

## CLINICAL REVIEW

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# The Link between Language Learning and Long-Term Memory?

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### **ABSTRACT**

Language acquisition has been shown to impact neuroplasticity, which is the ability of the brain to undergo structural changes in response to stimulus, behavioral experience, or cognitive demands. This research suggests how language learning affects human memory; the goal of this research was to find whether learning a foreign language could increase memory in human beings, and the goal of the research was to know the improvement felt by the subjects by increasing learning capacity. The objective behind the research is to find out the aim and motive of a learner in learning a language, and the methodologies used by them to learn it, which affect their long-term memory, which gets stored in the Hippocampus region. The conclusion draws on how humans acquire language, in three stages: encoding, retrieval, and storage, and how subjects felt the improvement in their long-term memory, after acquiring a new language. The results indicate that the subjects after learning a language felt improvement in their memory and ability to grasp.

### **KEYWORDS**

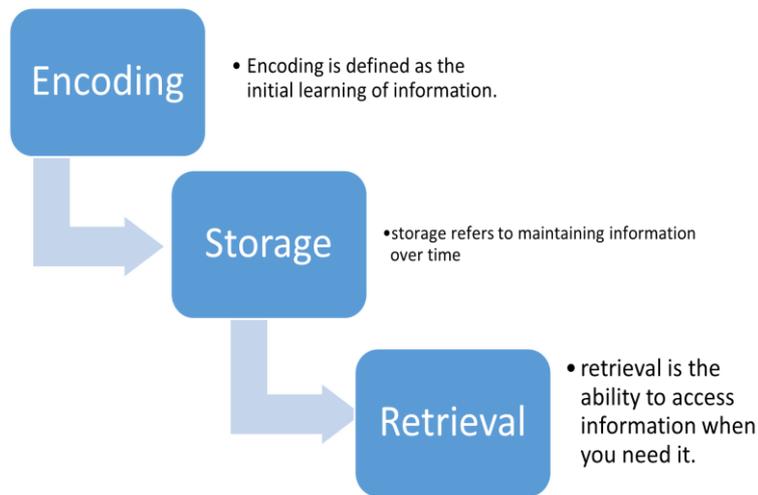
Psycholinguistics; Human Memory; Hippocampus; Human Brain; Language Learning

### **INTRODUCTION**

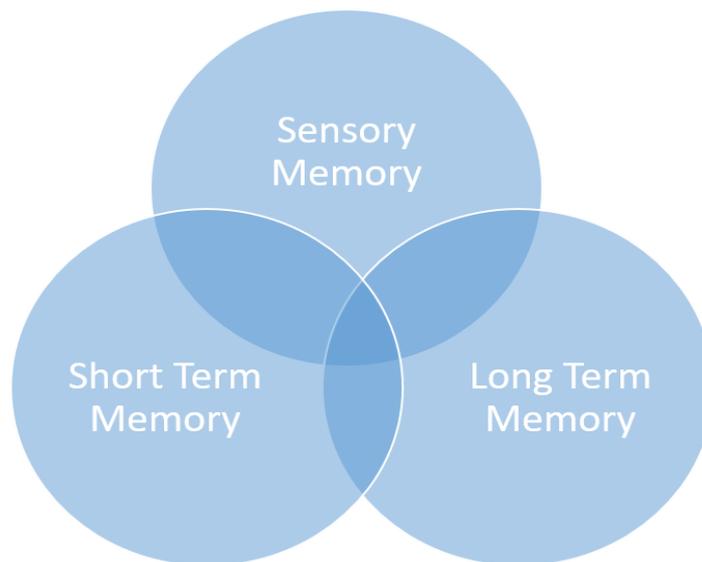
This study has focused on how language learning has an impact on Long-Term Memory after learning a foreign language compared to those, who just know their native language. Learning a language has become an inevitable phenomenon for Homo-Sapiens. As humans, we learn the language from conception, by hearing. The actual learning process starts in infancy and continues throughout life. Language not only helps us communicate with each other but also helps us understand each other. Monkeys and Humans have the same brain, the only difference is our superiority: language learning capacity (Figure 1) [1].

