English Teaching, Vol. 71, No. 3, Autumn 2016
DOI: 10.15858/engtea.71.3.201609.29

A Study on a Model of L2 Vocabulary Achievement for Korean University EFL Learners*

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Pae, Tae-Il. (2016). A study on a model of L2 vocabulary achievement for Korean university EFL learners. *English Teaching, 71*(3), 29-51.

The present study was designed to examine the effects of a variety of factors on English vocabulary achievement. To this end, a total of seven hypotheses were posed in light of previous research on vocabulary learning. To test these hypotheses, an SEM procedure was performed for a sample of 368 Korean university students. The effects of gender and academic specialization on English vocabulary achievement were also examined through multi-sample analyses. Results of the present study demonstrate that Korean university EFL learners' English vocabulary achievement was a direct function of motivation and vocabulary strategy. The effects of confidence, learner beliefs, and vocabulary learning methods, however, were found to be only indirectly connected to vocabulary achievement through motivation and strategy use. The results of multi-sample analyses for learners of different gender and academic major groups identified a total of four path coefficients whose effects functioned differentially across different learner groups. Implications of the present are also discussed.

Key words: L2 vocabulary acquisition, structural relationships, cognitive factors, affective factors, learning methods, multi-sample analysis

1. INTRODUCTION

Understanding the relationship between a word and other lexical components in semantic and syntactic structure of a whole sentence is critical to the complex meaning-making process of a written and oral message at both the intra-sentential and inter-sentential levels. Therefore, knowledge about how a word works in a sentence is a starting point of a long journey to language acquisition for both first language (L1) and second

* This work was supported by the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea (NRF-2015S1A5A2A01009270).

language (L2) users. So far, a number of studies have been conducted to better understand this building block of L2 acquisition, and accordingly, factors constituting a successful L2 vocabulary acquisition have received substantial theoretical as well as empirical attention from researchers and practitioners.

Previous studies about L2 vocabulary acquisition tend to focus on bivariate relationships between learners' vocabulary achievement and individual pieces of variables across affective, cognitive, and learning and teaching methods domains. Generally, it is documented in the literature that affective factors such as motivation (Laufer & Hulstijn, 2001; Tseng & Schmitt, 2008), beliefs (Gu & Johnson, 1996), attitudes, self-confidence or anxiety (Gardner & MacIntyre, 1991; MacIntyre & Gardner, 1989), cognitive factors such as strategies (Gu & Johnson, 1996; Nation, 2001; Pae, 2014), level of processing (Craik & Lockhart, 1972; Pae, 2014), task involvement (Laufer & Hulstijn, 2001; Kim, 2008), presentation or input mode (Kim, 2006; Park & Nam, 2006), or the degree of reading or writing connection (Min, 2008; Nation, 2001; Pichette, Serres & Lafontaine, 2012), and vocabulary learning methods (Elgort, 2011; Hunt & Beglar, 2002; Laufer & Hulstijn, 2001; Vidal, 2011) affect vocabulary accomplishment. .

Despite the significant contributions made by each of these so-called micro-level analyses, it is still not clear how the individual patches of information provided by previous studies would dovetail to make a coherent mental model of vocabulary acquisition. Developing a comprehensive model of L2 vocabulary acquisition would require researchers to identify individual key variables influencing learner's vocabulary acquisition, to specify the direct and indirect relationships between the identified latent variables where each latent variable should be measured through a set of its corresponding manifest or indicator variables, and to empirically test the structural relationships between the targeted variables in a systematic manner. To date, however, few studies have empirically examined the combined effects of multiple factors working in tandem across cognitive and affective domains in the presence of multiple measurement errors. In terms of methodology, current scholarship on L2 vocabulary research tends to rely on correlational methods in the form of either simple bivariate correlations or multiple regressions (cf. see Tseng & Schmitt, 2008 for a notable exception), which fail to provide information on the causal relationships among factors related to successful L2 vocabulary learning, thereby preventing development of a methodologically defensible model of L2 vocabulary acquisition.

Considering these research gaps, the present study aims to simultaneously analyze the combined effects of multiple factors in cognitive and affective domains on Korean university students' English vocabulary acquisition using a multivariate analytical technique known as structural equation modeling (SEM), thus proposing a structural model of L2 vocabulary acquisition in the context of Korean university EFL classrooms. Such a model is expected to provide L2 researchers and practitioners with information on the best

pathways that lead students to a successful acquisition of English vocabulary, and as an extension will yield implications for vocabulary syllabus design, materials development, and vocabulary teaching and learning.

2. RESEARCH BACKGROUND

2.1. Literature Review & Research Hypotheses

2.1.1. Cognitive factors

A review of literature on L2 vocabulary learning discloses several factors that are related to learners' L2 vocabulary achievement. Among the many variables, L2 scholars have traditionally noted the importance of cognitive factors in vocabulary learning and teaching because of their direct influence on the increment of learners' vocabulary knowledge base. Craik and Lockhart (1972), for instance, gave special attention to the effects of processing at different levels on vocabulary retention and recall. Specifically, Craik and Lockhart argue that the more integrative processes are involved in vocabulary learning across different levels in terms of phonological (e.g., sound and stress), morphological (e.g., visual shapes and forms), semantic (e.g., antonyms and synonyms), and syntactic patterns and structures (e.g., grammatical categories or collocations), the stronger the retention and recall that take place. This multi-level or deep processing facilitates subsumption at different levels, hence intensifying the cognitive depth in processing different word information associated with learning a word, which makes vocabulary learning more secure and long term. This so-called deep processing or cognitive depth processing in vocabulary learning is based on the logic that knowing a word involves knowing a word in terms of its spoken and written contextual use, its connections with words of related meaning and with its collocational partners, and its syntactic, pragmatic, and discourse patterns (Carter, 2001). A subsequent experiment made by Craik and Lockhart (1997) showed that asking learners of a word to consider its formal shape, its rhyming words, its synonyms, the semantic field in which it belongs, and all kinds of sentence patterns into which it fits had a strong positive effect on word retention and recall. Recently, Pae (2014) examined the effect of a multi-level deep processing strategy on vocabulary accomplishment using a sample of 240 Korean university students. Results of this study provided empirical evidence that multi-level deep processing made a significant positive impact on EFL learners' vocabulary achievement.

