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Learning a Foreign Language in Adulthood using Principles of Neuroscience

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Abstract: *The methodology of learning and teaching a foreign language is evolving. Better educational methods using research-based knowledge of the language centers of the brain, especially in relation to memory, are essential for both language learners and educators. One of the brain's main language centers, Broca's area, functions differently with native and foreign languages after the critical learning period, usually around the age of twelve. Analyzing the process of language learning in children who acquire a foreign language during the critical period can help improve language acquisition in adults. MRI scans have revealed that adult language learners use more areas of the brain when using a foreign language, which may be less than optimal. The brain retains plasticity, even after the critical period, and with extensive stimuli the brain can be trained to create more practical language-related memories. Instead of relying on declarative memory, language learners should engage their procedural memory. This process takes more time and repetition and the encoding of these memories is more effective when an emotional stimulus is present. There are a variety of techniques that can be used to accomplish this process. These findings suggest that the key elements for learning a foreign language in adulthood are an immersive environment, extensive repetition, practicing language in a variety of contexts, and learning in a manner than creates quality copies of the memory.*

Keywords: *Language, Learning, Memory, Wernicke's area, Broca's area*

1. Introduction

Recently, there is a growing tendency to evaluate English proficiency through testing practical communication skills instead of traditionally depending on renowned English proficiency tests, such as TOEIC or TOEFL. While most non-native English speakers retain high TOEIC or TOEFL scores, native English speakers, ironically, find it difficult to communicate with them. Additionally, Finland uses a word order similar to Korean language; however, about seventy percent of Finland population can speak English fluently unlike Koreans due to the educational reformation. Finland educational department chose learning based on listening and speaking rather than focusing on grammar and reading. This dilemma has led to educators to discard the old view and to find more accurate way to teach and evaluate English-language learner (ELL). Some researchers and educators have researched language-related brain areas with language acquisition to devise better educational methods. Through studying the brain regions involved in the speech and their activation patterns, it will be a great help to all foreign language learner and educators [1].

2. Language Acquisition and Brain

Along with language-related researches conducted by mostly linguists and psychologists in the past, recent discovery of the language-related brain areas by neuroscientists have added deeper understanding of language acquisition. The most prominent language-related brain area are Broca's area, which is located in the left frontal lobe, and Wernicke's area, which is located in superior temporal lobe that is between the primary auditory cortex and the angular gyrus. It has been well known that the role of Broca's area and Wernicke's area is

the modulation of the process of speech [2, 3]. The research conducted on 6 bilingual subjects reveals the difference between Broca's area and Wernicke's area used for utilizing foreign language. In the case of Wernicke's area, the utilizing area of the foreign language and mother tongue language overlaps a lot meaning that comprehension level does not vary much (between two languages). However, while using Broca's area there were much gap in utilizing area between mother tongue language and foreign language. It implies hardness in speaking foreign language as fluent as speaking mother tongue language [4, 5].

The modern language processing model developed from Wernicke-Geschwind model, which argues that three specific areas Wernicke's area, and Broca's area and articulate fasciculus works from comprehension of language to tuning is as in the following [6]. Firstly, the Language implementation system, which is consisted of from Broca's area, Wernicke's area to insula cortex and basal ganglia which localize inside the cortex, functions as activating the conceptive knowledge, analyzing all auditory signals, and regulating phoneme, syntactic formation and vocalization. Secondly, the Meditational system scattered through temporal lobe, parietal lobe, and occipital lobe, acts as mediator that connects the language implementation system and the conceptual system. Thirdly, the Conceptual system localizing in the whole cerebral cortex, systems as foundation of notional information [7].

The critical learning period for infants is the age of twelve [8, 9]. Before the age of twelve, most children acquire native and foreign language through the same language related brain areas. Then after, they cannot learn another language through the same area; therefore, a new efficient strategy is necessary to adapt to the change at the age of twelve. Children under twelve learn through imitation with greater flexibility, spontaneity, and tolerance to new experience while adults have to study the new language. For example, a newborn infant may not be aware of a grammatical structure, but it can distinguish whether it is right or wrong by vocal tone or feeling.

There are many scientific studies that show that the brain regions that participate in foreign languages before and after the age of 12 are different. For instance, the language-related brain areas that learned English after the age of 12 were much more widespread and activated than the brain areas before the age of 12 with the usage of fMRI. This asserts that ELLs after the age of 12 make speech primarily through deduction rather than understanding it, therefore requiring much more areas and activity of brain. Thus, it takes longer time and strenuous work for foreign adult learners unlike children under twelve, language learning tool utilizing the innate language learning process is necessary for ELLs after the age of 12. In other words, ELLs after the age of 12 needs to make an effort to learn naturally rather than to learn consciously.

