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A Contextualised Study of EFL Learners' Vocabulary Learning Approaches: Framework, Learner Approach and Degree of Success

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For this study a new memory-based vocabulary strategic learning framework was constructed involving four essential stages for vocabulary learning which can be translated into four corresponding strategy-driven processes that execute learning actions. A questionnaire study was conducted with Chinese university EFL learners who shared a similar background and learning context at the macro level, guided by four research questions: (1) can the memory-based strategic vocabulary learning framework be employed to classify learners' vocabulary learning strategies (VLS) satisfactorily?, (2) what strategies do Chinese university students use for learning vocabulary items?, (3) what are the learner clusters among Chinese university students regarding their use of VLS?, and (4) how are learners' vocabulary learning approaches related to their language achievement? It is found that learners' VLS use is very contextualised and subject to change due to many factors. A micro language-rich environment, where there is out of class reading and meaningful social interaction, is a key to high vocabulary achievement in an EFL context. The cluster analysis revealed a non-linear, complicated relationship between VLS use and vocabulary learning success. In addition, gender has a prominent impact on VLS use; however, the impact of learners' discipline on VLS use is unclear and needs further investigation.

Keywords: vocabulary learning strategies, vocabulary strategic learning framework, cluster analysis, learner approach, learning success

INTRODUCTION

While the field of language learning strategies (LLS) is generally a thriving and prolific one, it has encountered various critiques from different perspectives on a number of issues: (1) definitions, (2) classifications, (3) contribution to language achievement, (4) differences between good and bad strategies, (5) construct validity, etc. See Grenfell and Macaro (2007) for a review. It has also been pointed out that this phenomenon is not only confined to LLS but shared by other sub-fields such as motivation or learning beliefs in second language acquisition (SLA) (Grenfell & Macaro, 2007; White, Schramm, & Chamot, 2007). At the close of their panoramic review of the past 30 years' research on LLS, Grenfell and Macaro (2007, p. 28) point out: "LLS research is still quite an immature field" and go on to call for continuous efforts to address the problems and issues in this field.

This article begins with a review of a number of issues that have drawn considerable attention from LLS researchers in recent years. A theoretical framework, drawn from memory psychology, L2 vocabulary acquisition and LLS research, is constructed in order to provide clear guidelines for classifying strategy use. This theoretical framework is used to investigate Chinese university EFL learners' vocabulary learning strategies (VLS). A questionnaire study is then reported, aiming to shed light on two of the controversial issues that need more clarification and investigation, namely, classification of VLS and contribution to language achievement. What follows is an attempt to match learner clusters in terms of strategy use combined with two learner variables - gender and discipline - with their learning outcome via cluster analysis. This study intends to shed light on LLS research, or more specifically, L2 VLS research in terms of theoretical constructions and empirical investigations.

LITERATURE REVIEW

Classifying Language Learning and Vocabulary Learning Strategies

Inside the L2 field, the most widely known framework for classifying learning strategies is Oxford's (1990). Her six categories of strategies: *metacognitive, cognitive, memory, social, affective* and *compensation*, underpinned the design of the Strategy Inventory for Language Learning (SILL). The other two influential ones are O'Malley and Chaumot's (1990) three-category framework (*metacognitive, cognitive* and *social/affective*) and Vandergrift, Goh, Mareschal, and Tafaghodtari's (2006) five-category Metacognitive Awareness of Listening Questionnaire (MALQ). Outside the L2 field, there are two well-known strategy frameworks: the Metacognitive Awareness of Reading Strategies (MARSI) reported in Mokhtari and Reichard (2002) and the Motivated Strategies for Learning Questionnaires found in Vanderstoep and Pintrich (2003), which cover both strategies and motivation. Meanwhile, a number of disputes have arisen, notably, whether memory strategies should be separated from cognitive strategies or whether it makes sense to combine certain seemingly unrelated strategies (e.g. social and affective) in one category. Cohen (2011) further points out that such strategy classification by function may not always be possible and argues that "delineating whether the strategy is cognitive or metacognitive could be problematic" since it is likely that "both types of strategies may be engaged simultaneously in an overlapping way" (p. 20).

So far, most classifications of VLS are largely based on either Oxford's (1990) or O'Malley and Chamot's (1990) work. For example, Schmitt's (1997) VLS taxonomy is modelled on Oxford's framework, covering four out of the six categories (*social, memory, cognitive* and *metacognitive*). Fan's (2003) questionnaire draws on both frameworks, divided into nine categories, namely, management, sources, guessing, dictionary, repetition, association, grouping, analysis and known words. Note that "guessing", "dictionary" and

"repetition" would be classified under the same category - cognitive strategies - in Schmitt's taxonomy. After reviewing a number of studies, Nyikos and Fan (2007, p. 254) comment: "Classification of VLS has achieved only mild consensus to date". This is not surprising since the classification issues innate to the general LLS are bound to affect their sub-field, VLS. Echoing Cohen's (2011) concern, Nyikos and Fan (2007, p. 254-255) point out: "One reason researchers often overlap categories is that they frequently utilise a priori conceptual constructs from cognitive and social psychology to classify strategies, rather than specifically relying on emerging patterns of how learners deploy VLS". This alludes to another important feature of VLS or LLS, namely, that strategy use is not a fixed learner trait but subject to change, depending on the learning context and situation. This will be discussed in the next section.

Contextual Influence on Strategy Use

As an important learner characteristic, LLS, unlike language aptitude, is not a predetermined trait but can be more regarded as an acquired skill as a result of learning or schooling. It constantly interacts with other learner characteristics such as learning belief, style or motivation. In addition, many context-related factors can play an important role in cultivating or changing learners' strategy use both synchronically and diachronically. Synchronically, at a micro level, teachers' instruction, parental or peer influence might shape an individual's strategy use. At a macro level, ethnic culture (Bedell & Oxford, 1996; Griffiths, 2003), the learning environment (Gao, 2006; He, 2002), and language education policy (Jiang & Smith, 2009) can have a considerable impact on learners' strategy choice. For instance, the study by Jiang and Smith (2009) investigated Chinese participants from three different age groups. The results show that while the three groups adopted some similar strategies, there were also some group-specific differences due to the language education policy and predominant pedagogy associated with each age group. More specifically, the oldest generation mainly employed

memorisation or translation to tackle vocabulary learning, which was in accordance with the grammar-translation method prevailing in the 1970s and 1980s in China; in contrast, the younger generation used more strategies related to oral skills, reflecting the dominance of the audio-lingual approach in the 1990s, and the youngest generation demonstrated strategy used more related to Communicative Language Teaching that has been thriving in China since the early 2000s. Diachronically, the learner's strategy use will be changed in accordance with cognitive maturity, advancement in proficiency, changes in learning contexts, etc. Taking VLS as an example for illustrating such diachronic variation, Schmitt (1997) notes that Japanese EFL learners show different patterns for strategy preference as they grow older. For example, "repetition" and "focus on spelling" were favoured by younger learners while older learners adopted more strategies that involve a deep processing level, such as "imagery" and "association". A recent study by Ma (2013) demonstrates that changes in both the learning environment (from secondary school to university) and language assessment format (from language tests to academic assignments) are two key factors that account for the differences in participants' vocabulary learning strategy use at different times.