In an investigation of the effect of early language exposure on the brain, researchers compared Spanish Catalan bilinguals [2] exposed to two languages throughout that development, and a group cohort matched Spanish monolinguals (Figure 2). The bilingual group works left to have a larger Herschel's gyri relative to monolinguals,

an indication of a greater size of the auditory cortex. The researchers concluded that second language learning is a causal factor in the increased size of the auditory cortex. Our language learning capacity is felt in the Hippocampus region.



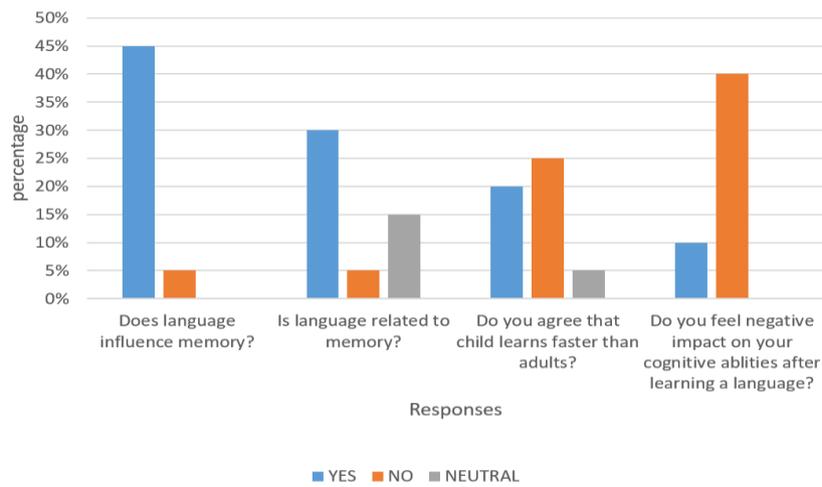
**Figure 1:** Stages of memory and their definition.



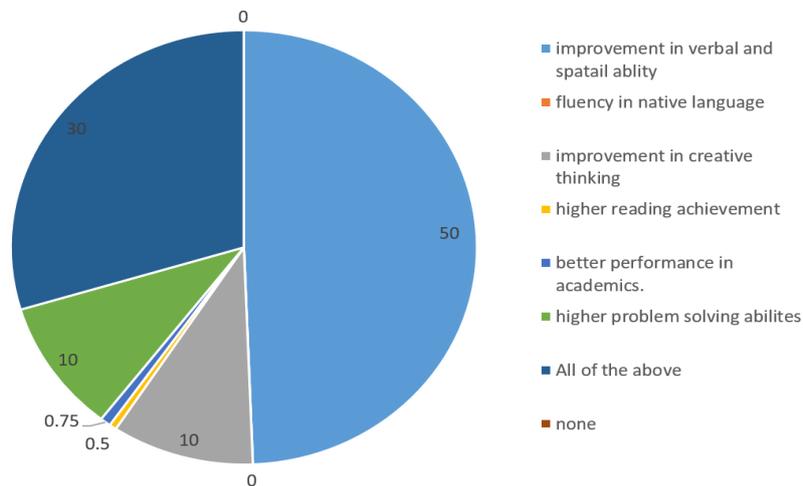
**Figure 2:** Different types of memory found in humans; the focus of this research is on the long-term memory.

The human brain has evolved over 100 years and ever since then (Figure 3), we have expanded our brain's capacity. The above study exposes us to the cognitive benefits felt inside the hippocampus, cortex, and human brain itself [3]. The cognitive benefits of learning a new language are undeniable. People who speak more than one language are with better memory, problem-solving and critical thinking [3] (Figure 4). Just after that, a study conducted in 2012 measured structural changes in the prefrontal and temporal cortices, particularly looking at changes in grey matter density. Grey matter is comprised of the cell bodies of neurons, and this area is generally associated with intelligence, attention, memory, and language processing. This contrasts with the white matter, which comprises axon bundles carrying nerve impulses between neurons and predominantly serves to connect

different regions of grey matter; it consequently determines the speed of information processing and memory recall.

