

Bilingualism and Cognitive Development

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Abstract

This article tends to investigate the way bilingualism affects cognitive and linguistic performance through the life. Studies show that bilingualism influences cognitive development in early childhood and make conclusion that language and cognition are interdependent. Through this article it has been proved that when a bilingual person uses one language, the other one is active at the same time so thanks to bilingual developed ability to inhibit one language while using another, bilingual brain can have better task-switching capacities than the monolingual brain. According to the results in tasks that required mental or symbolic flexibility bilingual children did well. The physiological effect on brain base, are increased activation in the dorsolateral prefrontal cortex. Gray matter in the left interior parietal cortex equally with white matter volume is different in bilinguals. Bilingual access newly learned words easily, and had larger gains in vocabulary. Bilingualism has positive effects against cognitive decline.

Key words: Bilingualism, cognitive development, Inhibition.

1. Introduction

Policy makers and educators regularly are anxious that learning and living in two languages have long-term negative effects on their educational achievement and acculturation and will slow children. From the first half of the 20th century, the question of whether bilingualism affects the individual has been discussed as a topic of essential investigation(Majid N. Al-Amri,12,20) Researchers have fallen into two main directions:many researchers claim that bilingualism is a negative phenomenon that has negative effects on bilingual. The results of such studies led the researchers to claim that bilingualism is a mental burden for bilingual children causing them uncertain and confused (McLaughlin, 98, 1978).

Some evidence against bilingualism was first based on personal intuition; Saunders (1988) argued that bilingualism leads to language mixing and language confusion which results in a decrease in intelligence and a reduction in the ability to think. Some researchers agreed with the famous linguist Otto Jespersen, who expressed a negative opinion about the effect of bilingualism on the child's power of learning (Majid N. Al-Amri,12,20).

Sear (1924) in Romaine (1989) studied 1,400, 7-14-year-old Welsh/English bilingual children in five rural and two urban areas of Wales(Al-Amri, 2013,). He concluded that bilingualism resulted in lower intelligence because of the lower scores obtained by bilingual children in rural areas.

On the level of personality development, it is believed that speaking two languages is a negative factor in personality or identity development (Appel and Muysken,202, 1987). There is a number of researchers claim that bilingualism has detrimental effect on personality which leads to tension and emotional liability (Majid N. Al-Amri,12,20).

Recently, a number of researchers have produced evidence on the positive side that claim that bilingualism affects cognitive, personality, and educational developmentsand affects creativity and intelligence and is a great help to the child(Majid N. Al-Amri,14-16,2013). They declared that the bilingualism has positive effects that facilitate learning a new language, and they reported that in school bilingual children are more motivated and often ahead of other classmates, especially in intellectual development (Grosjean, 142, 1982).

Peal and Lambert found that the bilingual children are better than the monolinguals, especially in verbal and non-verbal tests which required mental manipulation and reorganization of visual patterns. Following Peal and Lambert, a number of researchers appeared to confirm the conclusion reached in the 1962 investigation (Majid N. Al-Amri,14-16,2013). They claim that bilingualism can have a positive effect on intelligence and can give

bilingual children certain cognitive advantages over their monolingual peers (Saunders, 85, 1988).

Anita Ianco-Worrall (1972) in Saunders (1988) studies Afrikaans-English 4-9 year-old bilingual children in Africa. He argued that bilingual children are better than monolinguals in analyzing language as an abstract System. He concluded that bilingual children were capable of separating the meaning of a word from its sound at a much earlier age than their monolingual peers (Majid N. Al-Amri, 14-16, 2013).

Concerning personality development, a number of researchers argue that bilingualism does not affect personality. McLaughlin (1978), for example, mentions that the emotional and psychological conflicts that the bilingual children experience are not emerged from learning two languages but by hostile attitudes of society. He argues that it is not bilingualism that leads to negative effects on personality but socioeconomic considerations. He also argues that the difficulties that arise from conflicts of biculturalism, having to adjust to two ways of life, may produce conflicts of behavior and the stigma of inferiority.

Definitely, cognitive scientists now suppose that one of ordinary and common feature of human cognition is learning and using more than one language. Knowing more than one language has considerable positive effects in terms of “cognitive flexibility”.