Strategy Use and Language Achievement

It is often believed that strategy use should be closely related to learners' learning outcome, i.e. their language achievement or proficiency level. More specifically, more proficient learners use more strategies while less proficient learners rely on a small number of strategies. For instance, several studies carried out by Oxford and her associates (Dreyer & Oxford, 1996; Oxford, 1999; Oxford & Ehrman, 1995) showed a significant correlation ranging from .30 to .73. However, not all empirical studies provide clear evidence in support of this view. In fact, the studies by Politzer and McGroarty (1985) and Mullins (1992) did not yield any significant positive relationship. When a more complex statistical test, multiple regression, is applied, it is often found

that strategy use could only account for a small or tiny proportion of variance in language proficiency: 13% by Park (1997) and only 4% by Nisbet, Tindall and Arroyo (2005).

Takeuchi, Griffiths and Coyle (2007) offered some possible explanations for such inconsistent results in the relationship between strategy use and language achievement, of which two are particularly worthy of attention. (1) It is likely that learners might have used strategies other than those measured in the survey. This is shown to be true in the interview study by Griffiths (2003), where two participants used very few strategies listed in the SILL but reported frequent use of many other idiosyncratic strategies. (2) Language achievement may not depend on the overall frequency of all strategy items, but rather on the appropriate orchestration of strategy use in a specific context.

It further needs to be pointed out that correlation or multiple regression analyses which try to establish a linear relationship between use of all strategies and language achievement are somewhat misleading and may not represent how learners use strategies in reality. In a seminal survey involving experts in LLS, reported by Cohen (2011), the majority agreed that strategies are combined with each other in one way or another but the field "tended to describe strategies in isolated phenomena rather than as existing in clusters" (p. 27). VLS research yielded clear evidence that combinations of certain strategies are associated with distinct types of learners (Ahmed, 1989; Gu & Johnson, 1996; Kojic-Sabo, & Lightbown, 1999). In the study by Gu and Johnson (1996), the highest achievers only used a few strategies related to self-initiated reading and self-activated use of newly learned vocabulary items whereas they used far fewer strategies overall. Likewise, the best two clusters of learners reported in Kojic-Sabo and Lightbown (1999) made more self-initiated efforts in encountering new vocabulary items and used more dictionary strategies.

Strategies versus Tactics

Fuzziness in definitions for LLS has been a notorious issue which has accompanied LLS research ever since researchers first showed an interest in it. Disputes revolve around several issues, namely, (1) whether strategy use should be conscious or unconscious (Oxford & Cohen, 1992); (2) whether strategies and tactics should be separated or not (Oxford & Cohen, 1992; Stevick, 1989); (3) in which brain mechanism strategies are located (Macaro, 2006); (4) how to differentiate "strategic learning" from "ordinary learning" (Dörnyei, 2005). A full-length discussion is beyond the scope of this article and readers may refer to Cohen (2010) and Grenfell and Macaro (2007) for a review of the main issues.

Oxford (2011) has made efforts to clarify the difference between "strategies" and "tactics". She holds the view that self-regulation, as a capacity for setting learning goals and regulating learning efforts, can be translated into several meta-strategies (e.g., metacognitive, meta-sociocultural-interactive, and meta-affective), each of which governs a number of strategies. Under each strategy, there are a number of tactics that are "highly specific, 'ground-level' applications of strategies or meta-strategies in real-life situations for specific purposes and needs" (p. 31). In other words, strategies are more general while tactics are more specific and situation-dependent. This distinction is important and may contribute to solving partially, if not wholly, the overlapping issue regarding strategy classification mentioned earlier; it may also help to construct a new framework for classifying strategies in a skill-based domain such as vocabulary.

CURRENT STUDY

Background

The current study, focusing on VLS, reports the construction of a theoretical framework based on memory psychology in order to classify vocabulary strategies more satisfactorily and apply this framework in a survey study. Although a number of studies have attempted to classify VLS, such classifications are often subject to criticism and a lack of consensus is evident (Nyikos & Fan, 2007). This study endeavours to address this issue and advance our understanding of learners' contextualised strategy use for vocabulary learning. Contextualised strategy use can be interpreted in two ways in this study. First, the strategy items are designed for a specific group of learners who share a number of similar characteristics: age, cultural background, learning context, proficiency level, etc. Secondly, the strategy use focuses on one skill-based domain of language learning, e.g. vocabulary learning.

Another unsolved issue in strategy research is the complex relationship between strategy use and learning outcome as discussed above. The majority of studies have so far relied on correlation or multiple regression analyses to explore the relationship between the two on the premise that learning strategies are often used in isolation, which may not be true as we see it questioned by Cohen and the LLS experts surveyed in his study (2011). The current study, however, employs a comparatively less frequently used statistical measure, cluster analysis, in which learning outcome is related to different learner clusters associated with distinct use of a combination of certain strategies.

Constructing the VLS Framework

Previous frameworks for classifying VLS tend to focus on the functions (of a general psychological or behavioural nature) of strategies or tactics. For

example, those involving cognitive efforts are named "cognitive strategies" while those requiring metacognition of language learning are called "metacognitive strategies". Cohen (2011) raises doubts about making a clear distinction between strategy types classified by function and suggests that a given strategy could be classified as "metacognitive" or/and "cognitive" depending on the learning situation. It is felt that such function-based classifications, though useful to a certain extent in describing strategy use, may not be able to reveal the nature of what is involved in learning new vocabulary items. Acquiring vocabulary knowledge is not a one-off effort but requires repeated encounters of the new items which are to be processed in the mind and finally lodged in memory. As a way forward, a memory-based strategic framework will be constructed and adopted to classify VLS in the current study.

Psychologists have long been fascinated by how learners process and store information and knowledge in the mind. Despite the existence of various models that have been used to account for how information is processed, stored and retrieved in human brains, psychologists have reached a consensus that "learning and memory involve a series of stages" (Eysenck & Keane, 2010, p. 205). It is generally agreed that the information received from the environment needs to be first perceived visually or aurally in the sensory store, then the brain allocates some attention to certain received information which will be retained in short-term or working memory to be further processed, leading to some of the information being retained in long-term memory. Finally the information stored in long term memory will be retrieved to understand new input or produce output. This whole process has been well documented in a number of important psychological works (Baddeley, Eysenck, & Anderson, 2009; Eysenck & Keane, 2010; Gagné, Yekovich, & Yekovich, 1993). It follows that vocabulary learning may comprise several distinct learning stages.

