

Bilingualism and Executive Functions: Study of Working Memory, Selective Attention, Cognitive Flexibility, Planning in Monolingual and Bilingual Children**BENAISSA Ahmed^{1*}, BOUDOUH Mohammed²****a.benaissa@univ-blida2.dz**¹Language, cognition and interaction laboratory -University of Blida 2-Lounici Ali (Algeria)²Childhood and pre-school education laboratory -University of Blida 2-Lounici Ali (Algeria)

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Abstract. An emerging topic in cognitive development is the issue of bilingualism and whether it constitutes an advantage in children's performance on executive function. This issue has been discussed and debated in several studies; many of them have shown that bilingual children outperform monolinguals on tasks testing executive functioning, but other studies have not revealed any effect of bilingualism. The aim of the present study is to investigate the effects of bilingualism on children's executive functions (Working memory, Selective attention, Planning and Cognitive flexibility). Participants were a hundred children aged between 8 -11 years old; divided between fifty Arabic - French bilingual and fifty Arabic monolingual children. We administered the child language experience and proficiency questionnaire, digit span, visual attention, the wisconsin card sorting and Rey complex figure tasks in order to examine their abilities in executive functions. The results showed a significant difference between bilingual and monolingual children in executive function tasks. The bilingual outperformed monolinguals in all tasks administered in the study.

Keywords: Bilingualism, Executive functions, Working memory, Selective attention, Planning, Cognitive flexibility

Résumé. Parmi les sujets dominants sur dans le développement cognitif c'est la question du bilinguisme. Et des questionnements sur un éventuel avantage dans les performances des enfants dans les fonctions exécutives. Cette question a été discutée dans plusieurs études. Alors que de nombreuses études ont montré que les enfants bilingues sont meilleurs que les monolingues dans les tâches des fonctions exécutives. D'autres études n'ont montré aucun effet sur bilinguisme. l'objectif de cette étude est d'examiner les effets du bilinguisme sur les fonctions exécutives (la mémoire de travail, l'attention sélective, la planification, la flexibilité cognitive) chez les élèves. Les participants étaient cent enfants algériens, cinquante (50) enfants bilingues (arabe / français) et cinquante (50) enfants monolingues (arabe) âgés entre 8 et 11 ans. Nous avons administré le questionnaire de l'expérience et les compétences linguistiques, test de mémoire de chiffres, test d'attention visuelle, test de wisconsin card sorting, test de la figure complexe de Rey; afin d'examiner leurs capacités dans les fonctions exécutives. Les résultats ont montré une différence significative entre les élèves bilingues et monolingues dans les tâches des fonctions exécutives, les bilingues étaient meilleurs que les monolingues durant l'étude.

Mots-clés: Bilinguisme, Fonctions exécutives, Mémoire de travail, Attention sélective, Planification, Flexibilité cognitive

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1. Introduction and problematic.

Bilingualism is one of the most prevalent phenomena in the world's communities. It appears in the person's ability to master two languages at the same time with the same efficiency. The issue of bilingualism in Algeria has become an important subject in school with the existence of private schools and bilingual education. Over the past few decades, researchers have been interested in how acquisition and learning more than one language affects children's cognitive development. Many studies highlighted the impact of bilingualism on cognitive and executive functioning; however, their findings indicate a disagreement in the results between the advantages and disadvantages of bilingualism in cognitive and executive functioning.