3. Learning and Memory

Interestingly, human's brains have plasticity, an ability to change the brain structure in response to a variety of external stimuli. Theoretically, external stimuli can, in turn, alter the brains structures and functions to perform high-level cognitive processes including learning a new language [5]. Specifically, learning can stimulate brain stem cells to create new cells and a brain circuitry. Therefore, brain's plasticity allows learners to overcome the handicap after the age of twelve through selecting the efficient learning method.

Memory can be largely divided into declarative memory and non-declarative memory [10]. "I woke up late in the morning and was late for a school," and "I woke up and watched baseball games yesterday," recall the facts and events, which are declarative memories. On the other hand, non-declarative memory can be further divided into many types: the most regarded type, procedural memory, covers memory related with techniques, habits, behavior, and emotional learning. For instance, musical performance, riding a bike, and even tying shoelaces are procedural memories. These two memories are stored in entirely different brain areas; declarative memory is stored in the outer part of the brain while non-declarative memory is stored in the inner part of the brain.

Hippocampus has a major role in making declarative memory. Hippocampus is a bundle of neurons that manufactures memory through the process of judging whether the through judging and mediating the storage of memory in sensitive cortex and prefrontal lobe. The hippocampus shrinks and expands depending on the rate it generates neurons, thus the function itself improves in the presence of continuous stimuli. The amygdaloid body, processing

emotions such as fear and anger, plays a role in making non-declarative memory. In this context, some scientists mention as emotion is memory, implying that the more emotionally favoring the more easily to remember [11]. In most of the process declarative memory and non-declarative memory both participate in making memory, simultaneously.

Normally, declarative memory retrieve the stored information by recalling past events, however procedural memory does not. People's everyday procedural behavior, reflexes formed from learning, and emotional imprinting are naturally immersed in people's mind without constant conscious recalling. For example, people normally cannot remember the first time riding a bike, declarative memory, but our brain remembers the procedure when they are on the bike. Declarative memory, thus, is easily formed and forgotten, whereas non-declarative memory is long-lasting and takes repetition and considerable time. When speaking a native language, people are known to use non-declarative memory while declarative memory is used to speak a foreign language. Considering these types of memory, English proficiency is efficiently achieved through procedural memory usage after the age of 12. For example, a simple rule of putting 's' on verb of the third person singular requires practice for new learners. This grammatical rule is saved as declarative memory and will soon turn into non-declarative memory after the practice. In other words, the brains store English grammatical rules as long-lasting procedural memory form by repetitive practice. The same can be said for reading and listening skills in a foreign language. Best practices state that ELLs should acquire skills, such as prediction or understanding vocabulary in context, via explicit instruction, and modeling. According to Olsen and Land (2007) special attention should be learning what a strategy is, how to use it, and when to use it [12]. Reading or listening skills can then be practiced and added the student's "tool-box" of methods. However, only when these memories become non-declarative can students use these skills independently of the classroom. As such, the skills must be used in everyday life to ensure habituation.

Moreover, there is no short cut when a foreigner tries to learn another language according to the neurologists. Researchers assert that only constant practice involved in four different areas (reading, listening, speaking, and writing) will achieve language proficiency through repetitive stimulation of neurons in language learning brain areas. American Defense Language Institute educates about three thousand soldiers to allow language proficiency in each language. It is reported that each soldier receives about two hours of homework and seven hours of class at the institution.

Memory has two forms: short-term memory and long-term memory [13]. Short-term memory is known to be easily forgettable memory that lasts few seconds to several hours or so. On the other hand, long-term memory remains for several days, months, and years. Memory is known to be initially stored as short-term memory and permanently converted into long-term. This requires repetitive and intense stimulation. Emotion, for instance, can cause intense stimulation.

4. CONCLUSION

New innovative educational methods are necessary taking these characteristics of memory into consideration. To induce desired long-term memory formation, learners should be exposed to English friendly environment and recommended endless talking in English. Also, they should imagine themselves speaking English in various situations utilizing one specific sentence as a unit over and over again. Examples of this, that are currently in practice in the United States are thematic instruction and project based learning. Both of these methods use the repetition of themes and ideas to allow students to repeatedly use academic speech in context. Enjoying learning other language is also helpful to learners. Another foreign languages learning method considering brain function is rote memorization of sentences [14]. People's brain tends to filter out foreign languages to understand a native language better. In other words, the brain intentionally does not recognize the foreign language. Taking these tendencies into account, learners should read English literature out loud, exposing the brain to the situation of hearing: motivating the brains for the recognition. Moreover, listening and speaking are excellent ways for brains to immerse in a new language. Taking an extreme example of practicing listening and speaking, one person spends a long time answering questions ceaselessly and quickly from two individuals sat beside without having to think twice. All of these activities help in the process of encoding information. Foos and Clark et al. showed that on adults both rehearsing

information and connecting new knowledge to old information are ways to encode information [15]. According to their work, the key thing is that better copies of memories are created by more memorable encoding methods. Furthermore, the better the copy, the easier the copy will be to retrieve within the mind.

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