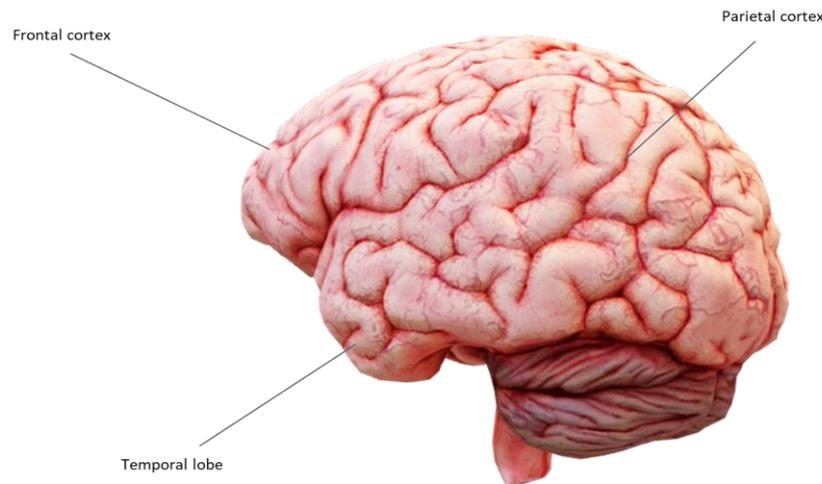


**Figure 3:** The survey conducted on 50 subjects and shows their responses in percentage.



**Figure 4:** The cognitive benefits felt by the subjects.

The study found that if a person learns something new, including a foreign language it increases the area of grey matter inside the prefrontal and temporal cortical [4]. Language could not exist without memory, in all its forms: working memory for sequential production and understanding, implicit memory for grammatical rules, semantic memory for knowledge, and episodic memory for communicating personal experience [5]. While learning a new language, it is first encoded in the Sensory memory, with rehearsals it is passed to the Short-Term Memory and then to the Long-Term Memory, where the memory is permanently stored. Long Term Memory is stored in the Hippocampus region and the capacity of the Hippocampus is influenced by language and learning capacity, learning capacity can be increased by learning a new language, engaging in complex activities, and physical exercises which could increase both hippocampi. The language areas of the brain are the two out of four lobes- Frontal, Temporal, and Broca's area, primary auditory area, and Wernicke's area. The temporal lobe plays a greater role while acquiring memory in the brain as we learn and remember, and retrieve information faster which gets encoded by hearing than what we read [brain of a bilingual, (Figure 5)].



As bilingual individuals age, their brains show evidence of preservation in the temporal and parietal cortices. There also is more connectivity between the frontal and posterior parts of the brain compared with monolingual people, enhancing cognitive reserve.

**Figure 5:** Showing the brain of a bilingual.

This study has surveyed 50 language learners, who know more than one language, and some with know their Native language as the only language. The Independent variable in the study is the Questionnaires' whereas the responses of the subject were the Dependent variables throughout the research. The Questionnaires were filled with the consent of the subjects and a pre-rapport was built. Each Questionnaire was analyzed without personal bias and there is no assumption about labelling 'good memory / bad memory'. The entire aim is to take a glance at how language learning improved the memory of the subjects and how significantly they felt improvement in their long-term memory. Working memory is defined as a dedicated, mental workspace for the storage, processing, and manipulation of information. One aspect of working memory includes the holding of information in a speech-based format, called the phonological loop [6].

## **METHODS**

### ***Aim***

To study the relationship between language learning and improvement in long-term memory.

### ***Objective***

1. To study the improvements felt by subjects after learning a foreign language.
2. To study the methodologies used by the subject as an aid for better learning.
3. To study the relationship between cognitive benefits to eustress of language learning.

### ***Sample***

Convenience sampling using questionnaires, self-reports, and interviews with 50 subjects, no minors were present in the study.

### ***Locale of the Study***

Due to the current COVID-19 situation, it wasn't possible to collect the data one-to-one person. The questionnaire was issued by online platforms and was filled by only adults above the age of 18, from all over India. Soon after that, a detailed self-report on language learning progress was asked by the respondents and were interviewed.

### ***Procedure***

To test the hypothesis-Effects of learning a new, a questionnaire was prepared. 50 subjects filled the questionnaire with their consent, the subject was mainly people who know and can speak more than one language and those who speak their native language as the only language, as the study wanted to find if learning a new language could improve their memory or not. The procedure was made simple, the subjects were asked to fill the responses via an online platform, and interaction was made with them after filling the questionnaires, regarding how they viewed the impact of the stated correlation and what fascinated them to learn more than one language. The discussion also was followed by listening to the mnemonics they used to improve their memory, which enables them to store the information for longer periods. The name of the subjects has remained confidential to the author of the paper.