Researchers have discovered that the cognitive systems of bilingual children be different from those of monolingual children in some considerable ways. Learning, speaking, and using two languages may affect basic aspects of neural and cognitive development, potentially influencing the way those systems learn and represent information.

It is a clear fact that human cognitive processes depends on linguistic abilities, but what is important is how does bilingualism affect cognitive and linguistic processes in general (Ellen Bialystok, York University)

2. Cognitive Consequences of Bilingualism

Language co activation

Current research on the organization of two languages in the mind of adult bilinguals shows convincingly that both languages remain active during language processing in either language. This view is in contrast to earlier models that posited a “switch” that activated only the relevant language (Macnamara & Kushnir, 1971).

Researches have proved that when a bilingual person uses one language, the other one is active at the same time. When a person hears a word, he or she doesn't hear all of the word

at once: the sounds of the word arrive sequentially, before finishing the word, the brain's language system begins to guess the word by activating lots of words that match the signal. For bilinguals the matter is to some extent different, this activation is not limited to a single language; auditory input activates corresponding words in spite of the language to which they belong.

Language co-activation is so automatic and causes people consider words in both languages without obvious similarity. Some of the most persuasive confirmation for language co-activation comes from eye movements studying. The bilingual person uses the control mechanisms all the time he or she speaks or hears, because both of the language systems of bilingual person are always competing and active. This continuous practice makes the control mechanisms strong and changes the associated brain regions.

Because of this evidence for the simultaneous activation of both languages, some researchers have suggested that bilingual individuals must develop skills to select the appropriate language and inhibit the inappropriate language to use in different situations (Green, 1998; Kroll & de Groot, 1997).

In addition, it has been hypothesized that, practice in selecting the proper language and inhibiting the improper language impacts children's general inhibition and control processes and this make bilinguals to show better abilities in task switching, they can easily negotiate conflicting and misleading cues. This ability is related to the practice that bilinguals have in monitoring and selecting the appropriate language to use in different situations.

3. Bilingualism and the Executive Function System

The improvement of the executive-function system, which is located in the prefrontal cortex, is the most critical cognitive achievement in early infancy. Bilingual children step by step would be proficient in controlling attention, they masters the ability of shifting between tasks, they gradually expand working memory. They also master the ability to observe sets of stimuli and inhibit distraction. Significantly, these are the same cognitive processes that show the first evidence of decline in aging. So, if bilingualism affects executive functioning, the impact should be found across the whole cognitive system and during the entire lifetime.

Evidences declare that bilingualism has long life positive effect on these executive-control or self-control processes. What Self-control means is stopping one from doing

something? Perhaps, self-control—and the neural pathways that support it—become strong by practice. If this is so, children who speak two languages or more must regularly alter between them must learn to inhibit the words in one language to speak the other language. These are tasks that need the child to inhibit preferred patterns of responding e.g. not jumping up when one should be sitting, not taking the candy when told not to, doing a task in a new way rather than an old way.

Typically, in this kind of research that compare the performances between bilingual and monolinguals, the researchers compare tasks that are apparently similar but include one condition that additionally requires some aspect of executive control. For example Bialystok and colleagues examine the dimensional-change card sort task to 4- and 5-year-old children. In this task, children sort cards either by the color (red, blue) or shape (circle, square). First participants sort the cards by one dimension (e.g. color) but are later asked to switch to the other dimension (e.g. shape). Children typically continue on sorting the cards by the original dimension (Ellen Bialystok, York University). This study shows that, bilinguals were more successful in switching to the second dimension following the rule change, indicating higher levels of executive control. These findings demonstrate that bilingual children have greater cognitive flexibility so they are better able to negotiate the conflicting aspects of the task and switch back and forth between sorting by shape and sorting by color (Dr. A.V Yadappanavar, 2003)

New research in cognitive neuroscience supported the idea that knowing and using two languages results in advanced cognitive functioning in the area of executive function and self-control. Surprisingly, in the majority of verbal and non-verbal tasks, the bilinguals outperformed the monolinguals (language log, 2009). In general in tasks that required mental or symbolic flexibility bilingual children did mainly well, which lead researchers to the conclusion that bilingualism fosters greater cognitive flexibility in children.

