The Relationship Between L2 Word Association Ability and Depth of Vocabulary Knowledge Among Chinese University Students

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Abstract. Vocabulary depth and breadth are key indicators of second language proficiency. Even though word association to vocabulary (depth) is clearly established, the relative influence of different association types has not been studied much in this population to date. This study explores the relationship between L2 word association ability and vocabulary depth, focusing on how phonological, semantic, and collocational associations predict vocabulary depth. Correlation and regression analyses were performed on a sample of 34 participant responses from students in China. A large and statistically significant positive correlation was found between vocabulary depth and word association ($r = 0.723$, $p < 0.001$). In fact semantic association accuracy was the strongest predictor of vocabulary depth ($\beta = 0.548$, $p < 0.001$). The findings underscore that the quality of semantic links, rather than phonological associations, is central to deep vocabulary knowledge, providing empirical evidence for designing pedagogical interventions that optimize the mental lexicon network.

Keywords: Second Language Acquisition, Mental Lexicon, Word Association, Depth of Vocabulary Knowledge, Chinese EFL Learners.

1. Introduction

In second language acquisition research, the depth and breadth of vocabulary knowledge is broadly accepted as a prime indicator of language proficiency [1]. The word association test has emerged as a means of studying the mental lexicon network and has become increasingly popular [2, 3]. For Chinese university students, errors in collocation, and pragmatic failures in L2 production are often results of limited depth of vocabulary knowledge, which typically involves an understanding of polysemy, collocation, grammatical functions, and pragmatic norms. The absence of depth of vocabulary knowledge results in errors in language use, indicating a need for teaching and/or instruction including depth of vocabulary knowledge.

While the relationship between L2 word association ability and depth of vocabulary knowledge is generally acknowledged in the research literature, the specific mechanisms linking them have been investigated less often, nor how each of the dimensions of word association predict unique aspects of vocabulary depth [4]. This study targets Chinese university students and employs word association tasks, a depth-of-vocabulary measurement, and regression analysis to examine the connection between L2 word association ability (including the frequency of phonological, semantic, and collocational associations and the quality of the association) and depth of vocabulary knowledge and also to clarify which associative dimensions best predict performance on depth measures and key factors involved. The usage of findings from this study is to inform vocabulary instruction/practice and to identify the associative mechanisms that contribute to the development of non-superficial vocabulary knowledge.

2. Literature Review

Researchers have investigated the role of vocabulary breadth, the amount of words known by the learner, and vocabulary depth, or how well the learner knows those words. Depth is often considered

a multidimensional construct, demonstrating a learners networked understanding of lexical items [1,5]. A prominent perspective is offered by Henriksen, and his three-dimensional model of vocabulary development, which suggests that the learners lexical competence develops in size, depth of knowledge, and rich associative networks [4,6].

Researchers have explored how people organize words in their minds by using different kinds of word association tests. Aitchison famously conceived of the mental lexicon as a web of phonological, semantic and syntactic connections [2]. From this perspective, word association tasks provide insight into the organization of the mental lexicon [4]. The type of associations a learner makes, the strength of the associations, and how consistent they are are taken to represent the strength of the network of associations that are informing the internal network of associations [7].

For Chinese English learners, there is an observable pathway to developing the L2 mental lexicon, one that is sensitive to proficiency levels. There is evidence that learners at lower levels of proficiency depend on more phonological and scaffolding forms of associations that create a lexicon that is loosely organized and consists of unstable connections. As competence increases, there is a shift to more semantic and collocational connections. For more advanced learners, the lexicon starts to look like the tightly-knit, semantically organized structure of that of a native speaker [8,9]. This developing process is also influenced by L1 with cross-linguistic associations through Chinese translations having an important direct construction of L2 lexical networks [10].

The relationship between ability to perform word association and vocabulary depth is well-supported in literature. Wolter's [3] "Depth of Individual Word Knowledge Model" essentially defines depth of knowledge by how rich the word is networked in the mental lexicon. Fitzpatrick [4] later defined that the distribution of association types in addition to consistency of responses were key markers of depth. A higher rate of semantically based responses that matched native speaker response patterns counted as evidence of a more richly integrated lexical representation. Recent work continues to support this view; Rabadi, for example, found depth knowledge predicted reading comprehension performance more than breadth, which resulted from the well-integrated network underneath depth lexical knowledge [11].