Vocabulary learning strategy is another important cognitive factor that merits attention. Vocabulary learning strategy has traditionally been regarded as a key area of L2 learning

and teaching, since it enables learners to acquire L2 words in a very short time. In order to gauge the effects of different vocabulary learning strategies on L2 vocabulary accomplishment, scholars have developed different classification schemes using the taxonomies originally suggested by Oxford (1990). For example, Schmitt (1977) categorized various vocabulary learning strategies into two major strategy groups (i.e., discovery strategy and consolidation strategy), where the discovery strategy is useful for discovering and learning a new word, while consolidation strategy is recommended for strengthening and consolidating the existing knowledge of a word. Schmitt further divided the discovery strategy into two sub-categories (i.e., determination and social strategy) and the consolidation strategy into three sub-categories (i.e., memory, cognitive and metacognitive strategy). On the other hand, Nation (2001) proposed a taxonomy of vocabulary learning strategies consisting of three general classes of strategies (i.e., panning, sources, and processes). The planning strategies pertain to the strategies used by learners when choosing what to focus on and when to focus on it (e.g., choosing words, choosing strategies), and the source strategies refer to the strategies used when learners find information about words (e.g., analyzing a word, using context). Finally, learners use the process strategies when they establish knowledge, such as noticing, retrieving, and generating. From a different perspective, Williams (1985) notes the connection between vocabulary learning strategies and deliberate and intensive teaching, and focused on the vocabulary learning strategies more closely aligned with the context of L2 classrooms, such as inferring from context, identifying lexical familiarization, unchaining nominal compounds, or synonym search, and word analyses.

Previous empirical studies on the effects of various L2 vocabulary learning strategies generally converge on the conclusion that the more active use of strategies leads to a greater performance on vocabulary achievement tests, but previous studies tend to show divergence in the specific kinds of vocabulary learning strategies that account for a significant proportion of variances in learners' vocabulary achievement. For instance, Gu and Johnson (1996) investigated the relationship between vocabulary learning strategy used by 850 Chinese university EFL students and their English learning outcomes as assessed by a vocabulary size test and the College English Test. Results of correlation and multiple regression analyses indicated metacognitive strategies were a significant positive predictor of learners' performance on the two measures of EFL learning outcomes, while visual repetition of new words was the strongest negative predictor of both vocabulary size and general English proficiency. For samples of Korean EFL learners, previous studies generally attest to the utility of vocabulary learning strategies across diverse learner samples from elementary to university students (e.g., Kim & Lee, 2008; Lee & Min, 2006; Pae, 2014; Son, 2006). For specific vocabulary learning strategies, previous studies generally report that Korean learners tended to rely on determination strategies (e.g.,

Maeng, 2013; Pae, 2014) or cognitive strategies (e.g., Kim & Lee, 2008). A review of the literature on cognitive factors prompts the following hypothesis that:

H1: Deep processing strategy and vocabulary learning strategy will bear a significant positive relation to L2 vocabulary achievement.

2.1.2. Affective factors

Affective factors, such as motivation, confidence, beliefs or attitudes, were also found to influence learners' vocabulary acquisition. The theoretical underpinnings for affective factors in the research of vocabulary acquisition were provided by Laufer and Hulstijn (2001). In their seminal article, Laufer and Hulstijn posited that L2 researchers should consider affective factors such as motivation, and need for a model of vocabulary acquisition, since "human beings are not just information-processing devices but they also possess motives and emotions, and they are integrated in a socio-cultural environment" and "motivation, emotion and socio-cultural factors may affect the way in which human beings process information" (p. 6). Findings of previous empirical studies verify the utility of affective domain in the prediction of learners' vocabulary acquisition. For example, using the AMTB (Attitude Motivation Test Battery), Gardner and colleagues investigated the relationships between acquisition and production of vocabulary and affective measures such as attitudes, anxiety, and motivation (e.g., Gardner & MacIntyre, 1991; MacIntyre & Gardner, 1989). Results of these studies point to a significant role of these affective variables in facilitating or debilitating vocabulary learning. More recently, using an SEM technique, Tseng and Schmitt (2008) analyzed the structural relationships between vocabulary knowledge and motivation. Based on the process model of motivation proposed by Dörnyei (2005), this study empirically demonstrates the significant link between motivation and vocabulary acquisition for a sample of 259 Chinese university students.