Bilingualism is an individual's ability to master two or more different languages through several aspects, such as language proficiency and the ability to communicate with others. This ability requires a lot of mental functioning. Both Mehrani & Zabihi (2017) see that the majority of research in bilingualism (e.g. Green, 1998; Neville, 1993) focused on the representation of two languages in the brain. Researchers were interested in fundamental issues such as how the two languages are mastered together in a bilingual brain (p.421). According to Ross & Melinger (2016) when bilinguals speak, both fluent language systems become activated in parallel and exert an influence on speech production. In order to prevent blending or catastrophic interference between the two language systems, it has been suggested that bilinguals inhibit the non-target language, as a consequence of maintaining separation between the two linguistic systems; bilinguals are purported to develop enhanced executive control functioning (p.1). Early theorists such as Vygotsky, highlighted the role of language in cognitive and social development and attributed a structuring impact to language on the development of human cognition. According to Vygotsky, language helps us to distance ourselves from impulsive behaviours by playing an important role in the development of self-control behaviours, such as inhibition and planning (Mehrani & Zabihi, 2017, p 422). During what is mentioned, we suggest the question of the impact of language on cognitive functions through the influence of bilingualism on executive functions. There is a lot of research that found bilingualism is beneficial and give advantage for children. Bialystok (1999, 2001) argues that bilinguals have an advantage; because from using their dual-language, they must constantly control which language is being used; while at the same time, suppressing the use of the other language; this is leading to more fully developed neurological mechanisms for controlling such attention, this is referred to as the executive functions (Abdelgafar & Moawad, 2014, p3). Executive functions (EFs) are a set of cognitive processes that are necessary for the cognitive control of behaviour. According to Goldstein & Naglieri (2014), Lezak referred to EFs as “a collection of interrelated cognitive and behavioural skills that are responsible for the purposeful, goal-directed activity, and include the highest level of human functioning, such as intellect, thought, self-control and social interaction” (p.5). This means the importance of including the ability of working memory (WM), cognitive flexibility, inhibition and planning. Many research and studies focus on the EFs of children by comparing monolinguals with their bilingual counterparts on several types of EFs. Most of the results indicate that the performance of bilingual children in EFs tasks is superior, and bilingual children outperform than

monolinguals on a variety of cognitive and EFs tasks. According to Mehrani & Zabihi (2017), these studies found an advantage for bilingual children in cognitive measures (e.g. Bialystok, 1999; Bialystok, Craik, & Ruocco, 2006; Bialystok, Craik, & Ryan, 2006; Carlson & Meltzoff, 2008; Costa, Hernandez, & Sebastian-Gallès, 2008), cognitive control and inhibition (Martin-Rhee & Bialystok, 2008; Kovács & Mehler, 2009a, 2009b), on cognitive switching tasks (e.g. Bialystok & Martin, 2004; Carlson & Meltzoff, 2008). In working memory the results are inconclusive, some results found an advantage for bilingualism like (Engle, 2002; Kane, Bleckley, Conway, & Engle, 2001), others like (Bonifacci et al., 2011; Engel de Abreau, 2011) reported no significant differences in working memory capacity between bilinguals and monolinguals; therefore, the researchers investigate to examine the impact of bilingualism on the executive function between bilingual and monolingual children, and investigate whether bilingualism and linguistic diversity are an advantage or disadvantage, especially in childhood. For this reason, the following questions are formulated:

Are there statistically significant differences between the monolingual and bilingual children in working memory, selective attention, cognitive flexibility, planning?

1.1. Research hypotheses.

There are no statistically significant differences between monolingual and bilingual children working memory, selective attention, cognitive flexibility, planning.

1.2. Importance of the study.

The importance of the study stems from an interest in bilingualism in Algeria and its impact on the performance of school-aged children.

1.3. Aims of the study.

The aims of the study are the following:

- The comparison of performance on the tasks of EFs between monolingual and bilingual children.
- Investigation in the effects of bilingual experience on young children's EFs.
- Studying the mutual influence between language and cognitive functions.
- Investigation in the advantage of the bilingual education system.

1.4. Operational concepts:

1.4.1. Bilingualism.

Macnamara (1967) defined a bilingual as anyone who possesses a minimal competence in only one of the four language skills: listening, comprehension, speaking, reading and writing in a language other than his mother tongue (Hamers & Michel, 2000, p 6). It can be defined procedurally in this study as the child's proficiency in the four skills (listening, speaking, reading and writing) of the second language (French), by the course of academic achievement in French for more than three years; with child language experience proficiency questionnaire for the teacher and parents.

1.4.2. Executive functions.

This concept involves several cognitive processes contributing to information processing. It is defined procedurally as a child's performance in the tasks of study; working memory: phonological loop (Digit Span task, WISC), selective attention

(Visual Attention test, NEPSY1), cognitive flexibility (Wisconsin Card Sorting test), planning and visuo spatial sketchpad (Rey Complex Figure task).

1.5.Theoretical framework.

a. The notion of bilingualism.