Some researchers believe that on tasks that require conflict management, bilingual people often perform better. The definition of inhibitory control is ignoring competing perceptual information and focus on the relevant aspects of the input. Bilingual people often perform better than monolingual people at tasks that tap into inhibitory control ability.

4. Changes in Neurological Processing and Structure

In order to know which brain regions are active when bilingual people perform tasks when they are forced to switch between their two languages, researchers have used brain imaging techniques such as functional magnetic resonance imaging (fMRI).

When bilingual people have to switch between naming pictures, increased activation in the dorsolateral prefrontal cortex is seen. This area is associated with cognitive skills such as inhibition and attention. Along with dorsolateral prefrontal cortex, anterior cingulate cortex is involved too. Bilateral super marginal gyri, and left inferior frontal gyrus (left-IFG), regions are also involved in cognitive control. The (left-IFG) is involved in both linguistic and non-linguistic cognitive control. The subcortical brain areas, which is associated with sensory processing is the neurological roots of the bilingual advantage.

When young people regardless of being monolingual or bilingual listen to simple speech sounds without any intervening background noise, highly similar brain response is seen. when the same sound is played with presence of background noise, the bilinguals' neural response is significantly higher, reflecting better encoding of the sound's fundamental frequency. In bilingual people, flowing of blood in response to the sound is greater in the brain stem.

In addition to differences in neuronal activation, bilingualism looks affect the brain's structure as well. Being proficient in a second language, as well as earlier acquisition of that language, is related to higher gray matter in the left interior parietal cortex which plays an important role in handling the balance between two languages. Equally, white matter volume is different in bilinguals. It seems that bilingual are different in the way neurological structures process information, and also the neurological structures themselves.

5. Improvements in Learning

Improved cognitive and sensory processing may help a bilingual person to process information in the environment that lead a clearer learning. This kind of improvement may help clarify why bilingual adults, learn a third language better than monolingual adults learn a second language. The benefit of bilingual language-learning rooted in the ability to focus on information about the new language while reducing interference from the languages they already know. This ability allow bilingual to access newly learned words easily, and lead to a larger gains in vocabulary because of being skillful at inhibiting competing information. In contrast, oral language proficiency, particularly in terms of early vocabulary development, is usually delayed for bilingual children. Reading and the acquisition of literacy is less well

studied, but the existing evidence gives little reason to believe that bilingualism itself significantly impacts on the manner or ease with which children learn to read.

Researchers believe that bilingualism, positively influence attention and conflict management in infants, quite early, as young as seven months.

The effect of bilingual context had great influence on word awareness, and this led to higher processing skills in reading acquisition and this shows a link between metalinguistic awareness and reading preparedness. The benefits to the development of metalinguistic awareness which has stem in bilingualism were not dependent mainly on the acquisition of some significant degree of competence in the second language, which is a situation specific to children, rather, important profit were observed for children whose contact with a second language was restricted. So this shows that even one-hour practice per week might provide children with some cognitive and educational benefits (Elementary Education Online, 2007)

Some researchers believe that bilinguals develop an advanced metalinguistic awareness of the arbitrary nature of language, and this lead to higher awareness of the symbolic nature of linguistic forms. This kind of awareness lead to superior skills in symbolic reasoning, which may contribute to their ability to perform well in tasks in which symbolic distancing aids with inhibition. Others have suggested that because bilinguals continually learn more than one label for the same concept, it causes flexible conceptualization of the world.

Researchers believe that 2- and 3-year-old bilingual children, in comparing with monolingual children, established superior cognitive flexibility in a new word-learning task. The one-label-to-one-object assumption, called “mutual exclusivity,” is sometimes considered a positive constraint on early word learning that promotes the early learning of nouns, but it is also a constraint that has to be overcome in later word-learning stages in order to learn adjectives, synonyms, and higher order category names (Markman, 1989; Markman&Wachtel, 1989).

6. Knowledge Transfer

Lexical competition refers to how an individual recognizes spoken words; words that are learned newly will compete with existing words that seems alike. If an individual knows two languages, it would be better if the person’s cognitive system, treated them as entirely separate and no interacting systems; this is an older idea of “separate systems for each language, which gives way to new evidence on interactions in development and knowledge

transfer, the result of this theory is that knowledge of two languages deepens children's understanding of key mathematical concepts.