To gauge the effects of learner beliefs on vocabulary learning, Gu and Johnson (1996) examined the effects of learners' beliefs about vocabulary learning as a part of a large scale study on vocabulary learning strategies and learning outcomes. To this end, Gu and Johnson developed a vocabulary belief questionnaire based on a 7-point Likert scale consisting of three subscales (i.e., MEMORIZE, ACQUIRE, USE). The first subscale (MEMORIZE) consisted of 8 items, and these items asked the respondents whether words should be memorized. The second subscale (ACQUIRE, 4 items) elicited respondents' agreement with a statement that words should be acquired in context, and the last subscale (USE, 5 items) assessed respondents' agreement with whether words should be studied and put to use. Results of the study demonstrate that the ACUIRE and the USE subscales were

rated highest and there was a significant positive correlation between these two subscale sores and scores on vocabulary size test, thus confirming the possibility that learners' beliefs significantly affect the level of vocabulary achievement. In a related manner, learners' attitudes toward vocabulary learning were also found to exert a significant effect on successful vocabulary learning (e.g., Kim & Lee, 2008; Son, 2006). Considering the research evidence about the relation between affective factors and vocabulary acquisition, the following hypotheses were formulated:

H2: Motivation and positive attitudes toward vocabulary learning will have a significant positive effect on L2 vocabulary achievement.
H3: Confidence and learner beliefs will be positively associated with L2 vocabulary achievement.

2.1.3. Learning and teaching factors

In the context of L1 learning, L1 learners acquire most of their vocabulary indirectly through natural settings, and therefore, learners of a certain level of language proficiency acquire their vocabularies in an implicit and incidental manner. In the context of L2 learning, however, because of the limited opportunities to be exposed to L2 words in an implicit manner, a certain amount of explicit or intentional teaching of L2 vocabulary, especially for an early stage of L2 acquisition, seems to be unavoidable (Hulstijn, 1992; Schmidt, 1990; Sternberg, 1987). Given these situations, both incidental and intentional methods have been suggested as a viable option for vocabulary learning and teaching in L2 classrooms. In this regard, in a discussion of current research and practice in teaching vocabulary, Hunt and Beglar (2002) strongly argued that L2 teachers should provide opportunities for both the incidental and the intentional learning of vocabulary.

The usefulness of incidental and intentional learning has also been empirically verified. For instance, Nation (1980) showed that an intentional or deliberate mode of vocabulary learning was an efficient and convenient tool for memorizing vocabulary. In a similar vein, it was reported that learners showed a higher retention rate under intentional learning conditions than under incidental learning conditions (Hulstijn, 2003). Similarly, Elgort (2011) indicated that intentional learning facilitated the acquisition of representational and functional aspects of vocabulary knowledge. On the other hand, effects of incidental learning of vocabulary were most striking when vocabulary was learned incidentally through connections with reading or writing (Nation, 2001), as exemplified by Pichette, Serres and Lafontaine (2012) and Vidal (2011). It is suggested that written modes of a language allow learners more time for processing a new word, hence more time for guessing the meanings of an unfamiliar word from the context, "whereas in speech it

passes ephemerally" (Ellis, 1995, p. 106). Therefore, it is hypothesized that:

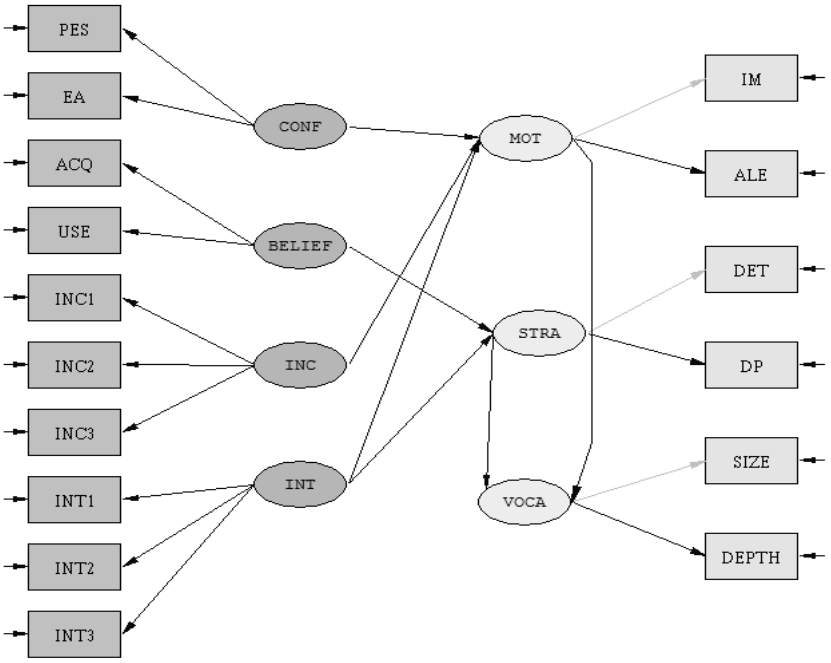
H4: Incidental learning will be positively associated with L2 vocabulary achievement.
H5: Intentional learning will be positively associated with L2 vocabulary achievement.

2.2. Model Specification

Development of an SEM model for hypothesis testing should be guided by theoretical consideration and existing research evidence. Figure 1 presents a conceptual model of SEM, and it schematically describes the complex relationships between latent factors and between each latent and its corresponding indicator variables specified in the present study.

