1. Neurolinguistics is the study of brain structures and functions relating to language learning and comprehension.
2. Recent studies have shown that learning multiple languages helps improve brain function and flexibility.
3. If multilingualism was encouraged in the United States and foreign language educations began earlier, the result would be a mentally stronger population with more opportunities for work and life all over the globe.

Neurolinguistics is an interdisciplinary field that studies the brain structures and functions concerned with language learning and its various sub-sections: phonetics (the study of speech sounds), phonology (the organization of those sounds into words and by extension languages), morphology or lexicology (the mental storage of words), syntax (sentence structure), and semantics (how words and sentences create meaning) [2]. Unfortunately for this field of study, neuroimaging processes, which are vital to any study of brain structures, were incredibly invasive and harmful to patients up until the 1970's, making neurolinguistics largely theoretical for most of its existence, with the vast majority of research coming from autopsies and not from the studies of living brains [9]. However, the invention of the magnetic resonance imaging (MRI) machine and the computerized axial tomography (CAT or CT) scan in the 70's, as well as the continuous improvements in those technologies from their invention to the present day have given researchers the opportunity to study the structures of the brain in ways that are painless, harmless, and safely repeatable for the patient, allowing for the study of neurolinguistics to grow and turn from theory into study and experimentation [9]. As such, new studies have become possible, such as the recent research into the effects of multilingualism on the brain throughout the 21st century.

An abundance of studies have been made into the differences between multilingual and monolingual brain functions. While these studies all researched different aspects of the multilingual brain, the majority came to the conclusion that proficiency in more than one language is linked to increased brain function and flexibility [3] [4] [5] [6] [8]. This increased plasticity seems to be focused on the left hemisphere of the brain, specifically Broca's Area and Wernicke's Area, both of which are heavily involved with speech and language learning [3]. The increased flexibility and learning ability in multilingual brains has been linked to the need to differentiate between the multiple languages, to keep the words, structures, and syntaxes separate, and to know when each should be used in order to more seamlessly switch between them [1] [7]. It also appears that the age at which the other languages are acquired affect the resulting increase in brain function: the earlier the child was when they started learning a language other than their dominant, or birth language, the stronger the connections in their brains are, and the higher plasticity their brains have [6] [7]. Studies have also researched the effects of learning specific languages on the English speaking brain; these studies surrounded the Mandarin, French, and Spanish languages. The study in Mandarin learners focused on lexical tone training, while the study of French and Spanish speaking bilinguals focused on literacy, but both saw a dramatic impact on brain function and learning ability, with the multilingual brains showing an expansion in the plasticity of the preexisting language learning learning areas of the brain and increased activation and function all over the brain [3] [5]. This is likely due to how fundamentally different these languages are from each other: the brain needs to stretch and become more flexible in order to accommodate the sounds and structures that

are so different. For example, Mandarin is a very tonal language (meaning that tone is a big part of communication: saying a word with a different inflection can give the word an entirely different meaning) while English is not. According to the study of English speakers learning Mandarin as a second language, the preexisting areas of the brain devoted to learning new languages grew larger and stronger, while other areas of the brain with similar functions were added to the language learning structures [3]. French, Spanish, and English are also very different languages, as seen particularly in the phonetics of each. Spanish is a language that is very easy to sound out, as the letter sounds are very consistent [5]. English and French do not have this luxury, and also take from very different roots, as English is a germanic language and French is a romance language (meaning that English is derived from Proto-Germanic while French grew from Latin). According to the study of these three languages in children learning to read, French and Spanish bilinguals showed hyperactivity in the areas of the brain linked to phonology, while only Spanish bilinguals showed this kind of activity when shown irregular words [5].

It is precisely these increases in brain function that make foreign language learning such a vital part of education world-wide. According to a poll in 2017, an average of 92% of students in the countries polled were learning a second language in school [10]. A different poll found that 23 of the 31 countries polled had over 50% of their student body learning two or more languages [11]. The United States stands in stark contrast to these numbers, with only 20% of American students learning a second language in schools [10]. If multilingualism was encouraged in the United States, and foreign language learning was made more mandatory in schools (particularly if language educations were started earlier, perhaps in early elementary school), then the United States would have a population that would have increased learning ability and flexibility, as well as more opportunities in a world that is increasingly globalized. This would in turn provide the world with a new generation of smarter, better prepared, and more conscientious workers who have a better understanding of the world outside of their own backyard, which is something that Americans today struggle with.

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