Before the experiment, a pilot survey was conducted on 5 subjects, to predict responses, and make required changes to the questionnaire. Thereby the study was conducted on 50 subjects. SRC-Student Research Committee approval was taken, suggesting no minor subjects were required for the experiment and there was no /minimal risk level to the experiment. The research was done, inviting language learners to participate in the forum, and post-response, the platform was held open for discussions about how language and memory are correlated. Data was collected through a questionnaire, analyzed, and complied with graphs. The conclusion is derived from the responses as well as scientific – going research in the field of the Psycholinguistic approach. The names of the subject were not revealed anywhere, except those listed with that of the author. In trial 1, the subject felt a bit of a headache while remembering their experience, which shows they were trying to recall their long-term memory. Graphs, figures and diagrams were prepared using Microsoft Excel, PowerPoint, and GIMP, respectively. The data were analyzed under the supervision and verified by senior researchers. The self-reports were analyzed as the pre-requisite of writing the manuscript and mainly the mnemonics found among learners were: active recall, where they constantly recalled to remember and lock the information. Pomodoro Technique was highly recommended by learners to increase focus and concertation.

### **RESULTS AND DISCUSSION**

The subjects inform, that they could remember things easily, and faster and it felt if enough retrieval cues were provided, they could remember the entire information. The results, after analyzing the provided data demonstrated, a new perspective on language learning, and improving memory. 50% of the subjects had found an improvement, whereas 25% viewed the same self, the remaining 10%, and 5% had a neutral and negative opinion about their learning, feeling stressed by learning a language which wasn't their native one and felt cognitive load and a decline in the memory they had before learning. However, the subjects who were able to speak more than a language, felt that they had an increased capacity to remember, quicker learning power, and they were able to remember things for a longer period. 75% of the respondents suggested that they were satisfied with their learning process, however, 25% of responses suggested they couldn't learn a new language due to "excess explosion of memory" as they lacked using learning aids such as mnemonics and other devices. Those subjects, who could speak, only their native language, felt no improvement and thus, felt no or less improvement in their capacity to remember longer bar diagram is prepared based on the responses (further calculated to percentage) and analyzed (Figure 4).

The next suggested how the cognitive skills and abilities of the subjects were deeply impacted. Bilinguals have been shown to outperform individuals who can only speak one language in tasks that require working memory.

The response rate amongst those who can speak more than one language was more accurate in response to trials, which suggests that bilinguals have an advantage in executive functioning. Bilingual participants could also outperform monolinguals in tests that required areas of the brain unrelated to the processing of language. This included visual-spatial span, suggesting that language acquisition can improve working memory beyond language processing. Recent studies have shown that in around 97% of people [7], language is represented in the left hemisphere. However, in about 19% [8] of left-handed people, the areas responsible for language are in the right hemisphere and as many as 68% of them have some language abilities in both the left and the right hemispheres [9]. The significance of the response was proving the hypothesis, more than half of the responses suggest a positive day-to-day impact on their learning. Language helps us retain what we observe and register around us. From the gathered data, we find how our brain is impacted by what and how we speak. The fact of branching and words are linked to such a fundamental cognitive process as memory enables us to research the psycholinguistic approach. This hypothesis-driven research hence finds that subjects who knew more than a language and felt improvement should have a larger capacity in the hippocampus region. Bilingualism also affects white matter, a fatty substance that covers axons, which are the main projections coming out from neurons to connect them to other neurons. White matter allows messages to travel fast and efficiently across networks of nerves and to the brain. Bilingualism promotes white areas as you age. It gives you more neurons to play with, and it strengthens or maintains the connections between them so that communication can happen optimally. A child in the stage of infancy being exposed to multi-languages, shows a higher cognition process, higher problem-solving, and the ability to think critically in later stages of life. Children learn fast as compared to adults, as they have a natural ability to absorb the information, as a part of the developmental process [10].

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## ***Conflict of Interest***

The author declared no conflict of interest.

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