FIGURE 1

Conceptual SEM Model



N = 368; CONF= Confidence; PES= Perception of English Self-confidence; EA= English Anxiety; BELIEF= Beliefs about English Vocabulary Learning; ACQ= Words should be acquired in context; USE= Words should be studied and put to use; INC= Incidental Vocabulary Learning; INT= Intentional Vocabulary Learning; MOT: Motivational Attitudes; STRA= Strategy; IM= Intrinsic Motivation; ALE= Attitudes Toward Learning English; DET= Determination Strategy; DP= Deep Processing Strategy; VOCA= Vocabulary; SIZE= Size of Vocabulary; DEPTH= Depth of Vocabulary

First, as shown in Figure 1, in response to the research findings that both the deep

processing strategy and the vocabulary learning strategy have a significant impact on learners' vocabulary acquisition, a direct path was specified between the strategy factor and vocabulary acquisition. Secondly, in view of the previous literature attesting a direct link between vocabulary acquisition and affective factors, a direct path was also specified between the motivational factor and vocabulary acquisition. Thirdly, following a social educational model of L2 acquisition, where effects of affective factors such as confidence, anxiety or beliefs are indirectly conveyed to L2 acquisition through motivational or cognitive variables (Gardner, 2001), the confidence factor and the learner beliefs factor were specified as a latent exogenous variable which makes an impact on vocabulary acquisition indirectly through a mediating variable. Specifically, given that students with a higher level of confidence are more likely to display a greater degree of motivation, the confidence factor was specified as a latent variable indirectly affecting vocabulary acquisition through the motivational factor. The belief factor, on the other hand, was specified as having an indirect influence on vocabulary acquisition through the strategy factor, based on the logic that learners with a strong belief about how words should be learned are highly likely to be active users of the vocabulary learning strategy. Finally, the intentional learning factor was specified as a latent exogenous variable with an indirect relation to vocabulary acquisition through the motivational and strategy factors, considering the tendency that learners learning vocabulary in an intentional and explicit way are likely to take advantage of a variety of vocabulary learning strategies and have stronger motivation and more positive attitudes toward vocabulary learning. The incidental learning factor was specified as having a direct relationship with the motivational factor only, since students learning vocabulary in an incidental manner in a natural context are less likely to use vocabulary learning strategies.

As a post-hoc analysis, the present study examined whether the SEM model as presented in Figure 1 could be applicable to different learner groups. Given the previous findings reporting no significant effect of gender (e.g., Maeng, 2013; Son, 2006) and a significant effect of specialization area on vocabulary achievement (e.g., Pae, 2014), it is hypothesized that:

H6: The strength of the structural paths specified in Figure 1 will differ across two learner groups with different majors (English versus non-English major).

H7: The strength of the structural paths specified in Figure 1 will be invariant across two gender groups.

3. METHODS

3.1. Participants

A total of 368 Korean EFL students enrolled in a large university in South Korea participated in the present study. All the study participants were sophomores or juniors, to accurately gauge the effects of different areas of specialization on vocabulary achievement. About 59% of the participants were females. To further control for the effects of different areas of specialization for multi-sample analysis, about half of the participants were sampled from English-related majors, such as English Language and Literature and English Language Education, and the other half from non-English majors, including Humanities, Social Sciences and Engineering.

3.2. Instruments

TABLE 1

Summary of Measurement Scales

Construct	Measurement Items	Alpha
CONF		
PES	4 items, AMTB (Gardner, 1985); Used as an aggregate score	.874
EA	10 items, AMTB (Gardner, 1985); Used as an aggregate score	.904
BELIEF		
ACQ	4 items, Gu & Johnson (1996); Used as an aggregate score	.703
USE	3 items, Gu & Johnson (1996); Used as an aggregate score	.723
INC	3 items	.791
INC1	Learn English vocabs incidentally through TV or movies	
INC2	Learn English vocabs through incidentally magazine or internet	
INC3	Learn English vocabs indirectly through experiences	
INT		.731
INT1	Learn English vocabs intentionally by planning	
INT2	Learn English vocabs regularly using vocab lists	
INT3	Learn English vocabs systematically by memorizing	
MOT		
IM	6 items, Noels (2001); Used as an aggregate score	.892
ALE	10 items, AMTB (Gardner, 1985); Used as an aggregate score	.904
STRA		
DET	6 items, Pae (2014); Used as an aggregate score	.811
DP	4 items, Pae (2014); Used as a single aggregate score	.801
VOCA		
SIZE	60 items, VLT (Nation, 1990); Used as an aggregate score	.912
DEPTH	40 items, WAT (Read, 1993); Used as an aggregate score	.857

CONF= Confidence; PES= Perception of English Self-confidence; EA= English Anxiety; BELIEF= Beliefs about English Vocabulary Learning; ACQ= Words should be acquired in context; USE= Words should be studied and put to use; INC= Incidental Vocabulary Learning; INT= Intentional Vocabulary Learning; MOT: Motivational Attitudes; STRA= Strategy; IM= Intrinsic Motivation; ALE= Attitudes Toward Learning English; DET= Determination Strategy; DP= Deep Processing

Strategy; VOCA= Vocabulary; SIZE= Size of Vocabulary; DEPTH= Depth of Vocabulary; AMTB= Attitude and Motivation Test Battery; VLT= Vocabulary Levels Test; WAT= Word Associates Test

As depicted in Figure 1, the present study investigated the structural relationships between a total of seven latent variables. Table 1 shows how each of these latent variables was measured. All the latent variables across three domains (i.e., cognitive, affective, and learning and teaching methods) except for vocabulary achievement were assessed using a 7-point Likert scale questionnaire item format. Initially, a pool of candidate items were created for each of the latent variables either by adapting existing questionnaire items used in previous studies (e.g., Gardner, 1985; Gu & Johnson, 1996; Noels, 2001; Pae, 2014) or by developing a new set of items for the sole use of the present study (i.e., incidental and intentional learning subscales). The initial version of all the questionnaire items were reviewed for content validity and revised as necessary. Next, all the items were field tested and were analyzed for item discrimination and reliability. Based on the results of item analysis, all the items showing a negative or a lower value of item-total correlation (i.e., point-biserial correlation of .3 or below) were removed from the item pool to maximize internal consistency for each item scale. Table 1 shows the final sets of items targeted in the present study, along with information about reliability evidence for each scale or subscale. As shown in Table 1, internal consistency as assessed by Cronbach's alpha ranged from .703 to .904, hence indicating a sufficient level of reliability for the measures utilized in the present study.

