

# Application of Information Processing Theory in Second Language Vocabulary Acquisition

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**Abstract:** Vocabulary acquisition is an intricate process, which has a close relationship with memory. In cognitive psychology, a large number of studies on memory system have been conducted based on the information processing theory, placing great value on second language learners' cognitive process. This study intends to probe into second language vocabulary acquisition from the perspective of information processing theory in hope to help learners acquire vocabulary more scientifically and efficiently.

**Keywords:** Second language vocabulary acquisition; Information processing theory; Cognitive process

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## 1. Introduction

Vocabulary is the basis of syntax and pragmatic expressions. It is also an important aspect in the process of second language acquisition. Some scholars hold on to the belief that the use of words is influenced not only by the limitation of its inherent characteristics but also by the cognitive ability of second language learners. A better understanding of the cognitive process in vocabulary acquisition can improve the utilization of cognitive ability in vocabulary teaching and learning as well as improve efficiency. For this reason, scholars have been paying attention to the relationship among vocabulary, cognition, and psychology.

Information processing theory provides a cognitive approach to discuss second language vocabulary acquisition and a new perspective in understanding the cognitive process of acquisition. It is the core theory of cognitive psychology, which studies the original structure and process of cognitive activities. Based on the information processing theory, language acquisition is regarded as a process of receiving and using information. The information from the external world would undergo a series of processing in the mind to change the information into an organized and meaningful one which would be kept as a memory and retrieved when required. This theory aims to explain how information is acquired, kept, processed, and used; consequently, it proposes an information processing model, which can be used to explain the cognitive process of second language vocabulary acquisition. Having better understanding about the cognitive process, learners and teachers can improve efficiency of vocabulary acquisition.

## 2. Information processing theory

According to Neisser, cognitive psychology concerns with "all processes by which sensory input is transformed, elaborated, stored, recovered, and used <sup>[1]</sup>." In the 1950s, psychology was deeply influenced by computer technology. As a result, researchers began to compare the process of human learning to the information processing in computers <sup>[2]</sup>. Cognitive psychologists have claimed that the human mind has a similar system of information processing as that of computers, in which this system can receive, store, make

transactions, and transmit information. Thereafter, information processing theory came into being. It focuses on how people attend to environmental events, encode information to be learned, relate it to the knowledge stored in their memories, store new knowledge, and retrieve it when needed.

Gagne advanced the theory by combining the principles with learning and put forward the basic model of learning in 1974. In Gagne's information processing model of learning, the information from the external world acts on a receptor; then, the appropriate register accepts the input where the information is coded in the form of image. Subsequently, it is encoded once again in the short-term memory (STM) and stored in a semantic form. With enough repetition and elaborate process, the information is encoded in the STM for the third time, and then the information is transferred to the long-term memory (LTM). At this time, LTM and STM act in different ways but with the same structure. When a new information needs to be explained by an old knowledge, the old knowledge is retrieved from LTM into STM. The information which is retrieved from STM and LTM activates an effector by the reaction generator and produces an operation behavior which influences the learner's environment <sup>[3]</sup>.

In this model, executive control and expectation are extremely important. Expectation is the target that learners expect or can be regarded as the learning motive. Executive control decides which information enters into the short-term memory from the register and decides on how to implement the coding. Gagne's learning model has made great contribution to the language learning and teaching field.

### **3. Cognitive process of second language vocabulary acquisition**

Thornburry has mentioned, "You can say very little with grammar, but you can say almost anything with words <sup>[4]</sup>." Wilkins also supported that notion by emphasizing that without vocabulary, nothing can be conveyed <sup>[5]</sup>. Vocabulary plays a crucial role in second language acquisition. However, training learners LTM in vocabulary acquisition is one of the most challenging issue.

Based on the information processing theory, the cognitive process of second language vocabulary acquisition consists of input (visual recognition, the activation of thinking), absorb or internalization (processing and memory), interlanguage system, and output (speaking, writing, and interpreting) <sup>[6,7]</sup>.

