

The Influence of Bilingual Learning Experience on Children's Cognitive Development

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Abstract. Bilingual education is becoming more and more popular in China. The reasons behind this phenomenon are objective environmental factors, that is, the market demand for English talents is growing day by day. There should also be subjective individual factors, that is, bilingual learning has something to do with children's own ability. However, the exploration of the impact of bilingual learning experiences on children's cognitive development is not in-depth enough. This paper aims to discuss the findings of previous studies on bilingual learning experiences and children's cognitive development. The core discovery demonstrates that bilingual learning experiences have beneficial influence on children's cognitive ability development, including executive function and inhibitory control. The relation between bilingual learning experiences and children's cognitive ability is positive. This paper has a reference value for future research on bilingual education experience and children's cognitive development, and also has reference significance for parents who are considering their children's education. Future researches should focus more on the relation between bilingual learning experiences and children's cognitive development.

1 Introduction

Nowadays, more and more Chinese parents begin to pay attention to bilingual education (that is, Chinese and English education). According to the 2010 data of the Ministry of Education's Statistical Bulletin on the Development of National Education, English training, as a pillar of China's education and training market, exceeded the mark of 15 billion yuan in 2009 [1]. There are several reasons behind this phenomenon. Firstly, tourism is developing rapidly; Second, the number of Internet users is huge, and 56.4% of the Internet language is English; Thirdly, English has been placed in an increasingly important position in general education [1]. This paper will focus on the impact of bilingual education, such as English and Chinese, on children's own abilities.

There is a large amount of research about bilingual education experiences, especially about the influence of bilingual experiences on language acquisition. In contrast, there are relatively few studies on the impact of bilingual experience on kids' cognitive abilities, and the researchers are not deep enough. Based on the situation mentioned above, it is significant to explore more about the impact of bilingual education experiences on cognitive abilities development of children.

This review mainly studies the influence of bilingual education on children's cognitive development. First, it will introduce the general situation of children's cognitive ability, including executive function, inhibitory function and so on. Then it explains the status quo of bilingual education in China, including Chinese and English education, Mandarin and minority language

education, and finally summarizes the relationship between bilingual education and children's executive function.

2 Cognitive development of children

According to Flavell, there have historically been several major waves of study on how children acquire information about the mind [2]. The first were inspired by Piaget's theory and work, either directly or indirectly. In Piaget's view, development of cognitive is the process of spontaneously concern on the structure of knowledge, which can be explained by transform an object, interpret an object, modify an object and understand an object [3]. Structures go through four stages of development. During the first 18 months of a person's existence, they go through a sensory-motor, pre-verbal period. The practical knowledge is developed at this phase. The creation of the schema for the permanent object is one instance. An object has no permanence for a newborn throughout the first few months of life. When it departs the sensory area, it stops to exist. No effort is made to locate it once more. Later, the baby will use spatial localization to attempt to locate it. A second step is pre-operational representation, which marks the start of mind, language, and the symbolic function. But at this point, there is no idea of conservation. A psychological test for the existence of reversible operations is conservation. In the third step, concrete operation starts. There are operations for categorizing, ordering, and building the concept of numbers, as well as spatial and temporal operations and all the basic operations for

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primary mathematics, elementary physics, elementary logic of classes and relations. A youngster can reason about hypotheses as well as objects in the fourth stage. The kid creates new logical operations, rather than only those involving classes, relations, and numbers [4].

Generally speaking, the development of cognitive ability is progressive. Cognitive abilities offer the foundation of innovation capability, which includes intelligence, inhibition, executive function, creativity thinking and so on.

2.1 Executive function of children

Creativity, flexibility, self-control, and discipline are all executive functions [5]. There are some disparities between children with worse and better executive functions. When IQ, gender, socioeconomic status, and other factors are taken into account, children who had greater self-control as children tended to have better health, earn more money, and commit fewer crimes 30 years later than those who had weaker self-control as children [6]. Executive function also has something to do with the age and situations. The Cognitive Complexity and Control (CCC) hypothesis proposes that executive function development may be explained by age-associated rises in the optimum complexity of the rules that children can construct and apply to solve problems [7].

There are six ways for developing executive functions in the early school years, according to Diamond and Lee: computerized training, mixing of computer and noncomputer games, aerobic activity, martial arts and mindfulness practices, tools and classroom curriculum, and Montessori [5]. Computerized training means employing computer games that gradually raise the demands on working memory. Mixing of computer and noncomputer games means children play both computer and noncomputer games individually. Aerobic exercise includes walking, running, bicycling, swimming, and so on. Self-control, discipline (inhibitory control), and character development are all emphasized in traditional martial arts, and this is why martial arts can help develop children's cognitive ability. Tools and classroom curricula, such as those social pretend play, are important for children's cognitive ability development since kids need to inhibit those behavior that are out of characters. Montessori is a kind of education method that involves children's natural interests. Because Montessori classrooms only have one of each material, children learn to wait until another kid finishes. Several Montessori exercises consist mostly on walking meditation [5].