Learners' vocabulary achievement was measured by both a vocabulary size test (Vocabulary Levels Test, Nation, 1990) and a vocabulary depth test (Word Associates Test, Read, 1993), as per the recommendations from previous studies (Nation, 2001; Zhang, 2012). The VLT consisted of a total of 60 items, and the WAT had a total of 40 items. The final aggregate scores from these two vocabulary tests served as two indicator variables for the vocabulary achievement factor. Reliability for each of these two tests was .912 and .857, respectively.

3.3. Data Analysis

Before data analysis, all the negative items were re-coded to represent a construct positively. Similarly, items belonging to the English Anxiety subscale (EA) were re-coded so that a higher value of EA subscale would mean a greater degree of learners' self-confidence in L2 learning.

In order to empirically test the hypotheses posed in the present study, SEM was performed. SEM makes it possible for investigators to simultaneously analyze the causal relationships between latent variables specified in an SEM model. Specifically, hypotheses 1 through 5 were tested by examining the statistical significance of the strength of the

seven structural paths representing the five research hypotheses. All the parameters in the SEM model were calibrated through a covariance matrix using the maximum likelihood estimation procedure.

Testing hypotheses 6 and 7 was conducted through a multi-sample analysis, which is a component of SEM, and with this analytical tool, researchers can simultaneously examine the factorial similarity or invariance of an SEM model across different samples of learners (Jöreskog & Sörbom, 1996; Pae, 2006). Multi-sample analysis works under the logic of a chi-square invariance test, which compares the increase or decrease of chi-square values between two nested models (e.g., usually a free baseline model with no equality constraints across groups and a constrained model where a specific path is constrained to be equal across two groups). A significant chi-square increase between a free baseline model and a constrained model at a given degree of freedom difference statistically verifies that the constrained path is not invariant across two learner groups (Anderson & Gerbing, 1988; Pae & Park, 2006). In the present study, invariance of the strength of the seven structural paths specified in Figure 1 was tested by one degree of freedom difference for two sets of group comparisons (i.e., males vs. females and English vs. non-English major).

4. RESULTS AND DISCUSSION

4.1. Assessment of Measurement Models

All the measurement models (i.e., relationships between a latent variable and its corresponding indicator variables) in Figure 1 were subjected to a confirmatory factor analysis (CFA) to check whether each latent variable was validly measured by its corresponding indicator variables (i.e., construct validity). The CFA model consisted of a total of seven latent variables and 16 indicator variables, where no structural relationships were specified between the latent variables. This CFA model produced acceptable model-data fits (GFI= .95, CFI= .98, NNFI= .96, RMSEA= .041, SRMR= .039), which indicate that all the latent variables were successfully represented by their indicator variables, thus demonstrating desirable evidence of construct validity.

In addition, as shown in Table 2, all the factor loadings of the CFA measurement models were significant, ranging from .51 to .95, thereby demonstrating that all the indicator variables were sufficiently powerful in representing their corresponding latent variables (Anderson & Gerbing, 1988). To further examine convergent validity, average variance explained (AVE) and composite construct reliability (CCR) were computed. Generally, an AVE value of .5 or above and a CCR value of .7 or more constitute sufficient evidence of convergent validity (Nunnally & Berstein, 1994). Given the reported AVE values ranging

from .55 to .84 and CCR values ranging from .71 to .91 as shown in Table 2, it is inferred that there was a strong convergence between the latent variables and their corresponding indicator variables (i.e., convergent validity) in the CFA model.

TABLE 2

Assessment of the Measurement Models

Construct / Indicators	Standardized Factor Loadings	AVE	CCR
CONF		.69	.81
PES	.95		
EA	.68		
BELIEF		.55	.71
ACQ	.68		
USE	.51		
INC		.63	.83
INC1	.92		
INC2	.78		
INC3	.60		
INT		.63	.85
INT1	.84		
INT2	.86		
INT3	.51		
MOT		.62	.77
IM	.78		
ALE	.80		
STRA		.65	.79
DET	.82		
DP	.79		
VOCA		.84	.91
SIZE	.93		
DEPTH	.95		

Note. N = 368; CONF= Confidence; PES= Perception of English Self-confidence; EA= English Anxiety; BELIEF= Beliefs about English Vocabulary Learning; ACQ= Words should be acquired in context; USE= Words should be studied and put to use; INC= Incidental Vocabulary Learning; INT= Intentional Vocabulary Learning; MOT: Motivational Attitudes; STRA= Strategy; IM= Intrinsic Motivation; ALE= Attitudes Toward Learning English; DET= Determination Strategy; DP= Deep Processing Strategy; VOCA= Vocabulary; SIZE= Size of Vocabulary; DEPTH= Depth of Vocabulary; AVE = Average Variance Extracted; CCR = Composite Construct Reliability.

TABLE 3

Test of Discriminant Validity

Factors	1	2	3	4	5	6	7
1. CONF	**.69**	.147	.260	.005	.376	.236	.111
2. BELIEF		**.55**	.132	.006	.153	.215	.048
3. INC			**.63**	.003	.245	.231	.066
4. INT				**.63**	.071	.068	.023
5. MOT					**.62**	.350	.198
6. STRA						**.65**	.165
7. VOCA							**.84**

Note. See Table 2 for the information about the variable names.