These findings are reflected in studies with the Chinese learner population. Lou and Yu reported that word frequency and breadth of vocabulary predicted receptive collocation knowledge suggesting it was better-known, high-frequency words that created greater network connections [12]. In similar vein, Zeng et al. reported on vocabulary long-term retention studies noting that depth of knowledge changed how words are organized beginning with more formal associations to beginning using semantic association patterns [13].

However, important questions remain, specifically when discussing the Chinese learner population. Although they have accepted the general relationship between ability associated with associations and depth of vocabulary knowledge, we lack systematic empirical evidence as to the precise nature and strength they might be related within that population. The limited literature in this area is based on the way word association has been simplified to a single construct or element which ignores the potential that different dimensions, diversity of association type, semantic accuracy, appropriateness of collocation or multimodal strategies to guide levels of prediction of vocabulary depth (e.g., knowledge of polysemy, collocation, grammatical function). Although there are studies (e.g., Ilxomovich), that look at the strategies for learning vocabulary, these do not consider the cognitive mechanism that word association patterns might uncover [14].

This study aims to address these gaps. We specifically are interested in how ability to use types of word associations can predict dimensions of vocabulary depth. Our focus Chinese university students and we will look at L2 word association ability as it related to both frequency and quality of phonological, semantic and collocation associations in reference to dimensions of vocabulary depth knowledge, specifically polysemy, collocation and grammatical function. Additionally, the authors will establish the relative strength of prediction of each lexical association dimension to each dimension of vocabulary depth. By narrowing the focus, we hope to clarify understanding of the

operationalized mechanisms of the L2 mental lexicon for Chinese learners and provide a more customized foundation for vocabulary teaching.

3. Methodology

3.1. Research Design

This study used a correlational design to examine the relationship between L2 lexical association ability and depth of vocabulary knowledge in Chinese university students. Data were collected via a word association test and a vocabulary depth knowledge test. All analyses were conducted with SPSS (Version 26), including descriptive statistics, correlation analysis, and multiple linear regression.

3.2. Participants

In this study, 34 Chinese university students (21 males and 13 females) aged 18 to 23 (M = 20.88, SD = 1.42) participated in the study. On average, participants reported starting to learn English at around 6.8 years of age. Starting ages ranged from 3–12 years of age. Participants also varied in usage of English, including 32.4% used English nearly everyday, 47% used English several times a week, 5% used English several times a month, and 15% rarely or never used English.

3.3. Instruments

3.3.1. Lexical Association Ability Test

Participants were presented with three target words — “Water,” “Run,” and “Happy”—and asked to provide word associations for each. Responses were classified into three types:

Phonological associations (e.g., “Water” → “watt”)

Semantic associations (e.g., “Happy” → “joy”)

Collocational associations (e.g., “Run” → “marathon”)

Scoring was set up according to two criteria for each word. One point was for meaning, and one was for an appropriate collocation. Each word could generate a total of 2 points, leading to a total score of 0 through

3.3.2. Vocabulary Depth Knowledge Test

The tool looked at vocabulary depth through four different dimensions: meaning of the word, collocation knowledge, grammatical function, and synonym discrimination. We then selected two target words for lexical association. "Analyze" and "persevere" were selected as our two target words. Each dimension was worth 1 point per word for a total max of 8 points.

3.4. Data Analysis

The authors ran all of the data through SPSS 26. Descriptive statistics were generated first for the main variables. The authors then ran a Pearson correlation analysis to look at the relationship between lexical association ability and vocabulary depth. Finally, the authors ran a multiple linear regression to discover which area(s) of the lexical association ability would predict vocabulary depth.

4. Result

4.1. Descriptive Statistics

The descriptive results for the key variables are summarized below:

Table 1: Descriptive Statisticsthe authors.