Bilingualism was an unknown phenomenon to individuals, and was limited to the mere knowledge of some words in a foreign language; in this way, it is easy to find definitions of bilingualism, without taking into account both the skills, competencies, efficiency and usability of language; until the emergence of some researchers and their definition appeared with confusion and contradiction. In 1933, for example, Bloomfield observed that bilingualism resulted from the addition of a perfectly learned foreign language to one's own undiminished native tongue. He did rather confuse the issue; however, by admitting that the definition of "perfection" was a relative one (Bhatia & William, 2004, p7). In addition, Bloomfield (1935) believed that "native-like control of two languages ... Of course one cannot define a degree of perfection at which a good foreign speaker becomes a bilingual: the distinction is relative". This definition includes language proficiency equivalent to the native speaker level in the other language; generally, Hugo (1986) sees that definition like Bloomfield, believe tended to restrict bilingualism to equal mastery of two languages; in this definition, there is a clear contradiction between what is said in the first sentence with reference to native-like control of two languages, and the final sentence which mentions relative degree of ability (p.1). Hakuta (1990) added that this definition will exclude most individuals, and create a new definitional problem of what native-like control of a language means (p.1). There are some specialists in linguistics have suggested definitions which are characterized by some ambiguity, and raise questions, for example Weinreich (1953) says "The practice of alternately using two languages will be called here BILINGUALISM and the persons involved BILINGUAL unless otherwise specified; all remarks about bilingualism apply, as well to multilingualism; the practice of using alternately three or more languages" (Hugo, 1986, p2). This definition is characterized by alternate use in the number of languages used where there is no difference between bilingualism and multilingualism without major determining factor (such as language proficiency or ability to communicate). According to Hamers & Michel (2000), Macnamara (1967) proposed that a bilingual is anyone who possesses a minimal competence in only one of the four language skills, listening comprehension, speaking, reading and writing, in a language other than his mother tongue (p.6). This definition has more clarity than the previous; where he determines the minimum level of proficiency by possessing minimal competence in only one of the four language skills; on the other hand, in a different way, Titon (1972) suggests a different definition that includes ability to speak the second language; according to its own structure by no interference with the mother language, and thinking for each language separately, where he says "bilingualism is the individual's capacity to speak a second language while following the concepts and structures of that language rather than paraphrasing his or her mother tongue" (Hamers & Michel, 2000, p7).

b.Executive Functions.

It is difficult to define Executive Functions (EFs) because it is a general term that encompasses a range of different cognitive abilities. Hughes & Ensor (2005) see the

term of executive function refers to the higher-order cognitive processes (e.g., inhibitory control, working memory, attentional flexibility) that underpin goal-directed behaviours (p.645), Diamond (2012) indicates that Executive functions (EFs also called executive control or cognitive control) refer to a family of top-down mental processes needed, when you have to concentrate and pay attention (p.1), McAlister & Schmitter (2017) have pointed out that EF “broadly defined as a collection of correlated, but highly separable higher-order supervisory control processes involved in the flexible production, and regulation of complex goal-directed problem-solving thoughts and actions, particularly in non-routine situations” (p.926). The most theoretical research (Miyake et al, 2000; Lehto et al, 2003; Hughes & Ensor, 2005; Best & Miller, 2010; Diamond, 2013) of EF has agreed on three basic components interrelated, but distinct and different; it includes: working memory, inhibition (including inhibitory control, interference control, selective attention and cognitive inhibition), cognitive flexibility (also called set-shifting, mental flexibility). More broadly, the highest level (higher-order) of executive functioning abilities and skills include other skills, such as problem-solving, reasoning and planning. EFs skills are essential in mental health, and cognitive development, also expanding capacities, contribute primarily to language acquisition, academic skills, and achieve success in children and adults.

Working Memory (WM). According to Liang Ma et al. (2017), WM is a cognitive system with limited capacity that enables the temporary storage and manipulation of information. WM is necessary for such complex tasks, as comprehension, learning, reasoning, and comprises the following three components: the phonological loop, visuospatial sketchpad, and central executive system; the phonological loop is a temporary storage system in which acoustic or speech-based information can be held as memory traces that spontaneously fade; the visuospatial sketchpad temporarily stores visual, and spatial information; the central executive is responsible for attentional control, and information processing pertaining to WM; the phonological loop and visuospatial sketchpad comprise the information storage system of WM, and the central executive serves as the information processing system of WM (p.1)