Table 3 provides evidence about discriminant validity, which evaluates the degree to which constructs with dissimilar theoretical orientations differ from each other. In the present analysis discriminant validity was assessed through comparing AVE values with the squared correlation coefficients between latent variables, as suggested by Fornell and Larcker (1981). The observation that all the AVE values surpassed the squared correlation coefficients provides evidence of discriminant validity. Different forms of validity evidence along with evidence of reliability suggest satisfactory psychometric properties of the measures used in the present study.

4.2. Results of SEM Analysis: Hypotheses 1-5

A final SEM model consisting of a total of seven latent variables and their related 16 indicator variables with the structural paths specified, as depicted in Figure 1, was tested for empirically confirming the seven research hypotheses formulated in the present study. The SEM model resulted in a chi-square value of 146.72 with 91 degrees of freedom ($p < .01$, $\chi^2/df = 1.61$). Since chi-square statistic tends to be sensitive to Type I error in a large sample size, supplementary fit indices were also reported. All the auxiliary fit indices were deemed to be acceptable (e.g., GFI = .93, NFI = .95, NNFI = .97, CFI = .98, SRMR = .052, RMSEA = .049), hence indicating a satisfactory fit of the sample covariance to the data. Table 4 shows the magnitude of the path coefficients between the latent variables.

TABLE 4

Test of Main Effects

Relationships	Standardized Path Coefficient	*t*-value
MOT → VOCA	.32	3.61*
STRA → VOCA	.23	2.54*
CONF → MOT	.53	6.34*
INC → MOT	.28	3.60*
INT → MOT	.35	5.87*
BELIEF → STRA	.76	8.85*
INT → STRA	.20	2.05*

Note. *$p < .05$

As shown in Table 4, the present SEM analysis identified a significant direct relationship between strategy (STRA) and learners' vocabulary achievement (VOCA). Given that the strategy factor was assessed through two vocabulary learning strategies (i.e., deep processing and determination strategies), it is inferred that learners who make more integrative processes in learning L2 vocabulary across phonological, morphological, semantic, and syntactic structures, and learners who make more effort for discovering and learning new words, are highly likely to reach a significantly higher level of L2 vocabulary

achievement, as indicated by a significant path coefficient (i.e., ß = .23) between STRA and VOCA. This leads to the acceptance of H1, which hypothesized a significant positive relationship between vocabulary learning strategies and L2 vocabulary achievement. This finding is consistent with a large body of research which attests to the utility of strategies in vocabulary learning (Craik & Lockhart, 1972; Gu & Johnson, 1996; Nation, 2001). The current finding is also in line with those findings based on Korean samples (Kim & Lee, 2008; Lee & Min, 2006; Maeng, 2013; Son, 2006), which reported on the significant role of learning strategies in Korean EFL learners' vocabulary learning. The present finding, however, differs from previous studies in that the present study empirically verified the predictive power of the vocabulary learning strategy in accounting for variances in learners' vocabulary achievement when the effects of other multiple predictors were statistically controlled for. It is also worth noting that the result of the present analysis empirically confirmed the effects of the deep processing strategy on vocabulary achievement for Korean university students with diverse areas of specialization, thus echoing the finding reported from Pae (2014).

Table 4 also shows that affective factors such as intrinsic motivation and positive attitudes toward vocabulary learning directly influence vocabulary achievement, which confirms H2. This finding suggests that learners who study English words for knowledge, stimulation, or sense of accomplishment or for pleasures experienced in the vocabulary learning activity and those who have more positive attitudes toward English vocabulary learning will show a greater level of achievement, thereby lending support to the significant effects of affective factors on vocabulary learning (Gardner & MacIntyre, 1991; MacIntyre & Gardner, 1989; Tseng & Schmitt, 2008). It is interesting to note that the strength of the relationship between motivation and vocabulary achievement is stronger than that between strategy and vocabulary achievement, as indicated by differences in the values of standardized path coefficients (i.e., ß = .23 vs. ß = .32). Although the differences in the two path coefficients were not statistically tested, a stronger relation between motivation and vocabulary achievement signals a greater impact of motivation on vocabulary achievement than does strategy use. This difference is certainly inconsistent with previous studies (e.g., Nation, 2001), and thus should receive more in-depth attention from a future study.

In a similar manner, consistent with previous findings (e.g., Gardner & MacIntyre, 1991; Gu & Johnson, 1996; Kim & Lee, 2008; MacIntyre & Gardner, 1989; Son, 2006), it was found that learners' confidence and beliefs about vocabulary learning are positively associated with vocabulary achievement, thus attesting H3. Notably, however, the effects of learner confidence and beliefs were indirectly conveyed to English vocabulary accomplishment through mediators, such as motivation and strategy, as confirmed by a significant path coefficient for the relationship between confidence and motivation (γ

= .53) and between beliefs and strategy (γ = .76). On the one hand, the confidence factor indirectly affected vocabulary achievement through motivation. This suggests that leaners with more positive perceptions of their English competence and those learners with a lesser degree of English anxiety are more likely to have a stronger level of motivation, which in turn takes the learners to a higher level of vocabulary achievement. On the other hand, learner beliefs about vocabulary learning indirectly influenced vocabulary achievement through strategy use. Considering that the beliefs factor was measured by two indicator variables about how vocabulary should be learned (i.e., ACQUIRE, USE), it makes sense that the beliefs factor exerted a strong direct effect on the strategy factor, since learners who believe that English words should be acquired in context or though active use would more actively utilize a variety of vocabulary learning strategies, which in turn brings about a higher level of vocabulary achievement.