In a similar vein, a number of L2 vocabulary researchers (e.g. Gu, 2003; Hatch & Brown, 1995; Nation, 2001; Schmitt, 1997) propose a stage-like vocabulary learning process. However, consensus cannot be reached among

them regarding the actual number and naming of stages involved in vocabulary learning. For example, Schmitt (1997) proposes only two stages: discovery and consolidation, whereas both Nation (2001) and Gu (2003) suggest three stages. Among all these stage-like vocabulary learning frameworks, Nation's (2001) psychological vocabulary learning processes are the most well-known, consisting of three stages: noticing, retrieval and generative use. Noticing can be interpreted as the first encounter with a new word; retrieval is the subsequent encounter with this word either in receptive or productive condition; generative use means meeting the word in a different context such as with a new meaning or different use. A closer examination of the noticing stage shows that it can be further divided into two stages: meeting the word orally or in written form and then finding out the word meaning (by guessing or checking in a dictionary). In a similar vein, two distinct stages can be differentiated for retrieval: the new word form needs to be connected to the meaning (could be an L1 translation or a similar L2 term) stored in the mind before the word can be retrieved for use. As indicated by a number of researchers (Ma, 2009; Bacroft, 2004; Laufer, Elder, Hill, & Congdon, 2004), the initial vocabulary learning primarily entails mapping the word form with one meaning and lodging the two in the mind, learning additional word information such as different meanings and usage will take place subsequently. In this sense, Nation's last stage, generative use, is not a truly essential stage for initial vocabulary learning.

Based on the findings from both memory psychology, L2 vocabulary acquisition and L2 strategy research, four psychological processes are proposed for learning vocabulary items: (1) perceiving the word form; (2) accessing the word meaning; (3) building the word entry in the mind; (4) retrieving the word from the mind. These psychological processes govern four corresponding strategy-driven processes: (a) discovering the new word; (b) obtaining the word meaning; (c) mapping the word meaning with form; (d) consolidating the use of words. Within this framework, two types of processes, internal memory processing and external strategy behaviours (including internal thoughts), are constantly in interaction with each other.

The learning task at hand produces a stimulus to the learner's mind, leading to some internal thoughts (metacognition or cognition) about the strategy planning, execution and monitoring, prior to actually tackling the learning task. These strategies are then converted into concrete actions by the learner who uses specific tactics. For example, the strategy to discover new words in the media could be implemented by the tactic of discovering new words by watching English films or by that of listening to English news. These complex processes (thoughts, strategies, and tactics) are interacting with the memory processes where new words are decoded, encoded and stored in the memory. See Figure 1 for an overview of the dynamic framework.

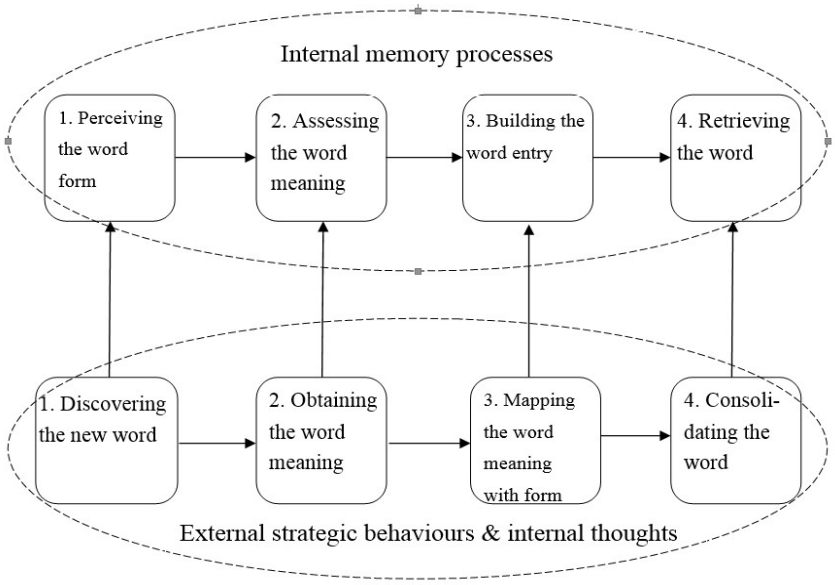

FIGURE 1
A Memory-based Strategic Framework for Vocabulary Learning

Research Questions

The current study will be guided by the following research questions:

1. Can the memory-based strategic vocabulary learning framework be employed to classify learners' VLS satisfactorily?
2. What strategies do Chinese university students use for learning vocabulary items?
3. What are the learner clusters among Chinese university students regarding their use of VLS?
4. How are learners' vocabulary learning approaches related to their language achievement?

Participants

Participants were 358 first year university students from a university in central China who were about to complete their first year of study. Of these, 145 were female and 210 male students; 3 who did not indicate their gender in the survey were excluded. Before entering the university, most of them had learned English for six years or more. Their ages ranged from 18-20; they were studying various majors, which fell into 6 disciplines: business (n = 22), engineering (n = 158), management (n = 26), science (n = 79), English (n = 36) and Japanese (n = 32). Although both English and Japanese majors may belong to one discipline, language, it was decided to separate the two since they received very different methods of English instruction from the university, as explained below. Except for the English major students, all the students took the same English courses, had the same syllabus, curriculum, textbooks, supplementary materials, mode and time of assessment; everything was centralised and implemented by the English department of the university. The test was divided into several parts such as reading comprehension, vocabulary and structure, and writing, the aim being to tap the students' general English language proficiency.

Instruments and Procedure

A Likert-type questionnaire was developed in accordance with the aforementioned memory-based strategic vocabulary learning framework and by incorporating the distinction between a general strategy and a number of specific, context-dependent tactics. Following Dörnyei's advice (2003), the majority of items were borrowed or adapted from existing VLS instruments (e.g., Fan, 2003; Gu & Johnson, 1996; Schmitt, 1997). In addition, a number of commonly used strategies by Chinese learners were included after consulting teachers and students in the university. For example, Chinese students often self-test their newly learned vocabulary to cope with high-stake language exams such as the Band 4 or Band 6 College English Test. Applying Oxford's (2011) recent distinction between strategies and tactics, each strategy, more general and unspecified, is composed of a number of more specific or situation-dependent tactics that these young Chinese university participants were likely to employ. For example, the strategy "discovering in social interaction" in stage 1 includes three tactics: discover new words from words used by my teachers; discover new words from words used by my classmates or friends; discover new words from words used by others I encounter. Using this framework, 74 tactics were grouped under 21 strategies involved in learning vocabulary. Participants were asked to indicate their use of each tactic on a five-point scale: 1 = not true of me; 2 = generally not true of me; 3 = sometimes true of me and sometimes not true of me; 4 = generally true of me; 5 = true of me.

