A Comparative Study of Effect of Bottom-up and Top-down Instructional Approaches on EFL Learners' Vocabulary Recall and Retention

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Abstract

This quasi-experimental study investigated the effect of bottom-up and top-down instructional approaches on English as a foreign language (EFL) vocabulary recall and retention. To this end, 44 high school students from two intact classes were assigned to bottom-up ($n = 21$) and top-down ($n = 23$) groups. The participants were exposed to 20 hours of explicit vocabulary instruction during 10 weeks (2 sessions per week). Two tests, vocabulary size test (VST) and controlled productive knowledge tests (CPKT), were administered to measure the participants' achievement before and after the treatment. The results of two-way repeated measures ANOVAs and independent samples t-tests revealed that the bottom-up group outperformed the top-down group on both immediate and delayed post-tests
Keywords: Bottom-up Approach, Top-down Approach, EFL Learners, Recall, Retention.

1. Introduction

In the field of language pedagogy, top-down and bottom-up processing are well-established concepts (Moskovsky, Jiang, Libert, & Fagan, 2015). Bottom-up is inductive or data driven processing starting with lower ranked units and moving upwards through higher ranked units (Jay, 2003). In bottom-up processing, the learner "focuses on individual words and phrases, and achieves understanding by stringing these detailed elements together to build up a whole" (Harmer, 1991, p. 201). Top-down is a schemata-driven or deductive processing that works from higher to lower ranked units (Jay, 2003). In top-down processing, learners use their prior knowledge to make predictions about the text (Lingzhu, 2003).

To ensure the precise and rapid processing of information, bottom-up and top-down processes work together in most situations (Field, 2004). Some theories have laid emphasis on bottom-up processing. Top-down processing emphasizes contextual factors such as socio-cultural knowledge and proceeds from whole to part (Paran, 1997). In other words, top-down processing happens when the reader activates his/her world knowledge to facilitate comprehending the text. On the other hand, in bottom-up reading model, the written or printed text is the center of attention and reading proceeds from part to the whole. Readers usually use their

knowledge of lexical items, structural points and phonological patterns to decode the text meaning. Due to the importance and significance of top-down and bottom-up processing as revealed by previous studies (e.g.; Field, 2004; Tsui & Fullilove, 1998), a great deal of studies conducted to investigate the effect of top-down and/or bottom-up processing in learning different skills, and their application in EFL classroom.

It has also been argued that top-down models of reading cannot be useful for language learners at elementary levels because knowledge of a minimum of 5000 words is essential to make top-down processing possible (Carrell & Eisterhold, 1983). In contrast, bottom-up models cannot be useful for the advanced language learners because students have the capability to decode graphical input automatically (Tsui & Fullilove, 1998). Figure 1 shows depicts the operation of bottom-up and top-down language processing (Celce-Murcia & Olshtain, 2001). The two types of language processing closely tied with the two principal forms of language use, perception and production. Language perception is essentially bottom-up. In fact phonological, morphological, and lexical aspects of the sentence/utterance must be processed before it is linked to conceptual-semantic context. Production operates adversely, starting with conceptual-semantic content and only then assigning grammatical structure to it.