Finally, the result of the present SEM analysis shows that learning methods such as incidental and intentional learning are positively associated with vocabulary achievement, which confirms H4 and H5, respectively. These findings are reflective of the previous studies pointing to significant effects of intentional and incidental learning methods on learners' vocabulary achievement (Elgort, 2011; Hulstijn, 1992, 2003; Nation, 1980, 2001; Pichette, Serres & Lafontaine, 2012; Schmidt, 1990; Sternberg, 1987; Vidal, 2011). Again, the effects of vocabulary learning methods carried over to learners' vocabulary achievement indirectly through motivation and strategy. Specifically, it was found that incidental learning had an indirect effect on vocabulary accomplishment through motivation, as indicated by a significant path coefficient between incidental learning and motivation (γ = .28). This means that learners who learn English vocabulary incidentally or indirectly through TV, movies, magazines or the Internet are highly likely to have stronger motivation, which in turn leads to a higher level of vocabulary achievement. Interestingly, intentional learning was found to be indirectly linked to vocabulary achievement through both motivation and strategy use, as evidenced by a significant path coefficient between intentional learning and motivation (γ = .35) and between intentional learning and strategy use (γ = .20). This finding implies that learners who learn English words intentionally or by planning, such as with a vocabulary list, are more likely to adopt vocabulary leaning strategies and highly likely to show a greater degree of motivation, which is in turn causally related to vocabulary accomplishment.

4.3. Results of Multi-Sample Analysis: Hypotheses 6 & 7

To assess whether the strength of the structural paths specified in Figure 1 is invariant across different groups of Korean university EFL learners, a multi-sample analysis was performed for each of the two comparisons (i.e., English vs. non-English majors, males vs.

females). All the multi-sample analyses were based on one degree of freedom chi-square invariance statistics using the least constrained model (i.e., a model with no equality constraints imposed across groups) as the baseline model. Results of multi-sample analyses are presented in Tables 5 and 6.

TABLE 5

Results of Multi-sample Analysis by Area of Specialization

Model	Equality Constraint	χ^2	*d.f.*	$d.f._{diff}$	χ^2_{diff}
1	Free	398.63	207	-	-
2	MOT → VOCA	401.64	208	1	3.01
3	STRA → VOCA	408.97	208	1	10.34*
4	CONF → MOT	399.72	208	1	1.09
5	INC → MOT	400.63	208	1	2.00
6	INT → MOT	401.52	208	1	2.89
7	BELIEF → STRA	406.05	208	1	7.42*
8	INT → STRA	405.24	208	1	6.61*

Note. $d.f._{diff}$ = difference in degrees of freedom between the free model and each corresponding model. χ^2_{diff} = difference in chi-square values between the free model and each corresponding model. *means significant at 0.05 alpha level. CONF= Confidence; BELIEF= Beliefs about English Vocabulary Learning; INC= Incidental Vocabulary Learning; INT= Intentional Vocabulary Learning; MOT: Motivational Attitudes; STRA= Strategy; VOCA= Vocabulary

As shown in Table 5, three structural paths (i.e., STRA → VOCA, BELIEF → STRA, INT → STRA) were found to be significantly different for Korean university EFL learners with different areas of specialization. This finding leads to the acceptance of H6. First, constraining a structural path linking motivation to vocabulary achievement (STRA → VOCA) to be equal for the English and non-English groups of learners produced a significant increase in the chi-square value (i.e., 10.34) at one degree of freedom difference. This suggests that the structural path that connects motivation to vocabulary achievement functioned differentially for the English and non-English majors (γ = .62 for English, γ = 0.20 for non-English). Specifically, it was found that the strength of the relationship between strategy use and vocabulary achievement was significantly stronger for English majors than for non-English majors. This finding further demonstrates that strategy use is a better predictor of vocabulary achievement for the English group. Similarly, imposing the path connecting belief to strategy use (BELIEF → STRA) as equal for two groups of learners with different areas of specialization significantly increased the chi-square value (Δ = 7.42), thus verifying that this structural path was not invariant for the two groups of learners. Investigation of the path coefficients in the baseline model indicates that the strength of the relationship between learner beliefs and strategy was significantly stronger for the English than for the non-English majors (γ = .75 for English, γ = .45 for non-English majors), again indicating that learner belief was more predictive of strategy for the English group. By the same analytical procedure, it was also found that the strength of the

relationship between intentional learning and strategy use (INT → STRA) was not invariant for Korean university learners with different areas of study (γ = .40 for English, γ = 0.19 for non-English). In summary, the results of the multi-sample analysis for the two groups with different specialization areas indicate that the strength of paths involving strategy use (STRA → VOCA, BELIEF → STRA, INT → STRA) was consistently and significantly stronger for the leaners majoring in English. This finding is consistent with Pae (2014), which reports that the predictive power of the deep processing strategy and determination strategy in explaining the variance in vocabulary achievement was significant only for learners majoring English, but not for learners with non-English majors.

TABLE 6

Results of Multi-sample Analysis by Gender

Model	Equality Constraint	χ^2	*d.f.*	$d.f._{diff}$	χ^2_{diff}
1	Free	324.65	207	-	-
2	MOT → VOCA	327.73	208	1	3.08
3	STRA → VOCA	332.45	208	1	7.80*
4	CONF → MOT	327.25	208	1	2.60
5	INC → MOT	326.29	208	1	1.64
6	INT → MOT	327.78	208	1	3.13
7	BELIEF → STRA	326.75	208	1	2.10
8	INT → STRA	325.76	208	1	1.11

Note. $d.f._{diff}$ = difference in degrees of freedom between the free model and each corresponding model. χ^2_{diff} = difference in chi-square values between the free model and each corresponding model. *means significant at 0.05 alpha level. CONF= Confidence; BELIEF= Beliefs about English Vocabulary Learning; INC= Incidental Vocabulary Learning; INT= Intentional Vocabulary Learning; MOT: Motivational Attitudes; STRA= Strategy; VOCA= Vocabulary