A vocabulary test was administered to measure students' vocabulary size. The size test was adapted from the alternative version of the Vocabulary Levels Test developed by Schmitt, Schmitt and Clapham (2001); two frequency levels - 3000 and 5000 - were selected and 30 items were included in each level. For each item, students needed to choose from among six English definitions to match three target words. An example is given below. The meanings of three words ('dignity', 'champion' and 'museum') are tested among the six given words.

1 bull
2 champion _____ formal and serious manner
3 dignity _____ winner of a sporting event
4 hell _____ building where valuable objects are shown
5 museum
6 solution

The Likert-scale questionnaire, including a section to collect learner background information (e.g. gender and discipline), and the vocabulary size tests were administered to the participants during class time with the assistance of their English teachers. It took the students up to 50 minutes, i.e. one lesson, to complete both instruments. As a large number of participants (n = 358) consisting of 8 intact English classes were involved in this study, it took about one week to complete all data collection. To ensure that the test results were true and valid, students were told clearly that the vocabulary size tests would have no bearing on their academic results.

Data Analyses

The data analyses consisted of three steps. First, exploratory factor analysis in SPSS 20 was used to analyse the 74 tactics so as to verify whether they would load on the predefined 21 strategies. Then each established scale underwent a reliability analysis. After this validation process, the mean scores of each strategy use were compiled to give readers a clear picture of how this group of Chinese university students approach vocabulary learning. Finally, the mean of each established scale (or strategy), the two testing scores at the 3000 and 5000 levels respectively, plus two categorical variables, gender and discipline, i.e. 24 variables in all, were entered into SPSS for a cluster analysis. The aim was to shed light on how these learners cluster together as well as how these learner clusters or types in terms of their VLS approaches are related to learning outcome.

RESULTS

Verifying the VLS Framework and Chinese Students' VLS Use

Using the principal component extraction and the oblimin rotation method, 23 factors were generated. Most of the factors overlapped with the prescribed 21 strategies. Following the advice given by Tabachnick and Fidell (2001), items that had a loading of .30 or higher were retained in the analysis. After examining the factors and their loadings, 11 items were removed from the analysis as each either had a loading lower than .3 or loaded on a rather different factor which might threaten the content validity of the scale. As a result, 21 factors with 62 items were retained. Then a reliability test was run for items of each factor, resulting in the removal of two more items under factor 19 as the calculated scale reliability (.446) was below .5 and considered unacceptable according to the guideline provided by George and Mallery (2003). Finally, 20 factors composed of 60 items, or 20 strategies with 60 tactics, were obtained (see Appendix1 for the 60 questionnaire items). See Table 1 for the resulting 20 scales under the four stages and the corresponding Cronbach's alpha; the mean and standard deviation for each strategy are also presented. In answering RQ1: Can the memory-based strategic vocabulary learning framework be employed to classify learners' VLS satisfactorily?, the items written based on this framework underwent both the exploratory factor analysis and the reliability analysis. The 20 factors generated largely overlapped with prescribed stages based on the framework, showing that this framework is a valid one and has been satisfactorily applied to classify learners' VLS. Thus, the answer to RQ1: Can the memory-based strategic vocabulary learning framework be employed to classify learners' VLS satisfactorily?, is a positive one. However, a small number of scales' reliability ranges between .5 and .6, considered to be poor or questionable by George and Mallery (2003), indicating that these scales need to be revised in future in order to improve their reliability.

TABLE 1

The 20 VLS Scales (Reliability, Mean and Standard Deviation)

Strategy-driven processes	Strategies	Items	Reliability	*M*	*SD*
1. Discovering new words	DR* (Discovering in reading)	2	.532	3.10	.80
	DM (Discovering in media)	3	.549	3.64	.70
	DS (Discovering in social interaction)	3	.800	3.03	.84
	DO (Discovering in orthodox learning)	3	.766	3.99	.70
	Total			**3.44**	**.76**
2. Obtaining the new word meaning	MG1 (Guessing with contextual clues)	3	.724	3.61	.66
	MG2 (Guessing with linguistic clues)	3	.717	3.15	.73
	MS (Asking for the meaning)	3	.697	2.78	.73
	MD (Using dictionary)	3	.519	3.92	.62
	Total			**3.33**	**.69**
3. Mapping the word form with meaning	SR (Recording the word)	3	.585	2.74	.73
	SB (Studying basic aspects)	3	.651	3.76	.64
	SE (Studying extended aspects)	4	.783	3.60	.64
	MeR (Repetition)	3	.613	3.57	.72
	MeC (Contextual retrieval)	3	.764	3.21	.82
	MeA (Structural analysis)	3	.787	3.31	.82
	MeI (Imagery)	3	.823	3.04	.84
	MeSou (Auditory)	2	.650	3.09	.79
	MeT (Tactile)	3	.765	2.37	.77
	Total			**3.19**	**.75**
4. Consolidating the use of words	URL (Using in Reading & Listening)	2	.650	3.12	.82
	UA (Active use)	4	.649	3.09	.72
	UT (Testing)	4	.733	3.06	.73
	Total			**3.09**	**.76**

Note. The full name of each strategy is given together with its acronym.

In order to answer RQ2: What strategies do Chinese university students use for learning vocabulary items?, an examination of the descriptive information (mean and standard deviation) for all stages resulted in two observations. First, if we average the mean for each stage, the result shows a decreasing pattern from initial discovery of new words till actually using them (stage 1 = 3.44; stage 2 = 3.33; stage 3 = 3.19; stage 4 = 3.09). This suggests that while students tried to use different means to encounter new words and find out the meaning, they made comparatively fewer efforts in mapping the word meaning with form or consolidating the use of the newly learned words. Second, the table shows that while most strategy use centres slightly above the middle value, 3, there were two types of strategies, i.e. the preferred and the less preferred, for each learning stage. For example, at stage 1, *discovering the new word*, the most popular strategy to encounter new words is through orthodox classroom learning situations (DO, $M = 3.99$), i.e. discovering new words from textbooks, vocabulary lists or exercises. Markedly lower are discovering words through reading (DR, $M = 3.10$) or social interaction (DS, $M = 3.03$). This observation may point to the fact that these Chinese learners used strategies very differently from each other for learning the L2 vocabulary at each stage; it is hoped that a number of distinct learner groups can be identified in subsequent cluster analysis.