Top-down Processing

Pragmatics

Written and Spoken Discourse

Vocabulary

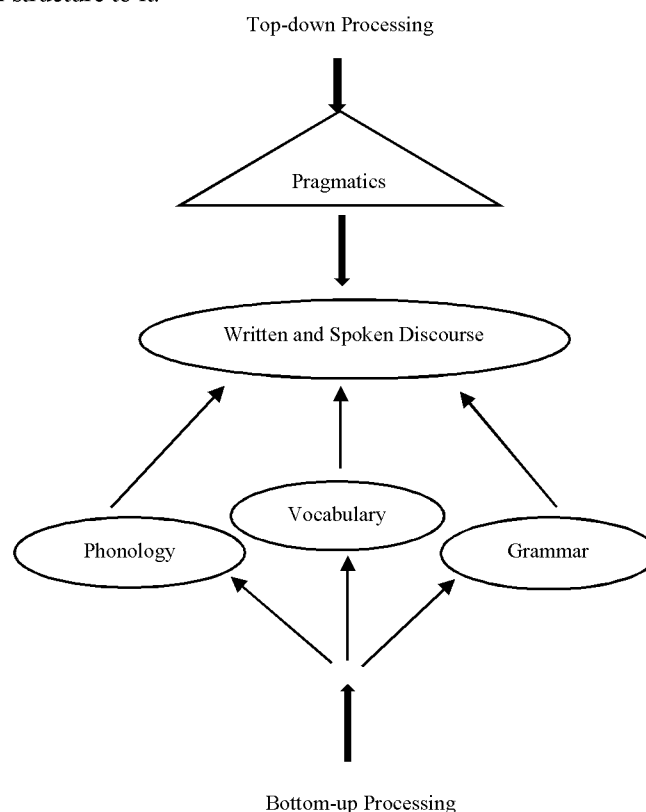Phonology

Grammar

Bottom-up Processing

Figure 1. *The Operation of Bottom-up and Top-down Language Processing*
(adapted from Celce-Murcia & Olshtain, 2001, p. 75)

Few studies have investigated the notion of top-down and bottom-up processing in learning some elements of language. Moskovsky et al. (2015) have first conducted a study to assess the relative effectiveness of two modes of academic English vocabulary instruction, bottom-up and top-down, in Chinese university students. They suggested conducting similar studies 9n different context. Therefore, this study aimed to examine the effect of two forms of L2 vocabulary instructional approaches (i.e., bottom-up and top-down) on recall and retention of EFL vocabulary learning. To bridge the existing gap in the literature, the following research questions have been addressed:

Q1: Do bottom-up and top-down instructional approaches affect EFL learners' vocabulary recall differently?

Q2: Do bottom-up and top-down instructional approaches affect EFL learners' vocabulary retention differently?

2. Method

This study adopted a quasi-experimental design involving pre-test, treatment, and two post-tests. The participants received the treatment in 20 sessions during 10 weeks, beginning one week after the pre-test. The immediate and delayed posttests were administered one day and eight weeks after the last treatment session, respectively.

2.1 Participants

A total number of 44 female EFL learners from two intact classes participated in this study. They were senior high school students studying at Efaf high school located in Andimeshk, Iran. Their age ranged between 16-17 years old and all of them were native speakers of Persian. Each class was assigned to one experimental group, bottom-up group ($n = 21$) and top-down group ($n = 23$).

2.2 Instruments and Materials

2.2.1 Target Words Selection

Target words included 40 words selected randomly from *The World of Words* (Richek, 2010). They were 15 verbs, 21 adjectives and 4 nouns (see Appendix). It should be mentioned that parts of speech was not important. Some of English teachers confirmed the unfamiliarity of these target words to the high school students. Moreover, a pre-test was also administered to ensure that all of them were unfamiliar to the students.

2.2.2 Controlled Productive Knowledge Test

The CPKT was adapted from Nation's (2001) Productive Levels Test. It comprised 40 sentences; 20 sentences involved 1 impaired target word that was randomly selected from *The World of Words* (Richek, 2010) and rest of the sentences each involving 1 impaired word served as the distractors. The words were

impaired according to the number of the syllables that each word had. For one syllable words, just the first letter, for two and three syllables words the initial syllable, and for more than three syllables words the first two syllables were written and the learner had to complete the impaired word.

2.2.3 Vocabulary Size Test (VST)

The participants were instructed to mark each lexical item with a (+) if they thought they recognized it; with (?) if they thought the word was familiar, but were unsure about the meaning, or with (-) if they could not recognize the word at all. When the participants selected the (+) option, they were required to provide at least one Persian equivalent. Following Wesche and Paribakht (1996), a lexical item marked with a (+) including a correct Persian translation was scored 1. A lexical item marked with a (+) but involving an incorrect Persian translation equivalent was scored 0.5. Items marked with a (?) received 0.5, and items marked with a (-) received 0.