2.2 Inhibitory control ability of children

The ability to suppress improper responses is known as inhibitory control. It is viewed as a unified concept that is essential to executive function, hard control, and many other facets of child development such as cognitive, social and emotional domains [8]. There is one way of

promoting children's inhibitory control ability, which uses go/no-go task as a measurement. A study demonstrated that even in 3-year-old toddlers, regular exposure to activities that support the learning of progressively complicated rule structures may enhance inhibitory control as determined by a go/no-go discriminating learning task [9]. The go/no-go task is great for measuring impulsiveness. It is a straightforward experimental strategy in which participants must answer by pushing an icon when they see a "go" signal and do not reply when they see a "no-go" signal. In conclusion, inhibitory control is important for cognitive development since it is a part of cognitive ability.

3 Bilingual education in China

3.1 Basic situation in China

Bilingual education is becoming increasingly popular in China, with kindergartens, primary schools, middle schools, and even colleges experimenting with and adopting bilingual education. According to a Beijing Academy of Educational Sciences expert, "there was a kindergarten in Beijing that used to have only a dozen children enrolled. It was desolate, and the machinery was idle. The school installed a multilingual kindergarten sign in the hopes of attracting more students." [10]. The discussion over bilingual education is heating up.

3.1.1 Chinese and English education

At present, there are still some problems in the preschool English education in China. Firstly, teachers are relatively poor. Since the threshold for entering kindergarten teaching is not high, schools can directly recruit teachers from the society, and non-kindergarten teacher graduates can also enter the institution through recruitment. Some preschool education institutions have teachers with low academic qualifications. Problems such as lack of professional training experience directly affect the quality and teaching methods of children's English teaching. Due to the lack of special teaching training, some teachers use indoctrination in the process of English teaching, only requiring children to memorize words and sentences. This indoctrination directly makes children lose their interest in English learning. The second is the impact of the teaching environment. Due to factors such as children's brain development and learning intensity, it is common for children to forget the basic English knowledge they have learned in preschool education. From above, it can be seen that there are still defects in the bilingual education of young children in China. Therefore, there are many opposing views on preschool English education in the society [11].

Also, there are other reasons for some experts to oppose bilingual (mainly Chinese and English) education. According to Li, bilingual education is different from foreign language education [12]. Li also strongly suggested that China can only implement foreign language education instead of bilingual education [12]. According to the Longman Dictionary of Language

Teaching and Applied Linguistics, Li defined bilingual education as a teaching method that uses two languages as the medium of instruction for non-linguistic subjects, which means using this foreign language to a level comparable to mother tongue [12]. Li believes that most people do not need this ability, and it is impossible to really cultivate students' ability to think in English [12]. All in all, English education is popular in China, and at the same time some experts still hold opposing opinion against this phenomenon.

3.1.2 Chinese and minority language education

It is well known that there are 56 ethnic minorities in China. For example, there are many Hmong people living in Guizhou Province, China. Leishan is an area in Guizhou. The local Chinese dialect and Hmong language are the main spoken languages in Leishan area. All schools take the promotion of Mandarin as the main task; the teaching language of teachers is Mandarin. All subjects except Hmong language are taught in Mandarin. Students read aloud and speak in Mandarin in class. At home, children communicate with their parents in Hmong. The main mode of Hmong-Chinese bilingual teaching is: to teach courses in Mandarin, and at the same time teach the Hmong language [13]. Generally speaking, the bilingual teaching model for ethnic minorities is: students learn Mandarin and their own language at school, use Mandarin for communication at school, and use their own language at home.

4 The relationship between cognitive development and bilingual education

4.1 Executive function

Many researches have explored the relationship between executive function and bilingual education. For example, two executive function assessments were administered by Esposito and Baker-Ward to bilingual or only speaking English kindergarten, second, and fourth grade pupils [14]. The two executive function tests are The Sun/Moon Task and The Trail Making Test.