Learner Clusters of VLS Use and the Extent to Which They Account for Vocabulary Achievement

Among the 24 variables included in the analysis, 20 are learning process variables (strategies), two are learning outcome variables (vocabulary size at the 3000 level and the 5000 level), one is gender (male or female), and the last is discipline (coded into 6 categories: Business, English, Japanese, Management, Engineering and Science). The first 22 variables (20 learning strategies and 2 learning outcomes) were coded as continuous data but the last two variables were categorical data. Following the guidance provided by Mooi and Sarstedt (2011), a two-step cluster analysis was chosen since it can handle

both continuous and categorical variables simultaneously. As a result, five clusters were obtained, summarised in Table 2. As can be seen from the table, the mean scores of the 3000 and 5000 levels are different from each other for all five clusters. A MANOVA (multivariate analysis of variance) test was used to measure the effect of the independent variable (being different clusters) on the two dependent variables (size scores at the 3000 and 5000 levels), showing a significant overall effect: F (8, 694) = 24.19, $p < .001$; partial $\eta^2 = .22$. J. Cohen (1988) provided guidelines for estimating the effect size of ANOVA and MANOVA using partial η^2: large ($\eta^2 > .138$), medium ($.059 < \eta^2 < .137$), small ($.01 < \eta^2 < .058$). The effect size of the MANOVA test of the current study is obviously a large one. A post-hoc test, using the Bonferroni method, showed that most clusters can be differentiated at both the 3000 and 5000 levels ($p < 0.001$) with only one exception; the mean scores of Cluster 3 (C3) at the 3000 and 5000 levels were slightly larger than those of Cluster 4 (C4) but the differences did not reach a significant level. Thus we assume that learners in C3 and C4 achieved a similar vocabulary learning outcome. In addition, a series of ANOVA tests was employed to show whether the strategy use can be differentiated for each cluster. The results showed overall significant effects for all 20 strategies except one, asking for the meaning (MS): F (4, 348) = 2.101, p = .08). In addition, the partial η^2 for all significant tests ranges from .382 to .096, suggesting large to intermediate effect sizes for these tests. Both the MANOVA and ANOVA test results indicate that the five clusters were satisfactorily generated with both the strategy use and vocabulary scores being well differentiated.

TABLE 2
Summary of the Information Pertaining to the Five Clusters

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5
N	30	34	83	130	76
Size 3000					
M	26	21.26	18.42	17.18	13.75
(Max=30)	(86.7%)	(70.7%)	(61.4%)	(57.3%)	(45.7%)
Size 5000					
M	18.83	15.06	11.78	10.36	8.01
(Max=30)	(62.8%)	(50.2%)	(39.27%)	(34.5%)	(26.7%)
Gender	Female dominated (93.3%)	Female dominated (82.4%)	Female dominated (95.2%)	All male (100%)	Male dominated (80.3%)
Major	English (93.33%) Japanese (6.67%)	Japanese (35.29%) Management (17.65%) English (20.59%) Science (17.65%) Engineering (8.82%)	Business (15.66%) Management (18.07%) Japanese (15.66%) Science (21.69%) Engineering (28.92%)	Engineering (61.54%) Science (30.00%) Business (6.92%) Management (1.54%)	Engineering (67.11%) Science (21.05%) Japanese (6.58%) Management (3.95%) English (1.32%)

To facilitate readers' understanding and interpretation of the cluster results, all 22 continuous variables (the 20 strategy use frequencies plus the two vocabulary size scores) were converted into z-scores. All z-scores for the five clusters are plotted in Figures 2 and 3. Figure 2 presents the information for C1, C2 and C5.

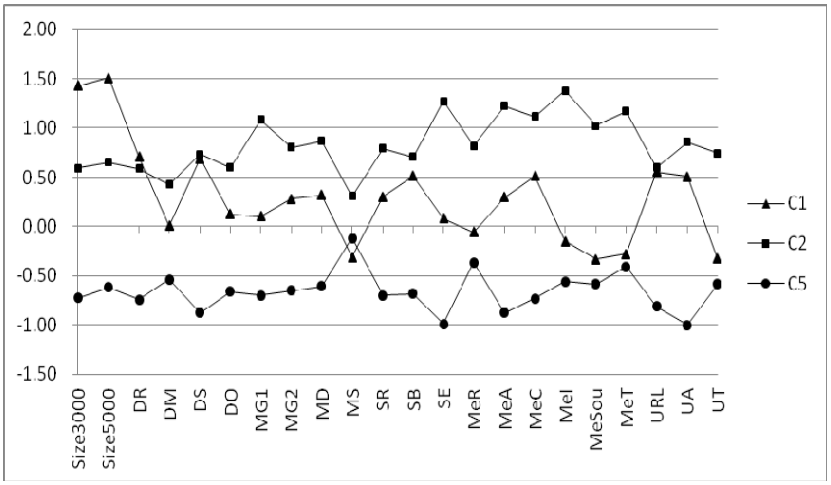

FIGURE 2
Learning Processes and Outcomes for C1, C2 and C5

Notes. **Stage 1**: DR = Discovering in reading; DM = Discovering in media; DS = Discovering in social interaction; DO = Discovering in orthodox learning; **Stage 2**: MG1 = Guessing with contextual clues; MG2 = Guessing with linguistic clues; MD = Using dictionary; MS = Asking for the meaning; **Stage 3**: SR = Recording the word; SB = Studying basic aspects; SE = Studying extended aspects; MeR = Repetition; MeA = Structural analysis; MeC = Contextual retrieval; MeI = Imagery; MeSou = Auditory; MeT = Tactile; **Stage 4**: URL = Using in Reading & Listening; UA = Active use; UT = Testing)

Cluster 1 (C1) had the smallest group size (n = 30) but with the highest vocabulary learning scores; these students knew on average 86.7% and 62.8% of the words at the 3000 and 5000 levels respectively. This group was dominated by females (93.3%) and comprised predominantly English majors (93.33%); they reported only using strategies slightly above the mean level, the mean of z-scores being 0.18. The only strategy in which they used more than all the other groups is "Discovering in reading" (DR, z = 0.71). This

group can thus be named "Female English readers". It is also noted that this group showed greater variability at each stage than other groups, the *z* score differences ranging from 0.63 to .89 for each stage.

Stage 1: *Discovering the new word*: apart from DR, another frequent strategy they used was "Discovering in social interaction" (DS, $z = 0.69$). By sharp contrast, "Discovering in orthodox learning" (DO, $z = 0.12$) and "Discovering in media" (DM, $z = 0.01$) were much less used.

Stage 2: *Obtaining the word meaning*: they reported comparatively higher use of the dictionary strategy (MD, $z = 0.32$) and guessing (MG1, $z = 0.28$), while the lowest used strategy was to ask others for the word meaning (MS, $z = -0.31$).