Table 6 shows the results of the multi-sample analysis by gender group, and shows no significant effect of gender on the structural relationships between latent variables except for the path linking strategy to vocabulary achievement (STRA → VOCA), as indicated by a non-significant increase in the chi-square value from the baseline free model for all the constrained models, excluding Model 3. For Model 3, it was found that constraining the path connecting strategy and vocabulary achievement to be the same for males and females significantly worsened the fit of the model (Δ = 7.80), which verifies that the strength of the relationship between strategy and vocabulary achievement was significantly different for males and females, thereby rejecting H7. Upon investigation of the path coefficients in the baseline model which were estimated freely without any cross-group equality constraints, it was found that the relationship between strategy and vocabulary achievement was significantly stronger for the females than for the males (γ = .21 for males, γ = .47 for females), hence demonstrating that strategy was a significantly better predictor of vocabulary achievement for the female group of university students. This

finding is consistent with a general tendency that female L2 learners are more involved with strategy uses and they tend to outperform their male counterparts in the use of L2 learning strategies, such as general study strategies, strategies for meaning (Ehrman & Oxford, 1988), and global or synthetic strategies (Bacon & Finemann, 1990; Young & Oxford, 1997).

5. CONCLUSIONS

The present study was designed to empirically examine the effects of a variety of factors across cognitive, affective, and instructional domains on Korean university students' English vocabulary achievement. To this end, seven hypotheses were posed in light of previous research on vocabulary learning. To test these hypotheses, a SEM procedure was performed for a sample of 368 Korean university students. The effects of gender and academic specialization on English vocabulary achievement were also examined through multi-sample analyses.

Several important findings were noted. First, Korean university EFL learners' English vocabulary achievement was directly influenced by motivation as assessed by intrinsic motivation and attitudes toward vocabulary learning. The present study also identified a significant direct relationship between vocabulary achievement and strategy use, such as deep processing and determination strategies. The effects of confidence, learner beliefs, and vocabulary learning methods (i.e., incidental and intentional learning), however, were found to be only indirectly connected to vocabulary achievement through motivation and strategy. To be specific, the effects of confidence, incidental learning, and intentional learning were indirectly conveyed to vocabulary achievement through motivation, while the effects of learner beliefs and intentional learning on vocabulary achievement were found to be mediated by strategy use. These results underscore the importance of motivation and strategy use both as a significant direct predictor of vocabulary achievement and as a variable mediating the indirect relationships between vocabulary achievement and confidence, beliefs, incidental learning, and intentional learning.

The results of multi-sample analyses for learners with different group membership in gender and area of specialization identified a total of four path coefficients whose effects functioned differently across different groups of learners. Specifically, multi-sample analysis by major area shows that the strength of three path coefficients (STRA → VOCA, BELIEF → STRA, INT → STRA) was consistently stronger for English majors than for non-English majors. Similarly, a multi-sample analysis of gender demonstrates that the strength of the relationships between strategy and vocabulary achievement was stronger for females than for their male counterparts, hence pinpointing strategy as a key variable

leading to group differences in gender and learners' areas of specialization.

All in all, these results yield some important implications for L2 vocabulary learning and teaching. First, given the finding that Korean university students' English vocabulary achievement was directly affected by motivation, it is recommended that classroom EFL instructors should promote intrinsic motivation and positive attitudes toward English vocabulary learning. In this regard, it is important that classroom teachers should encourage their students to be intrinsically motivated and to be involved with vocabulary learning tasks for their own sake. Therefore, English vocabulary tasks should be diversified in terms of contents, topic familiarity, and teaching methods in order to attract learners' attention to enhance pleasure experienced in discovering the meaning of unknown words. It is also crucial that L2 learners be armed with positive attitudes toward English vocabulary learning through interesting and curiosity-provoking learning materials in connection with reading and writing activities, as suggested by Pichette, Serres, and Lafontaine (2012) and Vidal (2011). Second, classroom instructors should be aware of the importance of strategy training, since the results of the present study indicate that learner's successful acquisition of English vocabulary is a direct function of strategy use, such as deep processing and determination strategy. Therefore, in order to expand learners' knowledge base of English vocabulary, an independent module of vocabulary learning strategy training should be implemented in EFL classrooms.

Considering the results of multi-sample analyses reporting a significantly stronger relationship between strategy and vocabulary achievement for females and for English majors, it is advised that English instructors in charge of males and non-English majors should give more focused attention to strategy training. In this matter, it is critical that strategy training should be carefully planned both in intensity and in form. First, the frequency and amount of explicit training of diverse vocabulary and general L2 learning strategies should be increased for these groups. Furthermore, vocabulary strategy training should be designed to better meet the demands of diverse learners with a wide range of L2 proficiency levels in terms of sequencing strategy tasks with different cognitive complexity. Finally but not in the least, given the present study finding that vocabulary strategy was directly influenced by learners' beliefs about vocabulary learning, it is important that strategy training should be complemented by instructional activities emphasizing vocabulary acquisition in context and actual vocabulary uses either in classrooms or outside of classrooms for meaningful purposes. The significant relationship between strategy and intentional vocabulary learning also suggests that promoting intentional vocabulary learning is another fruitful avenue of strengthening the effects of vocabulary training. This implies that the amount of cognitive effort expended on intentional vocabulary learning will boost the success of vocabulary strategy training, which in turn directly affects the final output of learners' vocabulary accomplishment.

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Applicable levels: Tertiary

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Received on June 1, 2016
Reviewed on July 15, 2016
Revised version received on August 15, 2016