

# The Tradeoffs in Processing the Forms and Meanings of New Words

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The dynamic of learning the forms and meanings of new words increases as technology continues to develop. For example, as compared to thumbing through the pages of a traditional book-based dictionary to look up the meanings of unfamiliar words, language learners can now instantly access new words by conveniently mouse-clicking on or typing in the spellings in an on-line dictionary.

However, in order to understand how ESL learners may best acquire new words, it is important to consider previous research and theory involved in learning new words. Therefore, this review will have four parts. First, studies that have examined the methods of handwriting and typing to learn word forms will be reviewed. Second, studies that have examined the different conditions of looking up words in dictionaries to learn word meanings will be reviewed. Third, the Type of Processing-Resource Allocation (TOPRA) principle will be presented as a theory to help explain the tradeoff between both types of learning. Last, pedagogical implications based on the research and theory will be discussed.

## **Writing Methods to Learn Word Forms**

### **Handwriting**

Some studies suggest that more active methods of tracing or writing letters and words are more effective for the retention of word forms than passive methods of observing letters or reading words. For example, with regard to tracing, Hulme (1979) found that participants who were able to look at and trace word forms had better recognition than participants who only looked and pointed at word forms. Similarly, Bartolomeo, Levi, Chokron, and Degos (2002) worked with a brain damaged patient who was unable to visualize the mental images of letters but found that he improved significantly when he was able to trace the contours of letters with his fingers. With regard to writing letters, Naka and Naoi (1995) found that repeated writing facilitates the recall the shape of a letter, while, Naka (1998) found that third and fifth grade Japanese children were better at recalling characters and letters practiced from writing by hand rather than by just looking at letters. In addition, Thomas and Dieter (1987) found that participants who wrote missing letters fared better than those who did not write letters, and thus concluded that copying words was better than not copying words. Also, with regard to writing words, Folse (2006) found fill-in-the-black exercises to be an effective means to retain word spellings.

### **Typing**

Results are mixed with regard to studies involving keyboard typing on computers for the retention of word forms. For example, using 24 first grade students, Cunningham and Stanovich (1990) examined the presence and absence of naming letters along with the effect of three physical motor activity conditions of spelling words by arranging letter tiles, handwriting on paper, and keyboard typing on a computer. Results showed that, although letter naming was not significant and did not significantly interact with the three motor activities, the handwriting condition was superior to both the arranging letter titles and the keyboard typing conditions that were not significantly different from one another. However, a replication of the same study

(Vaughn, Schumm, & Gordon, 1992) found that the handwriting condition was not significantly better than either the spelling with tiles or the typing conditions. The authors speculated that the reason for the difference in findings between the two studies can be attributed to the fact that Cunningham and Stanovich's participants represented a much higher socioeconomic sample and therefore were likely afforded more experience with books and writing.

Nevertheless, two recent studies have provided additional support for handwriting over typing for learning word forms. For example, in a study involving preschool children, Longcamp, Zerbato-Poudou, and Velay (2005) reported that handwriting training gave rise to better letter recognition than typing training. In a study involving adults, Longcamp, Boucard, Gilhodes, and Velay (2005) found that characters that were typed were more often confused than when they had been written by hand.

### ***Look-Up Conditions to Learn Word Meanings***

#### **Book Look-Up**

Several researchers have examined the use of book-based dictionaries and marginal glosses to consult or look up the meanings of unknown words. For example, studies involving book-based dictionaries (Cho & Krashen, 1994; Lupescu & Day, 1993) have demonstrated that learners were better able to remember word meanings if they looked them up in a dictionary for a reading task. Also, marginal glosses were found to be more beneficial for word retention than compared to when they were not present for a reading task (Hulstijn, 1992; Jacobs, Dufon, & Fong, 1994; Watanabe, 1997). However, Hulstijn, Hollander, and Gredianus (1996) found that learners were more likely to remember word meanings when they looked up the words in a dictionary compared to when their meanings were referred to in a marginal gloss. The researchers explain that, compared to referring to words in a marginal gloss, the use of a dictionary entails more mental effort because it causes a longer disruption from the flow of reading and involves the learners in judging and looking up the

words they perceive as relevant to a passage.