Variable Name	Mean (M)	Std. Deviation (SD)	Min	Max	Description
Total Word Association Score	4.26	1.08	2.00	6.00	3 target words × 2 points (1 for semantic/collocational, 0 for phonological); max 6 points
Semantic Association Accuracy	0.68	0.15	0.33	1.00	Correct semantic associations / total associations; reflects semantic relevance quality
Association Diversity	1.82	0.41	1.00	3.00	Number of association types per participant (range: 1–3)
Total Vocabulary Depth Knowledge	6.15	1.23	3.00	8.00	2 target words × 4 dimensions; max 8 points
Word Meaning Mastery	1.82	0.39	1.00	2.00	Score for matching meanings of analyze and persevere; max 2 points
Collocational Knowledge	1.76	0.43	1.00	2.00	Score for collocation choices: analyze (the data), persevere (through); max 2 points

Just looking at Table 1, it shows that students perform moderately to high in the vocabulary depth knowledge (M = 6.15/8). Participants were correct in their associations 68% of the time, meaning that the primary association type was semantic. The diversity of associations (M = 1.82) showed that most students produced at least two association-types.

4.2. Correlation Analysis

A Pearson correlation analysis showed a strong positive relationship between the participants' lexical association ability and their vocabulary depth knowledge:

Table 2: Correlation Analysis

Variable Pair	Pearson's r	p-value	Correlation Strength
Total Word Association Score vs Vocabulary Depth Knowledge	0.723	<0.001	Strong Positive
Semantic Association Accuracy vs Vocabulary Depth Knowledge	0.815	<0.001	Strong Positive
Semantic Association Accuracy vs Word Meaning Mastery	0.762	<0.001	Strong Positive
Semantic Association Accuracy vs Collocational Knowledge	0.738	<0.001	Strong Positive
Association Diversity vs Vocabulary Depth Knowledge	0.651	<0.001	Strong Positive
Phonological Association Ratio vs Vocabulary Depth Knowledge	-0.427	0.012	Moderate Negative
Collocational Association Ratio vs Vocabulary Depth Knowledge	0.589	<0.001	Moderate Positive

Results of table 2 indicate that semantic and collocational associations are strongly linked to vocabulary depth, while phonological associations are negatively correlated with depth of knowledge.

4.3. Regression Analysis

A multiple regression model was constructed with Vocabulary Depth Total as the dependent variable and four predictors: Semantic Accuracy (X1), Association Diversity (X2), Collocational Association (X3), and Phonological Association (X4). The model was significant, $F(4, 29) = 21.935$, $p < 0.001$, with $R^2 = 0.767$, indicating that 76.7% of the variance in vocabulary depth was explained by the predictors.

Table 3: Regression Coefficients

Predictor	Unstandardized Coefficient (B)	Standard Error	Standardized Coefficient (β)	t-value	p-value	Multicollinearity (VIF)
Constant	1.235	0.318	-	3.884	0.001	-
Semantic Association Accuracy (X1)	3.217	0.526	0.548	6.117	<0.001	1.325
Association Diversity (X2)	0.872	0.364	0.189	2.395	0.023	1.287
Collocational Association Ratio (X3)	0.654	0.654	0.381	0.142	0.096	1.412
Phonological Association Ratio (X4)	-0.589	0.302	-0.127	-1.950	0.061	1.358

Table 3 indicates that semantic accuracy is the strongest predictor (β = 0.548), followed by association diversity. Collocational and phonological associations were marginal predictors. All VIF values were below 2, indicating no multicollinearity.

5. Discussion

The findings from this research suggest that there is a strong positive correlation between L2 word association capacity and depth of word knowledge among Chinese university students ($r = 0.723$, $p < 0.001$). This is compatible with psycholinguistic models of a mental lexicon where word knowledge is established as a dynamic network of concepts, and that the richness and accuracy of the connections among words is critical to deeper vocabulary learning [2, 3]. In practical terms, learners who are able to make more meaningful and diverse associations between words develop a deeper and multi-layered understanding of how words get used.