Cognitive Flexibility. Cognitive Flexibility or “set-shifting” is the human ability to adapt the cognitive processing strategies to face new, and unexpected conditions in the environment (Cañas et al. 2003), it also represents the ability to adapt to changing tasks or problems; furthermore, it refers to the ability to shift from one mindset to another mindset; this often involves acting according to rules from one mindset that would be incompatible with rules from another mindset (Hutchison, 2008, p11). Wiseheart & Deák (2015) see that cognitive flexibility is the capacity to modify working memory, attention, and response selection in response to changing endogenous and exogenous task demands (p.31). Diamond (2012) believes that one aspect of cognitive flexibility is the ability to change perspectives spatially (e.g., what would this look like if I viewed it from a different direction?); to achieve this we need the ability to inhibit the previous perspective with activating, and upload another

perspective into the WM; according to this, cognitive flexibility requires and depends on inhibitory control and WM. Another aspect of cognitive flexibility involves changing how we think about something by changing the problem-solving strategy; if it is unsuccessful or isn't working, and try to find a new strategy to solve the problems (p.149).

Planning. As reported by Gangopadhyay, et al. (2018) Planning is a complex executive function (EF) task that entails evaluation, and selection of an appropriate sequence of behaviours that will lead to the desired goal. Planning is likely implicates multiple simple EF skills like inhibitory control, updating and switching (p.2)

2. Methods and Tools

2.1. Participants.

Participants were (100) school-age children in Algeria; composed of (50) Arabic - French bilingual children in private schools, and (50) Arabic monolingual children studying in public schools; all children aged between (8–11 years) in elementary school. Drawing on Macnamara's definition of bilingualism (1967), we selected bilingual participants who showed a minimal competence in only one of the four language skills: listening, comprehension, speaking, reading and writing proficiency in both languages, through performance in the French language course; in addition, parents completed a child language experience and proficiency questionnaire, and interview with the teacher about the competence and language skills of children within the classroom, based on this, bilinguals can perform similar activities in each language in the school environment; even though formal proficiency in either language may not match that of a monolingual speaker.

2.2. Material.

2.2.1. Child language experience and proficiency questionnaire (LEAP-Q) Marian, Blumenfeld, &Kaushanskaya (2007):

Parents completed a questionnaire regarding their children's language usage and provided family demographic information (parent education, language spoken by parents, family income, and race/ethnicity). Questionnaires were provided in Arabic and French, and parents completed the questionnaires in their preferred language. On the child language questionnaire, parents indicated the child's language background (children's languages according to acquisition and dominance), age of acquisition of some language behaviours, percentage of language proficiency (understanding spoken language, speaking, reading and writing), and what are the languages that allow children to interact with their common communication partners (mother, father, siblings, friends, and teachers), age at which their child began speaking French. Parents placed an 'X' on a line to provide an approximate indication of the percentage (between 0% and 100%) of time that their child spoke Arabic and French on a typical day; in order to confirm that bilingual children were speaking both Arabic and French daily; parent responses were used to categorize children into appropriate language groups, also an interview with each child participant regarding his/her daily language usage was conducted in order to verify the parent report.

2.2.2. Digit Span (repeating number sequentially and inversely):

It is a subtest of WISC III Battery; children are given sequences of numbers orally and asked to repeat them as heard in a sequential and reverse manner; this task evaluates the phonological loop in working memory.

2.2.3. Sub-test Visual attention:

It is a sub-test of NEPSY battery; children choose the faces similar to the face target among a range of different faces that represent a wrong stimulus; that is used to evaluate selective attention (inhibition).

2.2.4. The Wisconsin Card Sorting Test (WCST):

Developed by David Grant & Esta Berg (1948); a number of stimulus cards are presented to the child. The child is told to match the cards, but not how to match; however, he or she is told whether a particular match is right or wrong; this task is used to evaluate cognitive flexibility.

2.2.5. Rey complex figure test:

It is a complex figure where the child is asked to reproduce a complicated line drawing, first by copying it freehand (recognition), and then drawing from memory (recall); we used the test to evaluate planning and visuospatial sketchpad in working memory.

3.Results & Discussion.

To validate the hypothesis, we conducted a statistical analysis using a t-test where the results of the hypotheses are the following:

The 1st hypothesis: As Table 1 shows, the mean of bilingual children’s scores in the WM tasks was higher than monolingual children, (phonological loop MS: Mono= 15.34, Bilin= 19.90) (visuospatial sketchpad MS: Bilin=19.66, Mono=15.28). The value of the T-test for the differences between the two groups was: (phonological loop: -6.70, visuospatial sketchpad: 9.56); statistical significance at a level below 0.01. This shows that there are statistically significant differences between the monolingual and bilingual children in WM, and indicating that bilingual children performed better than monolinguals.