Stage 3: *Mapping word form with meaning*: the highest was "Studying the basic information" (SB, $z = 0.51$) and "Contextual retrieval" (MeC, $z = 0.51$), but the lowest was "Auditory" (MeT, $z = -0.33$), i.e. making use of rhyming or similar sound.

Stage 4: C*onsolidating the use of words*, "Using in reading & listening" ($z = 0.56$) and "Active use" ($z = 0.51$) were markedly higher than "Testing" (UT, $z = -0.33$).

From such distinct preferences at each stage, we could provide a picture of these English majors' vocabulary learning approach: they read extensively or engage actively in social interaction for discovering new words; they guess the word meaning with the help of linguistic clues or look up the word in a dictionary; they carefully study the basic aspects (L1 meaning, spelling, pronunciation, etc.) and make efforts to memorise the word in context (e.g. remembering the sentence in which the word is used); they make good use of the newly learned words either receptively or productively.

Cluster 2 (C2) was another small-sized ($n = 34$) and female dominated group (82.4%); it had the second highest vocabulary scores: 70.7% and

50.2% at the 3000 and 5000-levels respectively. Compared to C1, their vocabulary scores were considerably lower, almost one standard deviation lower than C1 at both 3000 and 5000-levels. This group was made up of a considerable proportion of Japanese majors (35.29%) mixed with students from other disciplines: English (20.59%), Management (17.65%), Science (17.65%) and Engineering (8.82%). Among all five clusters was the highest frequency of strategies, i.e. overall their strategy use was 0.86 standard deviation higher than the mean level. Compared to C1, the C2's strategy use more or less follows a similar pattern at the four stages, though the mean score for most strategies is considerably higher. In particular, they use markedly higher encoding (memory) strategies, e.g. imagery (MeI, z = 1.38), structural analysis (MeA, z = 1.22), tactile (MeT, z = 1.17). The mean of z scores reaches 1.06 for all meaning-form mapping strategies in stage 3. It is also noted that they use the "Testing" strategy considerably more than C1 in stage 4 when making use of newly learned words, which is perhaps closely associated with their frequent use of encoding strategies in stage 3. In addition, they show an overall smaller variation in strategy use than C1 at most of the stages, the z score differences ranging from 0.11 to 0.77. It would seem that in doing the exercises this group was engaging in vocabulary learning actively all the time and they especially favoured the encoding strategies associated with the testing strategy; they made great efforts and tried every means to learn vocabulary at each stage. C2 can be named the "active female strategy users & encoders".

Cluster 5 (C5) was male dominated (80.3%) and comprised students mainly from two disciplines: Engineering (61.54%) and Science (21.25%) This group had the lowest achievement; they knew less than half (45%) of the 3000-level words and less than one-third (26.7%) of the 5000-level words. They generally made very little use of strategies, the mean of z scores being -0.66. Among all the strategies, the highest strategy they used was "asking for the meaning" (MS, z = -0.12) in stage 2 while the lowest was using the words actively (UA, z = -1.00) in stage 4. They occasionally chose to ask others for meaning as this requires the minimum mental effort but they made

very little effort to use the word productively. Such low use of learning strategies and low vocabulary achievement suggest that these were generally demotivated L2 vocabulary learners. Consequently, they were the lowest vocabulary achievers and named the "male science & engineering passive strategy users".

Figure 3 provides the strategy use for **C3 and C4** which had similar intermediate vocabulary scores: 61.4% - 57.3% at the 3000 level and 39.27% - 34.5% at the 5000 level. However, the two groups differ greatly in gender and discipline compositions. The former was female dominated (95.2%) and composed of more or less equal proportions of students from different disciplines: Business (15.66%), Engineering (28.92%), Japanese (15.66%), Management (18.07%) and Science (21.69%). The latter group consisted exclusively of males (100%) and the students were mainly from two disciplines: Engineering (67.11%) and Science (21.05%). Regarding strategy use, both groups clustered around the mean level although there was some minor variation in most of the strategies concerned. C3 can be named the "female intermediate strategy users" and C4 the "male Science & Engineering intermediate strategy users".

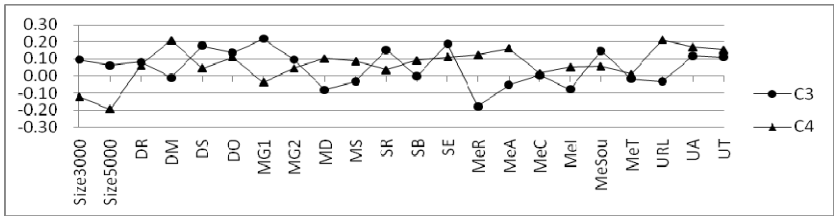

FIGURE 3
Learning Processes and Outcomes for C3 and C4

Notes. **Stage 1**: DR = Discovering in reading; DM = Discovering in media; DS = Discovering in social interaction; DO = Discovering in orthodox learning; **Stage 2**: MG1 = Guessing with contextual clues; MG2 = Guessing with linguistic clues; MD = Using dictionary; MS = Asking for the meaning; **Stage 3**: SR = Recording the word; SB = Studying basic aspects; SE =

Studying extended aspects; MeR = Repetition; MeA = Structural analysis; MeC = Contextual retrieval; MeI = Imagery; MeSou = Auditory; MeT = Tactile; **Stage 4**: URL = Using in Reading & Listening; UA = Active use; UT = Testing)

In answering RQ3: What are the learner clusters among Chinese university students regarding their use of VLS?, five learner clusters were generated in terms of strategy use mediated by gender and discipline: female English readers, female active strategy users & encoders, female intermediate strategy users, male Science & Engineering intermediate strategy users and male Science & Engineering passive strategy users. The answer to RQ4: How are learners' vocabulary learning approaches related to their language achievement?, is not so clear-cut and needs further consideration. There is no such linear relationship observed between the strategy use frequency and the vocabulary achievement; the highest achieving group, English female readers, only reported using strategies slightly above the medium level. This picture is further complicated by the two nominal variables, i.e. gender and discipline.