2.3 Data Collection Procedures

An English vocabulary course was designed especially for the purpose of the study. The design of the course syllabus was largely inspired by Coxhead's (2008) idea about vocabulary teaching. The vocabulary course involved 20 hours of EFL vocabulary instruction over 10 weeks (2 session per-week). One of the groups was exposed to the bottom-up vocabulary teaching, whereas the other group was exposed to top-down vocabulary teaching. Each lesson included teaching two words at each session. The target words were structured in six distinct steps:

Step 1: Introducing the spoken and written form as well as the morphemic structure of the target word

Step 2: Introducing the definition and L1 translation of the target word

Step 3: Introducing related forms from the same lexical family

Step 4: Introducing different phrases and collocations of the target word

Step 5: Presenting the target word at the sentence level

Step 6: Presenting the target word at the level of the whole context

The bottom-up group was instructed following the order of steps from 1 to 6 as above, and the top-down group was instructed in the reverse order, starting with step 6 and finishing with step 1. Two dimensions of the participant' English vocabulary competence (reception and controlled production) were measured quantitatively using VST and the CPKT. The two tests were administered at the beginning (pre-test), one day after the treatment (immediate post-test), and eight weeks after the end of the treatment (delayed post-test).

2.4 Data Analysis

To compare the experimental groups' scores across pre- and post-tests, two-way repeated measures ANOVAs were computed. To investigate if the performance of the two groups differed on any of the post-tests, independent samples *t*-tests were conducted for both VST and CPKT post-tests.

3. Results

The descriptive statistics of the VST for the bottom-up and top-down groups in the pre-test, immediate post-test and delayed post-test were calculated separately. Tables 1 and 2 show the mean (*M*), standard deviation (*SD*), and the number of participants (*n*) in each group over three test times.

Table 1. *Descriptive Statistics for the Vocabulary Size Test*

Group	*N*	Pre-test		Immediate Post-test		Delayed Post-test	
		M	*SD*	*M*	*SD*	*M*	*SD*
Bottom-up	23	2.043	1.551	13.804	2.782	11.173	2.489
Top-down	21	1.976	1.336	11.50	2.701	8.571	2.152

Table 2. *Descriptive Statistics for the Controlled Productive Knowledge Test*

Group	*N*	Pre-test		Immediate Post-test		Delayed Post-test	
		M	*SD*	*M*	*SD*	*M*	*SD*
Bottom-up	23	.130	.344	12.521	2.447	10.304	2.737
Top-down	21	.095	.30	10.047	2.710	7.381	2.290

To compare the experimental groups' scores across pre- and post-tests, two-way repeated measures ANOVAs were computed. The VST scores were entered as the dependent variable and time (pre-test and two post-tests) and the treatment as independent variables. Table 3 shows the results of this analysis.

Table 3. *Two-Way Repeated Measures ANOVA for the Vocabulary Size Test*

Source	*df*	*F*	*p*
Between Subjects			
Group	1	712.60	<.01
Within Subjects			
Time	2	660.513	<.01
Time × Group	2	6.37	<.01

Table 3 shows that there was a significant interaction between time and the treatment ($F_{[2, 42]} = 6.37$, $p < .01$), and there was a significant difference found in

regard to time (F [2, 42] = 660.513, p <.01). Moreover, the significant differences were found between the subjects in all three tests (F [1, 43] = 712.60, p < .01). According to the two-way repeated measures ANOVA for the CPKT (Table 4), there was an interaction effect between time and group showing that the two different sets of participants performed in different patterns over time.

Table 4. *Two-Way Repeated Measures ANOVA for the Controlled Productive Knowledge Test*

Source	df	F	p
Between Subjects			
Group	1	877.46	<.01
Within Subjects			
Time	2	867.01	<.01
Time × Group	2	7.37	<.01