This separating idea has focused on the positive transfer depends on the strength of the children's knowledge in each of the two languages between first and second languages in language related areas, such as phonemic awareness, decoding through phonics and word recognition strategies (reading), use of a broader sense of cognates recognizing words by their origin or similarity, or both. The different languages for bilingual children may have typical and intricate special effects on improvement, particularly on object concept development. Studies of early cognitive development proved that individuals learn to categorize concepts differently in different languages.

The finding suggests that the advantage of being bilingual may suggest more than just attention control but may also be important for learning and for transferring knowledge. Learning new ideas in one language may have positive effect in understanding of the idea even when the idea is presented in another language.

7. Color perception

One of the differences between bilinguals and monolinguals is in cognitive differences, for example, in the area of color perception, Caskey-Sirmons and Hickerson (1977) asked Korean-English bilingual and Korean monolingual speakers to label colors based on eleven basic Korean color terms, and they found that in color perception there are more variability among bilinguals than monolinguals. The findings show that learning a second language have its own effect in the way Korean speakers categorize colors when using their native language

8. Protecting Against Age-Related Decline

The neurological and cognitive benefits of bilingualism also expand into older adulthood. It seems that bilingualism causes delay in a natural decline of cognitive function and maintaining what is called "cognitive reserve". The definition of cognitive reserves is the efficient utilization of brain networks to increase brain function during aging. By keeping the cognitive mechanisms sharp and helping to recruit alternate brain networks, bilingualism may help to this reserve. Older people have improved memory and executive control in comparison to monolinguals. Moreover bilingualism can also defend against illnesses that speed up this decline, like Alzheimer's disease.

9. Acquisition of Literacy in Bilingual Children

Bialystok and Herman (1999) discuss areas of development that have been shown to be fundamental to the acquisition of literacy identifying, specifically the effects that bilingualism has on children's early literacy development. They merge the findings to see if bilingual children differ from their monolingual one. They conclude that in all areas of development, bilingual children were progressing at a different rate and in a different manner in comparison to monolingual children; some differences might be to the advantage of bilingual children others might seem to the disadvantage of them, both of which require further analysis.

10. Conclusion

This body of research has converged on the conclusion that the experience of speaking two languages has broad implications for cognitive ability, enhancing executive control function across life. In bilingual person two languages, are active at the same time; auditory input activates matching words in each of the languages in spite of the language to which these words belong to. These evidences of co-activation of both languages showed that bilingual individuals must develop skills to choose the proper language and inhibit the inappropriate language to use in different situations.

Bilingual children gradually would be skillful in controlling attention; they become mastered in shifting between tasks. It is proved that bilinguals have greater cognitive flexibility so they can negotiate the conflicting aspects of the task and switch back. In general, bilingual children did mainly well, in tasks that required mental or symbolic flexibility; this lead researchers to the conclusion that, bilingualism fosters greater cognitive flexibility in children.

Bilinguals' mind is different in the neurological structures and process information, in physiological base the increased activation in the dorsolateral prefrontal cortex is seen. Dorsolateral prefrontal cortex, anterior cingulate cortex, super marginal gyri, and left inferior frontal gyrus (left-IFG), are regions that are also involved in cognitive control. Bilingualism looks affect the brain's structure. Gray matter and white matter volume is different in bilinguals. Improved cognitive and sensory processing in bilinguals may leads a clearer learning. This ability allow bilingual to access newly learned words easily, and lead to a larger gains in vocabulary because of being skillful at inhibiting competing information. The effect of bilingual context had great influence on word awareness, higher processing skills in

reading acquisition and this shows a link between metalinguistic awareness and reading preparedness.

An advanced metalinguistic awareness of the arbitrary nature of language lead to higher awareness of the symbolic nature of linguistic forms and superior skills in symbolic reasoning. Researchers believe that 2- and 3-year-old bilingual children, in comparing with monolingual children, established superior cognitive flexibility in a new word-learning task.

A large body of research has pointed to the importance of “cognitive reserve, the protection against cognitive decline that comes from active engagement in stimulating intellectual, social, and physical activities. A four-year delay of symptoms of dementia is much greater than any effect associated with drugs and represents considerable savings in health care costs.

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