DISCUSSION

The Memory-based Strategic Framework for VLS Classification

A memory-based strategic framework was constructed and adopted for classifying vocabulary learning strategies used by 1st year Chinese university students. Applying the distinction between strategies and tactics made by Oxford (2011), 20 strategies were included in the questionnaire survey, each encompassing several tactics, and were divided into four strategy–driven processes, which correspond to the four psychological stages as depicted in Figure 1. If the four psychological stages are covert, internal and unobservable memory processes, the four strategy-driven processes are manifested by overt, observable behaviours governed by high-level conscious thinking and strategic planning of the whole learning process. The

exploratory factor analysis and reliability analysis confirmed the psychometric construct of each of the 20 strategies selected and the composite learning tactics. The mean scores for each strategy-driven stage show a decreasing pattern. This fits in with the general pattern of language learning: L2 learners generally receive more language input and only part of the input can turn into intake and even less into output. This can explain why strategies are used more frequently at the initial learning stages and less frequently for late stages in learning L2 vocabulary items. In other words, more efforts/strategies are needed to discover the new word form and find out its meaning, while less efforts/strategies are made by learners in mapping the word form with meaning and consolidating the newly learned word. In this sense, the proposed new framework appears to be satisfactory in classifying at least Chinese learners' VLS use and it sounds plausible from a theoretical point of view in SLA.

Chinese University Students' Overall Vocabulary Strategy Use

The mean and standard deviation of the 20 strategies as shown in Table 1 showed considerable variation among the Chinese participants. This suggests that not all existing VLS will be used or considered equally important by these Chinese students. For example, the strategy with the highest mean in the first stage was to discover words in typical classroom learning (textbooks, vocabulary lists or exercises) rather than outside-classroom reading or social interaction with others. This means classroom learning was the major learning platform for most of these 1st year university students. This is understandable since they were studying in an EFL environment and had far fewer language learning opportunities than those ESL students.

In the second stage, obtaining the word meaning, the highest was using a dictionary (MD, M = 3.79) whereas the lowest was asking for the meaning (MS, M = 2.78). This indicates that appropriate dictionary use is crucial for learning new vocabulary items in the EFL context. For this reason, Nation (2001) highlights the importance of using various dictionary strategies to

search for the suitable meaning for a particular item. While in the past decades lexicographers have made considerable efforts to make paper dictionaries more comprehensive and user-friendly (e.g. Oxford, Collins Cobuild, Longman, and Merriam Webster), nowadays various online dictionaries or dictionary apps are becoming indispensable learning tools for the younger generation, particularly university students. It would be worthwhile to investigate what specific strategies related to e-dictionary use could facilitate learners' L2 vocabulary acquisition.

In stage 3, mapping the word form with meaning, the two highest were studying basic aspects (e.g. L1 translation, word class, pronunciation) of the vocabulary item (SB, $M = 3.76$) and studying the extended aspects (example sentences, usage and collocations) of the item (SE, $M = 3.60$) to memorise the word. This means that overall this group of Chinese participants made considerable efforts in studying and retaining directly various lexical information in order to learn new vocabulary, which is in accordance with the traditional Chinese learning style as depicted by Gu and Johsnon (1996) and Hu (2002). Among those memory strategies included in the third stage, such as contextual retrieval (MeC), structural analysis (MeA) or imagery (MeI), the mean ranges from 3.21 to 3.09, showing that 1st year Chinese students make little deliberate mental effort to commit words to memory. This echoes Gu and Johnson's (1996) finding that their Chinese university participants "generally did not dwell on memorization, and reported using more meaning-oriented strategies than rote strategies in learning vocabulary" (p. 668). A recent study by Ma (2013) shows that more advanced learners (4th year English majors) rarely employ memory strategies but consider directly using the words, particularly in academic writing, to be the most efficient means to "memorise" vocabulary, whereas they recall a heavy reliance on memory strategies when in secondary school. Putting all these together, it seems that learners generally show a decreasing pattern in using memory strategies as they grow older or are placed in a richer language learning environment as is the case with English majors. All in all, strategy use is very context-dependent, when many factors may be at work, such as motivation,

learning style, cognitive maturity, learning culture, learning environment (home vs. abroad; secondary school vs. university), language education policy and pedagogy, language assessment format, learning style, language proficiency, type of learning tasks, etc.

Learner Approaches to Vocabulary Learning and Their Degree of Success

The cluster analysis yielded five distinct clusters in terms of VLS use. However, the relationship between strategy use and learning success is not straightforward and is further complicated by both disciplines and gender. First, the relationship between vocabulary strategy use and vocabulary achievement is not a linear one. In other words, it is not the more strategies used the better the vocabulary achievement becomes. For example, the "female English readers" only reported an overall intermediate use of strategies but had the highest vocabulary scores, whereas the "female active strategy users" comprising a considerable number of language majors (Japanese or English) reported the highest strategy use but with considerably lower vocabulary scores. The best group only reported the use of one strategy, "discovering words in reading", higher than all the other four groups, and the strategy "discovering words in social interaction" as high as the female active strategy users. This implies English majors are usually placed in a more advantageous language learning environment than students from other disciplines. Most English majors were "immersed" in a micro English rich environment as opposed to a general EFL environment, implying that they could avail themselves of many more authentic language learning opportunities as for L1 than most non-English majors. Thus, these English majors did not need to use a large number of VLS or do vocabulary-focused activities as other anxious non-English majors might. This finding echoes the difference found between ESL and EFL students in their use of VLS reported by Kojic-sabo and Lightbown (1999). A tiny number of English readers, three non-English majors, were identified against a few hundred Chinese

university students in Gu and Johnson (1996); it is their constant reading and frequent use of reading-related strategies that made them excel and do better than all the other students for their English achievement. This, together with the finding of the current study, seems to suggest that, no matter what discipline the student is studying, the student could engage in authentic and effective learning and hence does not need to use many extra strategies as long as a natural and rich language learning environment is created or self-created, where the student can learn words in meaning reading or interactive situations.

Secondly, closely related to the non-linear relationship between strategy use and learning outcome as discussed above, there might be some qualitative differences in vocabulary strategy use between English majors and students studying other disciplines. For example, the best English reader group showed a larger variation within each stage than the second best group made up of active strategy users. The first group valued a little more one or two strategies at each stage, whereas the second group valued most strategies in an indistinguishable manner in all four stages. Therefore,what distinguishes successful learners from those less successful ones does not lie in the large amount or high frequency of strategy use, but hinges upon learners' skilful selection and orchestration of the strategies which they perceive most in tune with their specific learning context. Further qualitative studies can be carried out to uncover in detail how such combination or orchestration of VLS, governed by self-regulation, leads to vocabulary achievement.

Thirdly, the cluster analysis clearly shows that gender is a key factor that affects the frequency of strategy use when many other factors are more or less controlled, such as age, ethnic group, learning culture, learning environment, etc. The three female-dominated groups used more strategies than the two male dominated groups. Although existing literature (Dreyer & Oxford, 1996; Green & Oxford, 1995; Nisbet, Tindall, & Arroyo, 2005; Peacock & Ho, 2003; Phakiti, 2003; Wharton, 2000) seems to suggest that whether females use more language learning strategies than males or not is not a solved issue, this current study provides clear evidence that female

learners are generally more active for learning vocabulary in terms of strategy frequency than male learners.