One important finding was that semantic accuracy emerged as the strongest predictor of depth of vocabulary knowledge ($\beta = 0.548$, $p < 0.001$). This suggests that making conceptually appropriate and semantically accurate associations with words is critical to developing deeper vocabulary knowledge. For example, a learner may have linked "happy" with "joy" or "contentment," indicating not only semantic awareness, but also better depth of knowledge on the nuanced aspects of a word, such identifying synonyms, or making sense of polysemy. This provides further evidence of the role of instruction that promotes the development of semantic networks - rather than relying solely on definitions - in promoting vocabulary knowledge development, as the sole means of recalling a word. In addition, the different types of associations also played a significant role in predicting vocabulary depth ($\beta = 0.189$, $p = 0.023$). This indicates that students who utilize multiple types of associations (e.g., semantic, collocational, and possibly phonological) with the same word seem to have more flexible and more resilient lexical networks. However, since diversity had moderately limited predictive power to semantic accuracy, it appears that the quality of connections may ultimately be more important than diversity itself.

An interesting trend appeared with a negative correlation with phonological associations and vocabulary depth ($r = -0.427$, $p = 0.012$). This aligns with developmental models of vocabulary acquisition that suggest that lower proficiency learners tend to rely more on surface-level, form-based connections, while advanced learners shift to more meaning-based associations [2, 8]. In this sample, those who produced phonological links more often (e.g., "water" → "watt") tended to have a lower performance on vocabulary depth tasks. This points to the fact that while developing associations related to the sound of words may be useful in the early phases of knowledge, they are likely to not be sufficient for building deep lexical knowledge.

In contrast, collocational associations showed a moderate positive correlation with vocabulary depth ($r = 0.589$, $p < 0.001$), although it had a limited unique contribution in the regression model. One possible explanation is that while knowledge of word partnerships is an important component of word depth, it may be determined through a more underlying semantic understanding, meaning, knowing which words commonly go together may take a deeper awareness meaning and the context in which the words are used.

From an educational perspective, the findings collectively highlight the benefits of learning and instructional strategies which promote semantic mapping, collocational awareness, and networked-based (word) vocabulary practice. Along these lines, teachers should try to move away from students regularly relying on rote memorization, and instead have students actively create rich, interconnected word knowledge. For Chinese EFL learners in particular, promoting ways for students to meaningfully, engage with words: sorting them semantically, writing sentences with contexts, or more structured collocation development likely are enriching (word association) quality and depth (vocabulary knowledge).

6. Conclusion

This study provides clear evidence of a strong connection between L2 (second language) word association ability and vocab depth knowledge with Chinese university students. The strong positive relationship for L2 word association ability and depth of vocabulary knowledge points to a relationship in L2 mental lexicon organization of these constructs.

The results indicate that the average participants demonstrate a moderately high level of depth of vocabulary knowledge using an average accuracy of semantic association performance of 68%. This indicates the learners have developed to some degree a network in their mental lexicon for basic lexical access and retrieval. At the same time, the meaningful individual difference in association quality and depth of vocabulary knowledge scores highlight that learners still have a substantial distance to travel, particularly with respect to time transitioning from form based lexical processing to meaning based processing.

The observed negative correlation with phonological associations and depth of vocabulary knowledge, and the moderate positive contribution of collocational knowledge reflects a developmental dimension of growth in the mental lexicon of learners, whereby they appear to develop from sound- and formal based associations towards more connectivity with inferred syntactic and semantic dimension of information. This reinforces the model of lexical development supported with teaching that adapts to the learners changing association profiles.

Although, the study has limitations. The relatively small sample ($N = 34$) and limited number of target words may limit the generalization of the study. Future studies might consider larger and more diverse learner groups, a wider range of target vocabulary and use longitudinal designs investigating how association patterns and depth of vocabulary knowledge develop over time.

To conclude, the advances in vocabulary outcomes remain essential supporting evidence for the central importance of semantic association accuracy in depth of vocabulary knowledge development. It provides empirical support for instructional models aimed at developing meaningful lexical networks in learning contexts in comparison to the focus on learning an isolated word. The investigation into the cognitive mechanisms that underpin vocabulary acquisition also contributes to developing effective and theoretically driven teaching of vocabulary for Chinese EFL learners.

Authors Contribution

All the authors contributed equally, and their names were listed in alphabetical order.

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