The Sun/Moon task, mentioned by Archibald and Kerns, was aimed to discuss children's cognitive flexibility [15]. According to Archibald and Kerns, the Sun-Moon Stroop was made up of two pages of stimuli that were randomly ordered rows of colourful drawings of suns and moons. In the first condition, participants had 45 seconds to react "sun" to photos of suns and "moon" to pictures of moons as soon as possible throughout the rows. If a participant made a mistake, he or she was forced to stop and remedy the mistake before continuing. If a participant reached the bottom of the page before his or her time ran out, he or she was told to restart at the top. Participants in the second condition were told to say "moon" to photos of suns and "sun" to pictures of moons. In the Trail Making Test, the individual must link 25 successive objects on a piece of paper or a computer screen in a way that is similar to that

used in join-the-dots exercises. The test is divided into two sections. The objectives in the first are all whole integers from 1 to 25, which the participant must link in numerical sequence. The participant must join the dots in sequence while changing letters and numbers (1-A-2-B-3-C...) as quickly as possible without pulling the pen from the page in the second part. If the participant makes a mistake, the test administrator corrects it before the participant continues.

On the trail-making task, bilingual students outscored English kids in the second and fourth grades, according to their findings [15]. A possible strategy would be to utilize bilingual education as a scaled variable to see whether it is related to executive function performance. Bialystok and Barac carried out two experiments to assess the association between the amount of time kids engaged in an immersion course and how they performed on executive function assessments [16]. Executive function and metalinguistic tasks were assigned to children from English-only-speaking households who attended schools where teaching was either in Hebrew or French. The tasks were unlike with each other in both situations; however, there came the same outcomes: performance on the metalinguistic task was related to children's verbal ability and intelligence, while performance on the executive function task was pertaining with the amount of time children had participated in the bilingual activity and their level of bilingualism. As a result, children's executive function performance is influenced by their level of bilingualism and experience with bilingual schooling.

4.2 Inhibitory control

Stroop test was an experiment done by John Stroop [17]. Stroop carried out his study by presenting several iterations of the identical test with three various sorts of stimuli: color names shown in black writing, color names in ink other than the color specified, and squares of a certain hue [17]. Words and conflict-words were utilized in the first experiment [17]. The exercise asked the participants to read the written color names of the words regardless of the ink color (for instance, they would have to read "yellow" regardless of the font color) [17]. The second experiment used conflict-words and color patches as stimuli, and participants were asked to indicate the ink-color of the letters apart of the written word, in addition to name the color of the patches [17]. If the word "yellow" was written in blue font, they would have to say "blue" instead of "yellow." The participant said the color name when the squares were displayed. Stroop evaluated his participants at various degrees of practice at the tasks and stimuli used in the first and second experiments in the third experiment, investigating learning effects.

Lee Salvatierra and Rosselli revealed an obvious bilingual advantage in a basic Stroop type inhibitory control test, but no significant difference in bilingual performance compared to monolinguals in a more complicated task of attention orientation [18]. Another study found that when compared to monolingual peers of

the same age, bilingual students' working memory ability did not seem to be much better; however, bilingual students outperformed monolingual children in the test requiring inhibitory control and cognitive change [19]. Bilingual educated students, in their daily life, need process and handle two language systems on a regular basis. The bilingual speaker must suppress nontarget language(s) interference while speaking or identifying the target language in order to complete this job successfully. The multilingual speaker must also be able to create or understand language shifts while switching between two languages. Bilinguals are believed to have an edge in cognitive control due to their additional training in these abilities when compared to monolinguals [20].

From the above studies, it can be seen that bilingual education experience is closely related to children's various cognitive abilities, including executive ability and inhibition ability, and the overall trend is positive, that is, bilingual education is beneficial to children's cognitive ability.

5 Conclusion

The core content of this review is the impact of bilingual learning experiences on children's cognitive ability. Judging from the previous literature, the development of children's cognitive ability is progressive. In China, bilingual (mainly Chinese and English) learning is becoming more and more popular, but there are some shortcomings under the surface of the prosperity; experts also have different opinions on this phenomenon. In minority autonomous regions, however, children use Mandarin in their studies and their own language in private life. Finally, different experiments have shown that bilingual learning experience can improve children's cognitive abilities, such as executive ability and inhibition ability, which proves that bilingual learning experience is beneficial to children's cognitive ability.

Many previous studies have focused on the impact of bilingual learning experiences on children's language acquisition. In contrast, there are fewer studies on the impact of bilingual learning experience on children's cognitive improvement. This article can provide a reference for future research on bilingual education experience and children's cognitive development. At the same time, this can also explain part of the reason for the current phenomenon of bilingual education in China, and it can also provide a reference for parents when choosing their children's education methods.

Many previous studies have ignored the individual differences of children and some other factors, such as differences in educational investment of native families. If the factor of family economic income to which the child belongs is controlled, there may be different results. Future study can pay their attention on control those confounding variables. In this way, experiments will be more rigorous.

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