Fourthly, findings from this study support the view held by other researchers (Mochizuki, 1999; Peacock & Ho, 2003) that English majors used strategies in a rather different way from students studying non-English disciplines. The current study also seems to give the impression that Science and Engineering students tend to be more passive strategy users than students from other disciplines such as English, Japanese, Business or Management, and hence lower achievers. However, this may well have been overshadowed by the gender effect: the majority of Science and Engineering students were male students in this study. In this sense, whether a discipline, other than English, has an effect on learners' strategy use remains unsolved and deserves further investigation.

CONCLUSION AND SUGGESTIONS FOR FURTHER RESEARCH

This study constructed a memory-based strategic framework which reveals the intricate, dynamic interactions between the covert, abstract internal mental processes and the overt, concrete learning efforts/behaviours, resulting in four strategy-driven processes: *discovering the new word, obtaining the word meaning, mapping the word meaning with form, consolidating the use of the word*. In this sense, the current study confirms that the differentiation made by Oxford (2011) between general learning strategies and concrete, specific learning tactics is a valid one. In addition, it advances our understanding of the truly essential learning stages involved in initial vocabulary learning from a memory psychological point of view.

This study also intends to provide a snapshot of VLS use in a specific learning context, i.e. 1st year Chinese EFL learners learning English vocabulary with a similar background in terms of age, ethnic group, learning culture, learning environment, proficiency levels, instructional pedagogy, etc.

The cluster analysis yielded five distinct learner clusters and the results disclosed a more complicated relationship between the VLS use and vocabulary achievement than has been previously thought. It is not the learner type that used the most frequent strategies that achieved the highest vocabulary level, rather, it is a small number of students largely composed of English majors who read often and interact a lot with others. The results seem to suggest that it is the natural and meaningful learning environment that places English majors or other active readers in a much more advantageous position than students who are not placed in such an authentic learning environment. In this sense, it would seem that creating a micro language-rich environment in a general disadvantaged EFL macro environment is a key factor for learners to obtain success.

The cluster analysis employed in the current study differed in notably one way from previous studies (e.g., Gu & Johnson, 1996; Kojic-sabo & Lightbown, 1999) that investigated the relationship between VLS and vocabulary achievement. Only continuous variables (i.e. interval data encoded in values) were used in previous studies whereas both continuous and categorical variables (i.e. nominal data encoded in categories) are included in this study. Whilst one categorical variable, gender, clearly bears an impact on learners' VLS use, namely, females tend to make more frequent use of VLS than males, no such clear effect has been observed for the other categorical variable, namely, discipline.

Finally, based on the findings of this research and the issues arising from it, a number of suggestions are put forward for researchers who are interested in pursuing this line of research. Future studies should aim to test this four-stage framework with more powerful statistical techniques such as Structuring Equation Modelling to obtain more solid empirical evidence to consolidate this new framework. More qualitative studies can be conducted in future to examine how a micro language-rich environment can be self-created with the help of learners' skilful and strategic learning behaviours and self-regulating capacities. Researchers may consider including more types of relevant categorical variables in cluster analysis or continue to probe into what effect

discipline might have on learners' VLS or LLS in a qualitative, in-depth manner. In addition, with a larger sample, a more powerful statistical method, e.g., hierarchical linear modelling may be employed to reveal a more precise relationship between various categorical variables and VLS or/and vocabulary learning outcome.

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APPENDIX

Finalised scales of the 60-item questionnaire (English version)

Stage 1: Discovering new words

Discovering in reading (DR)
Discover words from reading stories/novels that interest me
Discover words from reading magazines that interest me

Discovering in media (DM)
Discover words from watching movies
Discover words from watching TV programmes
Discover words from listening to songs

Discovering in social interaction (DS)
Discover words from words used by my teachers
Discover words from words used by my classmates or friends
Discover words from words used by others I encounter

Discovering in orthodox learning (DO)
Discover words from textbooks
Discover words from exercises
Discover words from vocabulary lists

Stage 2: Obtaining the word meaning

Guessing with contextual clues (MG1)
Guess the meaning by using my knowledge of the topic
Guess the meaning by considering the idea of the paragraph
Guess the meaning by logical development (cause and effect; connectors) in the context

Guessing with linguistic clues (MG2)
Look for any definitions or paraphrases in the paragraph that support my guess
Analyse the word structure when guessing the meaning
Guess the meaning by analysing the word class

Asking for the meaning (MS)
Ask teachers for the word meaning
Ask classmates for the word meaning
Ask others around for the word meaning

Using dictionary (MD)
Look up the word in a dictionary to confirm my guess
Look the word up when seeing it a few times
Check whether the meaning obtained fits the context when looking up a word

Stage 3: Mapping the word form with meaning

Recording the word (SR)
Make vocabulary lists
Put vocabulary in a vocabulary note book
Make vocabulary cards

Study basic aspects (SB)
Study the Chinese translation
Remember the word class
Practise pronouncing the word

Studying extended aspects (SE)
Study the example sentences
Study the usage
Study the collocations
Study the synonyms or antonyms

Repetition (MeR)
Repeat the word orally
Look at the word several times
Spell the word out repeatedly in my mind

Contextual retrieval (MeC)
Remember the sentence in which the word is used
Remember the word with the context (conversation, or story) where it occurs
Make up my own phrase or sentence containing the word

Structural analysis (MeA)
Analyse the word in terms of prefixes, roots and suffixes
Analyse the word by breaking it into meaningful parts, e.g. cow-boy
Memorise commonly used roots and affixes

Imagery (MeI)
Create a mental image of the new word
Create a mental image in which the word is interacting with something else
Create a mental image of the sentence/context where the word occurs

Auditory (MeSou)
Remember words together that sound similar
Remember words that rhyme together

Tactile (MeT)
Act out the word's meaning
Place labels on the object that represents the word
Draw pictures to illustrate the word's meaning

Stage 4: Consolidating the use of words

Use in Reading & Listening (URL)
Read as much as possible in order to meet and consolidate the words

Listen to English materials/programmes extensively to meet and consolidate the words

Active use (UA)
Try to use the newly learned words as much as possible in speech and writing
Try to interact with native speakers, my teachers or classmates with the newly learned words
Try to think in English with the new words
Try to use idiomatic English

Testing (UT)
Do vocabulary exercises
Do dictation by myself
Test words on my own
Test words with classmates or friends

Note. All 60 vocabulary learning tactics are grouped into 22 strategies which are divided into 4 learning strategy-driven processes: *discovering the word*, *obtaining the word meaning, mapping the word meaning with form* and *consolidating the use of words*.