Table (1): Descriptive statistics on each WM tasks shows the differences between monolingual and bilinguals.

Measures WM	Monolinguals (N=50)		Bilinguals (N=50)		T test	significance
	MS	SD	MS	SD		
phonological loop	15.34	3.39	19.90	3.40	-6.70	<0.01
Visuospatial sketch pad	15.28	3.81	19.66	2.77	9.56	< 0.01

The 2nd hypothesis: As Table 2 shows, the mean of bilingual children’s scores in the accuracy of performance on selective attention task was higher than monolingual children (accuracy MS: Bilin=30.58, Mono=27.66); and the mean of bilingual children’s performance time on the task in selective attention it was less (faster) than monolinguals (time MS: Bilin=180.06, Mono=264.94). The value of the T-test for the

differences between the two groups was: (accuracy: -2.92, time: 12.58); statistical significance at a level below 0.01.

Table (2): Descriptive statistics on each SA task shows the differences between monolingual and bilinguals.

Measures SA	Monolinguals (N=50)		Bilinguals (N=50)		T test	significance
	MS	SD	MS	SD		
Accuracy	27.66	5.20	30.58	4.77	- 2.92	< 0.01
Time	264.94	45	180.06	15.81	12.58	< 0.01

The3rd hypothesis: As Table 3 shows, the mean of bilingual children's scores in the planning task was higher than monolingual children (MS: Bilin= 27.94; Mono=19.30). The value of the T-test for the differences between the two groups was: (-6.95); statistical significance at a level below 0.01. This shows that there are statistically significant differences between the monolingual and bilingual children in planning, and indicating that bilingual children performed better than monolinguals.

Table (3): Descriptive statistics on planning task shows the differences between monolingual and bilinguals.

Measure	Monolinguals (N=50)		Bilinguals (N=50)		T test	significance
	MS	SD	MS	SD		
Planning	19.30	5.14	27.94	7.11	- 6.95	< 0.01

The4th hypothesis: As Table 4 shows, the mean of bilingual children's scores in the cognitive flexibility task was higher than monolingual children (MS: Bilin= 38.68; Mono=30.24). The value of the T-test for the differences between the two groups was: (-7.64); statistical significance at a level below 0.01. This finding shows that there are statistically significant differences between the monolingual and bilingual children in cognitive flexibility, and indicating that bilingual children performed better than monolinguals.

Table (4): Descriptive statistics on cognitive flexibility task shows the differences between monolingual and bilinguals.

Measure	Monolinguals (N=50)		Bilinguals (N=50)		T test	significance
	MS	SD	MS	SD		
Cognitive flexibility	30.24	5.66	38.68	5.37	- 7.64	< 0.01

In this research, we aimed to investigate the effect of bilingualism on aspects of EFs. Our results show significant differences between monolinguals and bilinguals; where bilingual children outperformed monolinguals on EFs tasks.

The finding of our study coincided with the results of Bialystok (1999) study, which found the role of attention control in improving WM in bilingual children, and that the bilingual experience provides them with more advantage than the monolinguals. According to Mehrani & Zabihi (2017), the researchers (eg, Engle, 2002; Kane, Bleckley, Conway, & Engle, 2001) contend that in some cognitive tasks, particularly those requiring a high degree of attention, bilinguals often display enhanced WM performance. These findings have led some researchers to hypothesize that bilinguals may increase the efficiency of their WM function; because they have developed an ability to inhibit one language while using another. Hernández, Costa, Humphreys (2011) & Morales, Calvo, Bialystok (2012) found that bilingual children were faster and more accurate in their responses in WM compared with monolingual. In addition, Blom et al. (2014), White & Greenfield (2016), Cockcroft et al. (2017) Morrison, Kamal, Taler (2018) indicate that bilingualism has been found to enhance the ability to store, and manipulate information in WM; in their study, they recorded brain activity (event-related potentials, ERPs) between monolinguals and bilinguals; found that bilinguals have more cognitive resources available to complete cognitively demanding tasks, also in selective attention (inhibition) the findings of our study are congruent with the results of Bialystok et al. (2008), Blumenfeld & Marian (2011) who reported that bilingual children displayed a better performance on tests of inhibitory control. Mehrani & Zabihi (2017) mention that this finding provides support to theoretical accounts which suggest bilingual children experience control of attention in daily life; because they have to actively ignore labels from the language that they are not speaking at any particular time. This finding can also be explained in Vygotsky's theory (1978) which highlights the role of language in developing self-control behaviours, such as inhibition and planning, also Blom et al. (2017) found that bilingual children outperform monolinguals in attention (selective attention, interference suppression). These outcomes support the hypothesis that bilingualism influences the development of attention, and confirm that the effects of bilingualism on cognition are found across different sociolinguistic settings. Blom et al. (2017) added that much previous research like (Green, 1998; Bialystok et al., 2004) focused on interference suppression (Inhibition of similar stimuli) guided by the hypothesis that bilingualism affects inhibitory control; because bilinguals continuously need to suppress the interfering language. This is the basis of the advantages of bilingual experience.