### **Mouse-Click Look-Up**

Chun and Plass (1996) conducted three experiments to investigate how well vocabulary is learned by mouse-clicking on different media annotations that involved one hundred and sixty second-year students of German. From the results of Experiment 1, which explored how well vocabulary is learned when the goal is reading comprehension, the researchers suggest that the ease of look-up and the availability of different types of annotations encourage more active behavior or initiative on behalf of the learner. From the results of Experiment 2, which explored the effectiveness of different annotations for vocabulary learning, the researchers state that words which were annotated with pictures and text were learned best because they were coded with both verbal and visual modes of information that are remembered better than words coded with only definitions. Lastly, from the results of Experiment 3, which explored the relationship between look-up behavior and performance on the vocabulary test, the researchers speculate that learners preferred certain types of annotations because they are helpful in offering retrieval clues for remembering words.

Other studies involving mouse-clicking have indicated that the number of mouse-clicks on a word does not necessarily correlate with word retention. For example, Laufer and Hill (2000) conducted a study involving mouse-clicking to examine look-up behavior to learn vocabulary while reading for comprehension. Their study involved thirty-two EFL non-English major participants from a university in Israel and 40 ESL social science and arts majors from a university in Hong Kong. The results showed that while the Hong Kong based students spent nearly 10 minutes reading the text and looked up words almost twice as often as the Israeli students, who spent between five to six minutes reading text, the relationship between the number of selections and retention was weak. Therefore, students with a larger number of look ups did not necessarily remember more words.

Peters (2007) conducted a study involving the action of mouse-clicking on words

to investigate students' look up behavior and word retention for relevant and non-relevant words necessary and not necessary to answer comprehension questions. The study involved 84 native Dutch speakers who were high-intermediate students of German, and focused on the relationship between the students' frequency of look-ups and word retention. Although results showed that remembering word meanings for relevant words was two or more times as high as non-relevant words, the frequency of clicks on words did not correlate highly with word retention. Nevertheless, the researchers explain that, because the students' priority was to comprehend content, relevant words relating to the understanding of a text were given more attention, and thus were better remembered in comparison to non-relevant words.

### **Type-In Look-Up**

Knight (1994) examined learning vocabulary using a computer-based dictionary compared to learning vocabulary from context. The study involved 105 second-year native English-speaking university students learning Spanish. Results showed that the participants who partially typed words to look them up in a computer-based dictionary scored significantly higher on vocabulary tests than compared to participants who only read a passage.

Knight attributed these results from the findings that participants who used a dictionary spent more time on a passage compared to participants who did not use a dictionary. In addition, although reading comprehension increased proportionally with regard to time for the low and high ability dictionary groups, the amount of vocabulary learned for the low ability dictionary group increased in greater proportion compared to the high ability dictionary group and, therefore, the low ability students benefited more from using a dictionary than the high ability students. Knight suggests that, because the low verbal ability participants were more dependent on vocabulary compared to the high verbal ability participants, they were at a greater disadvantage when they were told to guess from context. Dictionary use, however, helped to compensate for this disadvantage.

### **Look-Up Comparisons**

Liu and Lin (2011) conducted a study comparing the four conditions of a computerized pop-up dictionary, a type-in dictionary, a book-based dictionary, and no dictionary in order to examine if the ease of using a dictionary enhances or reduces text comprehension and vocabulary learning. The study involved eighty first-year Taiwanese college students learning English as a second language. With regard to reading comprehension, there was no significant main effect of using a dictionary across the four conditions. However, with regard to incidental vocabulary learning, there was a significant main effect for using any one of the three dictionaries versus not using a dictionary for vocabulary learning. With regard to vocabulary-learning efficiency, there was a significant difference among the dictionary conditions that showed that students who used a pop-up dictionary learned words more quickly than those who used the type-in dictionary, and students in the type-in condition learned significantly more words than those who used a book dictionary.