Table 4 shows that time interaction with treatment for the CPKT was significant (F [2, 42] = 7.37, p <.01) and there was a significant difference found in regard to time (F [2, 42] = 867.01, p <.01). Furthermore, the significant difference was found between the subjects in all three tests (F [1, 43] = 877.46, p <.01). Figure 2 is a visual representation of the mean changes of VST for the bottom-up and top-down groups over three testing periods.
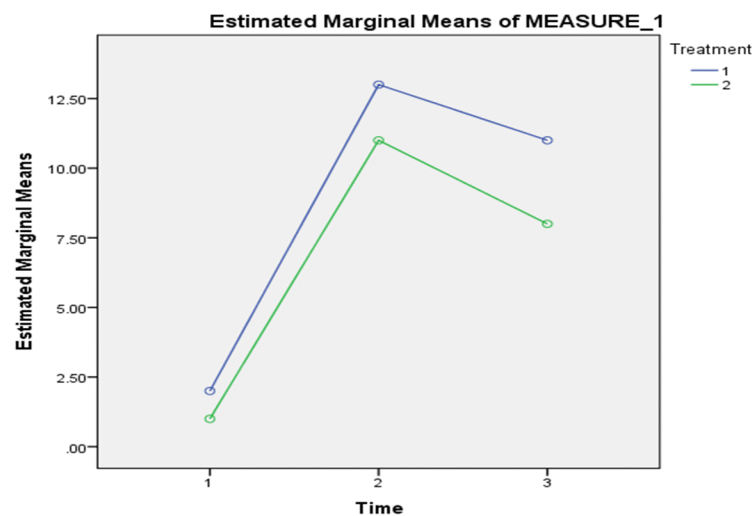

Figure 2. *Mean Changes of Vocabulary Size Test over Time*

As Figure 2 illustrates, the bottom-up group (group 1) showed better observed improvement than the top-down group (group 2) in the immediate (Time

2) and delayed posttests (Time 3). Figure 3 depicts the mean changes of the CPKT in the bottom-up and top-down groups over the three testing periods.
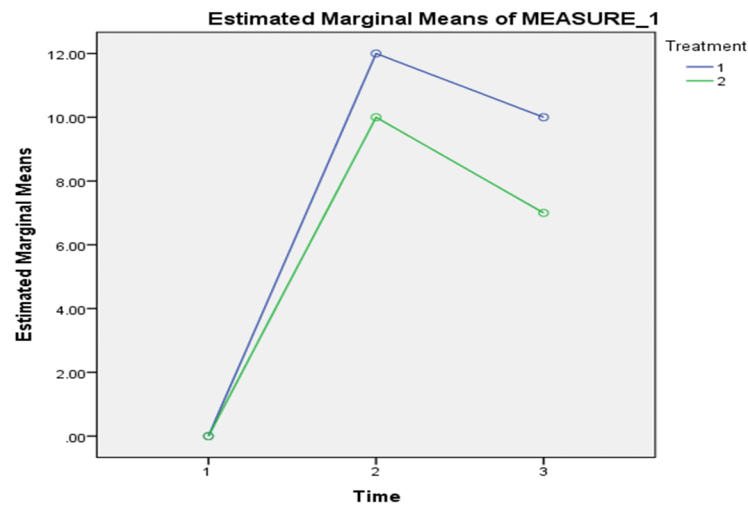

Figure 3. *Mean Changes of Controlled Productive Knowledge Test over Time*

According to Figure 3, the bottom-up (group 1) outperformed the top-down group (group 2) on both immediate and delayed post-tests. To investigate if the performance of the two groups differed on any of the pre-test and post-tests, independent samples t-tests were conducted for both VST and CPKT post-tests. All these tests were significant as displayed in Table 5, indicating that the bottom-up group outperformed the top-down group.

Table 5. *Independent Samples T-Tests for the Vocabulary Size*

test	t	df	p
Pre-test	.153	42	.879
Immediate post-test	2.782	42	$<.01$
Delayed post-test	3.693	42	$<.01$

The results showed that bottom-up and top-down groups did not have significant difference in VST pre-test ($t = .879$, df = 42, $p > .01$). The results suggest that bottom-up group led to better gains than the top-down group in VST immediate post-test ($t = 2.782$, df = 42, $p < .01$). Moreover, the bottom-up group outperformed the top-down group in VST delayed post-test ($t = 3.693$, df = 42, $p < .01$). The independent sample t-tests for the CPKT post-tests were computed (Table 6).

