Cognitive effect of bilingualism: enhancement by stimulation

Linguistics, Language

Bilingualism is considered to have numerous benefits in modern society. It enables a person to have competitive advantage in a simple communicative aspect but also in social success. As a result, more emphasis is given to learning a new language from early age and bilingual is thought as a merit. However, there has been skepticism about bilingualism regarding cognitive development of children.

It was considered as hinderance regarding the children’s cognitive development. In a bilingual setting, the amount of input of each language is comparatively insufficient and unequal compared to monolingual setting. For many years, people thought that bilingual settings lacked the appropriate amount of input required for language competency and even cause confusion, leading to slow development of children.

However, recently, numerous studies and empirical evidences are supporting the argument that bilingualism is not only providing positive effects on social success, but also development in human body itself. The acquisition of communicate tool have additional benefit on individual physique and this additional characteristic implies significant features regardingeducationand social policy. Among the benefits that has been studied as a result of bilingualism, cognitive effect is the benefit that is directly related and observable regarding human body. Broad studies are being held to prove the relation with bilingualism, second language acquisition and cognitive benefits.

Although controversies rise regarding which comes first and second, such as cognitive superiority led to bilingualism or bilingualism led to cognitive

advantage, evidence and studies suggest that bilingualism seems to be the reason for cognitive advantage. On the other hand, mechanism of how language learning helps human cognition is controversial and leave space for research. From many possible explanations, the stimulation by language could be a possible reason.

If language usage is related to human cognitive sensory, using multiple language could be using multiple and diverse cognitive sensory compared to monolingual. As a result of additional usage of sensory, bilingualism might have resulted advancement in function. Through the mechanism of stimulation and enhancement, the correlation between bilingualism and cognition could be explained.

From previous research by Liquan Liu in 2017, it is possible to find benefits of bilingualism in cognitive development. Liu have suggested that bilinguals had higher cognitive performance and ability compared to monolinguals. For example, bilinguals were more likely to perceive new information or knowledge faster and were able to utilize it. The performance was not bounded only in language performance, but also non-linguistic performance.

Regarding language performance, Liu argued that bilinguals were better in “ discriminating two different language, communicationskills, learning of two speech structures simultaneously, and social communication skills.” (Liu 2017) In a non-linguistic perspective, bilinguals had “ higher neural sensitivity to stimulus, visual cues and higher working memory capacity”

(Liu, 2017) The abilities and performances shown are described as cognitive ability of human.

The concept and meaning of cognition entail broad meaning. As a result, to identify the effect of bilingualism, the necessity of narrowing down the concept of cognition arises. In terms of meaning of the word itself, cognition is described as “ the mental action or process of acquiring knowledge and understanding through thought, experience, and the senses.” (Cognition. Oxford Dictionary) It encompasses processing ability, agility and production abilities. Moreover, it includes both socio-cultural aspect and aspects in human body.

Amongst the multiple definition and aspect of cognition, it could be narrowed down to two aspects: cognition in social aspect and physical aspect. Social aspect of cognition could be referred to how people perceive social relation and world. It could be compared to the software in a machine that interpret stimulus and produce outcome. How bilinguals would perceive superior or elderly when using different language, or how different language users perceive the world could be an example.

Sapir-Whorf hypothesis could be considered as study regarding social cognition. However, cognitive effect in social aspect has possibility in interpretation as the process or result cannot be illustrated through clear data. On the other hand, cognition in physical aspect is a hardware that includes capacity and ability of our body. The activation rate of brain, the capacity to handle multiple task, how it is susceptible to damage, and how it

reacts to outside stimulus could be an example of physical cognition. Compared to the social aspect, physical cognition has less room for interpretation as it could be observed by scientific studies, such as neuroscienceand brain science. The performance of individuals' physical ability could be measured and interpreted.

When searching for evidence or case regarding physical cognitive effect of bilingualism, thecase studycomparing the point whendementiaarrive between monolingual and bilingual shows clear evidence of advantage. Bialystok compared the age when dementia occurred between 93 lifelong bilinguals and 91 monolinguals. The characteristic of two group was that monolingual group experienced higher education, which imply that they are not intellectually less developed then bilinguals.

Surprisingly, the result showed that in average, bilinguals showed 4 years of delay in occurrence of dementia. Moreover, the difference in the point of L2 acquisition did not show significance in delay of dementia. The delay of dementia could be interpreted as bilingualism affecting cognitive reserve, which is the capacity of brain defending brain damage. Bilingualism had enhanced the hardware of human brain.

In terms of software of human brain, study on executive function proves that bilingualism enhances the processing ability of human. Moreover, the effect was depicted regardless of the type and content of bilingualism. Executive function is a set of capacity regarding human cognitive ability. It is related to process control and production of human such as attention control,

reasoning and flexibility when solving problem. In terms of bilingualism study, bilinguals were measured to do Simon task and showed higher performance compared to monolinguals. Luk has conducted a research comparing monolingual and bilingual children.

The result showed that bilingual children had higher verbal fluency compared to monolingual children. Luk tried to measure the agility and amount that a child could produce in a given setting. Bilingual children had higher letter fluency in a condition where they had to produce words with just one letter given. Luk argued that letter fluency is an indication to measure how competitive a person is in controlling brain and memory recollection. The ability is related how human reacts to stimulus and utilize its brain to produce outcome.