The researchers attributed these findings to test difficulty and the dynamic offered by the use of a pop-up dictionary. For example, test difficulty for reading comprehension was the same in that students in all conditions were prohibited from looking back at the text while taking the reading comprehension test. However, vocabulary-learning efficiency was influenced by the ease of use offered by the pop-up dictionary. The researchers found that students were able to check the meanings of new words two or more times using a pop-up dictionary compared to the other two conditions. This additional exposure might have increased the likelihood of a word being learned.

### ***TYPE OF Processing-Resource Allocation (TOPRA)***

Type of Processing-Resource Allocation (TOPRA) (Barcroft, 2000) is a model used to explain the relationship between the semantic and formal components to process word meanings and word forms. The semantic component refers to when learners focus on the meaning of a word. For example, this component concerns the extent to which the word snail represents an animal, insect or food, or if the learners

try to think of other words related to the word *snail*. Learners can focus on this component when they either receptively listen to or read words to understand content or productively vocalize or write words to communicate. The formal component refers to the structural or formal properties of a word made up by the orthography and phonology of a word. For instance, learners can focus on the form of a word if they are engaged in activities that require them to count the number of letters to help solve puzzles such as word searches, and crosswords, play games such as hangman, or distinguish between homophones such as *road* and *rode*. Learners might pay attention to a word's phonology or count its syllables to write a poem or song or engage in listening and pronunciation activities to distinguish between minimal pairs such as *sung* and *song*. Learners might focus on the formal properties of both letters and sounds to access the meanings of unknown words in a dictionary.

Depending on the focus of an activity, the TOPRA model depicts an inverse tradeoff between learning the meanings and spellings of new words. For example, the model states that, if the processing demands of a semantic related task to learn the meaning of a new word is high, the semantic learning for that word will be high. However, this will consequently decrease the learning for the formal properties of that word. Conversely, if the processing demands of a form related task to learn the spelling of a new word is high, the formal learning for the word will be high. However, this will consequently decrease the learning for the semantic properties of that word. The TOPRA model (Barcroft, 2003) is depicted in Figure 1.

Semantic Processing (e.g., focus on meaning)	Form Processing (e.g., focus on word form)
Semantic Learning (e.g., memory of known words)	Form Learning (e.g., new L2 word forms)

*Figure 1.* Type of processing-resource allocation (TOPRA) (Barcroft, 2003).

The TOPRA model has been supported by studies demonstrating the negative effects that semantic tasks have on L 2 word form learning. For instance, Barcroft (2000, 2004) found that when English-speaking learners of L 2 Spanish wrote new Spanish words in sentences, there were negative effects for productive L 2 vocabulary recall. Barcroft (2002) reported that when English-speaking learners of L 2 Spanish were put into three categories of making pleasantness ratings about Spanish words (+ semantic), counting the number of letters in Spanish words (+ structural) and learning Spanish words (control), there was a tradeoff in that Spanish free recall was higher for the structure or forms of words while English recall was higher for the semantics or meanings of words.

### **Pedagogical Implications**

The previous studies that have examined the different activities and conditions of word look up and the TOPRA theory suggest that language instructors consider three factors when learners use an on-line dictionary to acquire new words. First, language instructors can take into account that different activities involved in learning new words foster different levels of retention. For example, with regard to learning word forms, the comparison of handwriting and typing words showed that there was a difference for the retention of word forms if they were passively viewed or actively written. Second, language instructors should consider that different look-up conditions might also influence vocabulary learning. For instance, with regard to learning word meanings, the comparison of different resources suggest that just as using a paper-based dictionary or a gloss can foster different levels for word meanings, looking up word meanings by mouse-clicking on or typing words in a computer can also lead to different levels of retention. Third, language instructors can also consider the tradeoff between learning word forms and word meanings. For instance, the TOPRA theory suggests that if the semantic processing to learn the meaning of a new word is high, the formal processing or retention of the new word's spelling might be low. Conversely, if the learners focus on formal processing is high



to learn and retain the spelling of a new word, the semantic processing or retention of a word's meaning might be limited. Language instructors should keep these three factors in mind to understand how the tradeoffs of processing the forms and meanings of new words may vary when they design lessons that involve an on-line dictionary for their learners.

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