First, when an input acts on a learner's sensor, processing begins. One thing that should be emphasized is that the learner's attention is the prerequisite for further processing. In other words, only the input that is noticed by the learner can be assimilated. Besides, before an input is internalized, there is another stage – understanding. The use of language is inseparable from the knowledge of language. Therefore, learners need to take advantage of certain tools to explore more information about the input or acquire more vocabulary knowledge, including pronunciation, spelling, semantics, allocation, etc. Only in this way can the acquired information be further processed at a semantic level.

After these two stages, the acquired information would be absorbed. There are mainly three stages before this information is stored in the interlanguage system: encode, storage, and retrieve. Encode means that as soon as the information is noticed and understood by the learner, it would be transferred into the mind and then encoded into a form that is easier to be stored. The encoded information is stored in the mind to be retrieved when needed. The acquired information is not isolated but related to other words or phrases. Therefore, the vocabulary stored in the mind is not only about its characteristics and meaning but also other relevant vocabularies. All of these form the mental lexicon. For example, given that the word "transport" has been stored in mind, new information such as "car" and "plane" can activate the information of "transport" because they may be classified as the hyponym of "transport" or regarded as having strong semantic relations with "transport." In this way, it is easier for learners to encode new vocabulary information and retrieve it when needed. Retrieving is crucial if learners desire to have the vocabulary information being transferred into the interlanguage system in the LTM. After enough repetition and processing in the semantic level, the vocabulary would be transferred into the interlanguage system in the

LTM. All these three stages are interconnected: effective encoding advances the storage of memory, and effective storage improves the efficiency of retrieving.

The last part of the model is output. Processes before output are for learners to use vocabulary fluently and appropriately in specific situations. By using the language, learners can examine whether there is a successful acquirement of vocabulary. Speaking and writing are the hallmarks of output.

#### **4. Factors influencing the cognitive process of second language vocabulary acquisition**

##### **4.1. Attention**

As described above, only the input that is noticed by the learner can be further processed. In fact, whether learners are able to notice the language form or not depends on the frequency of the language form. Since most second language learners live in a different language environment from that of native speakers, they have less access to inputs from daily conversations, media, and other authentic materials. Therefore, with the low frequency of some vocabularies, they are less likely to notice those vocabularies.

Moreover, for adults, it is more difficult to acquire vocabulary because they have acquired their first language. Children naturally pay attention to any input from the external environment in first language acquisition. However, as they grow up, different areas in their minds would no longer be malleable, and these areas become oriented. In other words, when receiving input, learners would consciously monitor the system which controls information processing.

Other than the interference of the first language, linguistic competence also affects the attention of second language learners. In vocabulary acquisition, learners may only know one meaning of a polysemous word; therefore, it is common for them to mistakenly think that this word has been acquired before, thus neglecting the vocabulary altogether. Consequently, the information of this polysemy is incomprehensible in the interlanguage system, and it cannot be regarded as a successful acquirement. As a result, the gap between the existing knowledge and new input would not be recognized. In that case, learners would not notice the input; thus, the input cannot be further processed. In conclusion, it is crucial to consciously invoke learners to take notice of vocabulary in the language input process.

In classrooms, learners mainly receive input by listening and reading. Research has shown that through reading input or listening input, it can be deduced that interactive tasks are more effective for vocabulary acquisition compared to writing tasks. Therefore, reading and listening tasks can help learners to concentrate and notice more vocabulary inputs, and though different tasks, there may be varying degrees of effect on noticing. Compare to listening and reading input, the use of visual input is easier to stimulate the interest of learners. Picture input is one of the forms of visual input. Colorful pictures may help learners gain more visual information and notice more vocabulary in it.

