's more often used for _____ and is very _____ with the local _____. This is the far _____ of the park and over there you can see the _____, a natural feature here long before the park was designed. Just next to it we have our outdoor _____, a favorite spot for _____. The area is now most often used by primary schools for _____. And finally let's pass by the Waterbird Refuge. This area is in a sheltered part of the estuary, that's why the park's _____ is a favorite spot for _____ who can use it to spy through binoculars. You can watch a variety of water birds, but most visitors expect to see black _____ when they come to the shelter. You might spot one yourself right now!

Answers to Vocabulary Fluency Test

Paragraph 1	Paragraph 2	Paragraph 3	Paragraph 4
1. general	1. nature	1. train	1. visitors
2. information	2. reserve	2. lines	2. upgrade
3. factories	3. man-made	3. encourage	3. plant
4. area	4. gardens	4. public	4. life
5. demolition	5. blue-and-white	5. transport	5. cycling
6. buildings	6. tower	6. car	6. popular
7. site	7. centre	7. limited	7. clubs
8. exciting	8. formal	8. circular	8. end
9. space	9. twelve	9. relax	9. frog
10. warehouses	10. metres	10. bench	10. pond
11. storehouses	11. stairs	11. rose	11. classroom
12. public	12. views	12. island	12. school
13. discussed	13. direction	13. boats	13. parties
14. developer	14. large	14. shed	14. biology
15. housing	15. kilometre	15. trees	15. lessons
16. community	16. Olympic	16. cafe	16. viewing
17. recreation	17. arena	17. climb	17. shelter
18. outdoor	18. gymnastics	18. nature	18. bird
19. indoor	19. track	19. reserve	19. watchers
20. sports	20. field	20. wetland	20. swans

APPENDIX 2

The speaking test scoring criteria

band	fluency & coherence 25%	lexical resource 25%	grammatical accuracy 25%	Pronunciation 25%
5	Speaks fluently with rare repetition or self-correction; Speaks coherently with fully appropriate cohesive features; Develops topics fully and appropriately	Uses vocabulary with full flexibility and precision in all topics	Uses a full range of structures naturally and appropriately	Uses a full range of pronunciation features with precision; Effortless to understand
4	Speaks fluently with only occasional repetition or self-correction; Speaks coherently with normally appropriate cohesive features; Develops topics coherently & appropriately	Uses a wide vocabulary resource readily and flexibly to convey precise meaning	Uses a wide range of structures flexibly Produces a majority of error-free sentences with only very occasional inappropriate errors	Uses a basic range of pronunciation features with relatively control
3	Willing to speak at length, though may lose coherence at times due to occasional repetition, self-correction or hesitation; Uses a range of connectives and discourse markers but not always appropriately	Has a wide enough vocabulary to discuss topics at length and make meaning clear notwithstanding inappropriacy	Uses a mix of simple and complex structures, but with limited flexibility May make frequent mistakes but rarely cause understanding problems.	Uses a range of pronunciation features with mixed control
2	Cannot respond without noticeable pauses and may speak slowly, with frequent repetition and self-correction	Talk about familiar topics but can only convey basic meaning on unfamiliar topics and makes frequent errors in word choice	Produces basic sentence forms; Errors are frequent and may lead to misunderstanding	Mispronunciations are frequent and cause some difficulty for the listener
1	Pauses lengthily and little communication possible	Only can produce isolated words	Cannot produce basic sentence forms	Speech is often unintelligible