The research conducted by researchers distinctively show that bilingualism and learning a language helps cognitive development. However, the reason why it helps human cognition is not explained as it is a finding by result. Moreover, as there are many variables that is related in human language learning it is difficult to narrow down the reason that what has caused the benefit. However, through neuro scientific research it is possible to assume and depict the reason and the process that cause the effect. By comparing bilingual and monolingual brain, it is possible to see the difference in brain development.

Moreover, if learning a language is a stimulus to brain and usage of language as a work out of brain, it is possible to distinguish and identify what kind of

process does it to brain. From a Darwinist perspective, body parts of living organism evolve and enhance its ability if there are constant usage and stimulus. On the other hand, body parts lose its function and atrophied if it is rarely activated or used. For example, wisdom tooth and coccyx has lost its function and atrophied as it lost its usefulness. From this frame, our brain and cognitive development could also be explained by stimulation and enhancement.

Among many neuro scientific studies, research comparing monolinguals and bilinguals in brain matters and activation shows the process and evidence of why bilingualism enhances cognitive performance in human. Firstly, Luk ‘ s white matter research and Abutalebi’s grey matter research on human brain show the development difference between bilinguals and monolinguals. Human brain’s central nerve system is constituted with two different matters, which are white and grey matter. Grey matter is a matter which contains neurons and synapses, and it is usually pinkish-grey.

Grey matter controls muscles in our body and perceives outside stimulus. On the other hand, white matter is constituted of axons that connects different grey matter parts in our brain. The integrity of white matter is related to the function of brain, affecting learning performance, utilization and connectivity of brain parts. It is believed that the volume and density affect general performance of human. The density and volume could be used to measure cognitive capacity of individual.

In terms of white matter volume, Luk and the research team observed the changes in connectivity and structure of aging lifelong bilinguals and monolinguals. The result showed that the white matter integrity was higher in corpus callosum compared to monolinguals. It resulted higher brain connectivity between other parts of the brain. The result could be interpreted as there were higher connection between different parts and it has led to enhancement in brain function. On the other hand, Abutalebi had observed and compared grey matter volume between monolinguals and bilinguals.

The research subjects were late bilinguals and monolinguals. Theobservationresult showed that bilinguals had bigger grey matter volume in inferior parietal lobule compared to monolinguals. Inferior parietal lobule is a part of brain which affects “ lexical representation, semantic integration, and phonological working memory”. (Michelli et al. 2004) Possible explanation is that bilinguals had more stimulus and activated the brain compared to monolingual. Moreover, in a simple view, if the only difference is the number of languages that is used, using more language might have triggered the development in brain parts.

Lastly, in terms of activation and utilization of brain, PASA hypothesis and related study provides the benefit of bilingualism. Through the study, it was possible to observe the activation and utilization rate of bilingual brain. PASA (Posterior-to-Anterior Shift in Aging) hypothesis predicts that there is a shift in neural activity in brain parts while human is aging. Generally, an average person shows decrease in neural activity in posterior sensory region of brain

and the anterior sensory region’s activation rate increases. (Grant et al. 2014)

However, bilinguals showed different result compared to average monolinguals. Bilinguals activation rate in posterior region did not show significant decline while aging as monolingual subjects did. Moreover, the connectivity between two regions were higher than monolinguals. Grant argued that the cause of this difference came from the language switching process. By switching language, it had stimulated and utilized different parts of the brain.

As a result, the researchers could observe better memory preservation, recollection, executive function and capability to recollect detailed information from past events. Moreover, bilingualism seem to benefit cognitive reserve, enabling higher restoration rate from brain damage. From the researches, the stimulation of additional language has enhanced both the software and hardware of the brain, which resulted higher cognitive ability.

To conclude, by integrating the findings from numerous researches, strong correlation between bilingualism and enhancement of cognitive ability seem to exist. However, the finding is susceptible to opposing argument as the findings are mostly empirical. The claim which comes first, the innate cognitive ability has resulted ability to perform bilingualism, could arise.

However, when considering other sensory or physique in human body is also developed through constant stimulation and utilization, brain and cognitive

development would also be like as it is. Moreover, by using neuro science techniques, the difference in development over time would give clear evidence and correlation between bilingualism and cognition. The discoveries would be able to provide deeper intuition and room for enhancement concerning language policy, schooling, child education and so forth.

Works Cited

- Abutalebi, J., Canini, M., Della Rosa, P. A., Green, D. W., Weekes, B. S. (2014) The neuro protective effects of bilingualism upon the inferior parietal lobule: a structural neuro imaging study in aging Chinese bilinguals. J. Neuro linguistics 33, 3–13. 2014. 09. 08
- Cognition | Definition of cognition in English by Oxford Dictionaries. Retrieved December 03, 2017, en. oxforddictionaries. com/definition/cognition
- Grant, A., Dennis, N. A., & Li, P. (2014). Cognitive control, cognitive reserve, and memory in the aging bilingual brain. Frontiers inPsychology
- Liu, Liquan. Lecturer inChild development, (2016) Western Sydney University. “ Bilingual babies are better at detecting musical sounds, research shows.” The Conversation, 13 Oct. 2017
- Mechelli, A., Crinion, J. T., Noppeney, U., O’Doherty, J., Ashburner, J., Frackowiak, R. S., et al. (2004). Neuro linguistics: structural plasticity in the bilingual brain. Nature 431, 757–757