Table 6. *Independent Samples T-Tests for the Controlled Productive Knowledge*

test	t	df	p

Pre-test	.360	42	.721
Immediate post-test	3.182	42	.008
Delayed post-test	3.853	42	.001

The results showed that bottom-up and top-down groups did not have significant difference in CPKT pre-test (t = .721, df = 42, p > .01). As Table 6 illustrates, the bottom-up group led to better gains in CPKT immediate post-test than the top-down group (t = 3.182, df = 42, p < .01). Moreover, the bottom-up group outperformed the top-down group in CPKT delayed post-test (t = 3.853, df = 42, p < .01).

4. Discussion

It was revealed that bottom-up approach had a better effect on vocabulary recall than top-down approach. The results also showed that the bottom-up group was better than the top-down group vocabulary retention. The sequencing of vocabulary instruction used in bottom-up approach seems to be consistent with the three stages proposed by Jiang (2000). The first step involved in the bottom-up instruction presenting phonological, morphological and graphics features of the target word. After that, the definition of the word and Persian translation were given. The first three steps seems to correspond to the first two stages of Jiang's (2000) model, and steps 4-6 of the bottom-up approach, which were related to the word's use in upper linguistic structures. (e.g., collocation, clauses, discourse) seem to be related to Jiang's stage 3. As it was mentioned, the top-down approach involved the reverse sequence of instructional steps.

Learners' L2 proficiency is another important factor. In relevant literature, there is an agreement that top-down processing is more common among more proficient learners, and lower proficient learners tend to use bottom-up processing (e.g., Shohamy & Inbar, 1991; Tusi & Fullilive, 1998). Probably this pattern is due to the different ways of processing with language perception and production. Essentially, language perception is bottom-up and production is top-down.

The findings are in line with Moskovsky et al. (2015). They claimed that bottom-up teaching strategy has more effect on L2 vocabulary learning. However, their study lacked delayed post-test to evaluate vocabulary retention. But the present study benefited from delayed post-test to examine the learner's vocabulary retention. The notion of bottom-up mode of information processing is widely rooted in the sociocultural and educational tradition of China (Ma, 2009). Over a long time, the concept of step to step evolution from smaller to more basic elements to complicated and elaborate structures seems is a continuous theme in Chinese thoughts and philosophy (Li, 2006). Also most of education in the Chinese context includes bottom-up instruction (Peng, 1997). But as compared with the findings of the present study, it was revealed that the positive effect of bottom-up processing than

top-down processing is not due to cultural factors, but rather to the features of human processing.

Perfetti (1985) suggested that successful language processing can be impossible without solid bottom-up skills, claiming that less proficient readers may be over-relying on top-down processing, because their bottom-up skills such as word recognition are poor. Other researchers are in favour of both top-down and bottom-up instructional approaches and in fact take a more balanced view. They argue that some of the language skills such as reading and listening are very complex mental operations involving both top-down and bottom-up processing. Over-reliance to either processing mode can lead to poor outcome (Carrell, 1988; Stanovich, 1980).

5. Conclusion

The findings of the present study have implications for curriculum developers and syllabus designers since accommodating learners' views in developing language teaching materials and textbooks will improve the quality of materials. They can replace traditional approaches in vocabulary learning with more organized approaches to help EFL learners acquire and retain vocabulary more appropriately. The findings are also beneficial for language learners. As it was suggested, bottom-up and top-down strategies activate learner's schemata and also they can be served as a guide to aid learners in the gradual construction of mental linkage.

This study is not devoid of limitations. In this study, low proficient language learners were examined. Similar studies with language learners at different proficiency levels can be conducted. In this study, the course duration was limited to 10 weeks. Further studies with longitudinal design can give us a clearer picture. In this study, only one area of language (i.e., vocabulary) was investigated and other areas of language such as grammar and pronunciation were not considered. Therefore, future research can investigate this issue.

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Appendix
List of Target Words

Aficionado	Dynamic	Appall	Augment	Mandatory

Fraternal	Condemn	Contemplate	Flaunt	Harass
Adroit	Chagrin	Contend	Thrive	Defer
Intrepid	Conservative	Elated	Boisterous	Intervene
Altruistic	Concise	Ludicrous	Undermine	Prohibit
Venerable	Liberal	Radical	Supplant	Catastrophe
Gullible	Articulate	Skeptical	Emphatic	Pacify
Dogmatic	Gauche	Stoic	Attrition	Corroborate