##### **4.2. Comprehension**

When the input is noticed by the learner, it still requires the learner to understand the information before internalization. According to Krashen's input hypothesis, language is acquired through comprehensible input from context and extra-linguistic knowledge<sup>[8]</sup>. Therefore, the requirement of vocabulary acquisition is not only limited to understanding the whole text but also inferring the meaning of the vocabulary correctly. In this case, it is possible to acquire vocabulary.

First, learners would infer the meaning of vocabulary by means of the context in which it occurs. However, not all contexts can provide clues for inference in all situations. For example, contexts that do not exist in the real world, those with too many new words, and those that would mislead learners. Learners need to take advantage of linguistic knowledge, common knowledge, and strategic knowledge to understand the vocabulary in linguistic context or co-text. However, second language learners may lack

linguistic knowledge, leading to the failure of developing a correct understanding of the meaning of certain vocabularies, thus halting the next cognitive process of vocabulary acquisition.

Second, from the cognitive perspective, vocabulary storage is also an important factor in understanding vocabulary from the context. Inferring the meaning of vocabulary is a top-down process, which requires the attention from learners and occupies the cognitive resources. Therefore, if most vocabularies in the text (low-level processing) can be identified autonomously, learners can release more cognitive resources to understand the meaning of certain vocabularies (high-level processing).

As comprehensible input plays an important role in vocabulary acquisition, teachers should pay more attention to the vocabulary appearing in the task when the task is used to catch the attention of learners. It can help learners notice new information more quickly and comprehend this input by means of other information. This method requires teachers to have an accurate understanding of each learner's level in second language vocabulary. Other than understanding the meaning, teachers should help learners acquire the usage, collaboration, and other aspects of the vocabulary, in order to ensure subsequent processing and vocabulary acquisition.

### **4.3. Memory**

After noticing and comprehending, the processing continues, and the vocabulary is then transferred to the interlanguage system. At this stage, it can be said that the vocabulary is stored in the LTM. However, in the case where the vocabulary is required, the retrieval process occurs. Repetition can stimulate memory and improve one's familiarization to vocabulary. Therefore, it is an important way to enhance the efficiency of retrieving. Vocabulary acquisition is a process of long-term accumulation. If a word or phrase appears once only, the probability of it being acquired is very low.

Furthermore, the knowledge of vocabulary does not only include its meaning in special context but also its relationship with other words, its grammatical purpose, collocation, using frequency, etc. Therefore, learners need to acquire vocabulary in different contexts, in order to ensure comprehensive acquisition. Meanwhile, the efficiency of information retrieving is relative to the form of encoding and storage. When learners come across a word or phrase in different contexts, the word or phrase can establish a relevance with certain context or extra-linguistic situation. This would not only complete the information in context but also help in vocabulary memorization.

Establishing a net of vocabulary network can reduce the burden of memorization for learners and also form a firm basis for retrieving vocabulary. However, in second language vocabulary acquisition, high-frequency vocabularies with large amount of retrieving can be acquired more quickly, while the some low-frequency vocabularies would be acquired slower, resulting from the low amount of retrieving. Therefore, low-frequency vocabularies should be frequently used to stimulate learners, in order to reinforce memorization. Output tasks can also be regarded as a way to enhance the retrieval of vocabulary. In order to complete a certain task, learners would have to retrieve information. In this way, vocabulary acquisition would be more comprehensive and firmer.

## **5. Conclusion**

Information processing theory provides a perspective on the cognitive process of second language vocabulary acquisition, denoting that the acquisition consists of input, absorb, interlanguage system, and output. At different stages, different conditions must be satisfied. By discussing the cognitive process of second language vocabulary acquisition, it can be found that attention, comprehensive, and memory play important roles in the cognitive process. If teachers consciously adopt strategies such as assigning interactive questions and providing familiar information, vocabulary can be acquired more effectively.

However, this article only discusses several factors involved in the acquisition; therefore, there is still a lot of room to scrutinize other factors affecting vocabulary acquisition.

### **Disclosure statement**

The author declares that there is no conflict of interest.

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