In cognitive flexibility (Shifting ability), the results found in the study were consistent with the finding of Mehrani & Zabihi (2017), where they interpreted this result as a number of empirical studies have also shown signs and impact of improvement in children's shifting ability, as a result of bilingual experience. For instance, Bialystok & Martin (2004) & Okanda et al. (2010), Carlson & Meltzoff (2008) demonstrated that bilingual experiences from infancy show an advantage on shifting tasks over monolingual children. Bialystok & Martin (2004) speculate that this advantage is obtained through bilingual children's representation analysis and attention control. Mehrani & Zabihi (2017) added for this finding that bilingual experience affects the development of young children's shifting abilities, and more generally supports the earlier speculations that bilingual children's language switching enhances their cognitive shifting abilities. Bialystok et al. (2004); Prior

&Whinney(2010)see that through their daily practice of language switching, bilinguals can develop their shifting function because their language switching practice can be transferred to non-linguistic shifting tasks.

In planning, our finding is coincided with what was found with Gangopadhyay, McDonald, Weismer, Kaushanskaya (2018) that bilingual children are more efficient in planning throughout the duration of the task; while monolingual children showed significant gains with more practice. They cited a study conducted by Festman et al. (2010) to examine planning performance in bilinguals (bilingual adults switchers and non-switchers), where they found that the non-switchers demonstrated fewer errors on the Tower of Hanoi compared to the switchers; suggesting that bilinguals with stronger language control (switchers) are also better at planning. In another study examining bilingual planning, Craik & Bialystok (2006) administered a “cooking breakfast” planning task to younger and older monolingual and bilingual adults; they found superior planning performance in older bilinguals than in monolinguals. Gangopadhyay et al (2018) explain the main finding that bilinguals were more efficient planners than monolinguals; to the broader issue of the presence of bilingual advantages in executive functioning. Although the differences in the current study with the studies mentioned in the tool used to evaluate the skill of planning; where they used the Tower of Hanoi and the current study used the Rey complex figure test.

Conclusion.

According to literature and previous empirical studies, through the existence of a bilingual advantage in executive functions; the current study found the same results of experimental and empirical studies which are in the same context. This indicates the positive impact of bilingualism on cognitive development in childhood; in addition to the advantages, that help the child to achieve school skills and the interaction between cognitive processes and language through the mutual influence interrelated; it cannot acquire language without higher cognitive processes, and the positive effect of acquiring more than one language on cognitive abilities, and the human brain, besides the psychological and cultural aspect of the individual. Bialystok (2015) believes that bilingualism is an important factor in cognitive development in the linguistic environment in which the child is exposed, and the linguistic experiences contribute to and affect the quality of the cognitive systems. Researches have contributed to an examination of the impact of bilingualism on cognition and found a positive impact and advantage of bilingualism on executive functions.

The usual explanation is that both languages are always active in bilinguals; so the domain-general executive function system is incorporated into language processing to direct attention to the target language, and in so doing becomes reorganized; thus, bilingualism “trains” executive function through its constant recruitment for language selection. An enhancement of executive function is not trivial: executive function is a major predictor of academic success, and academic success predicts long term health and well-being. Bialystok (2015) mentions that the most important source of bilingual advantage is the ability to pay attention, inhibition and monitoring; where successful performance appears the ability to accurately respond to specific stimuli while ignoring other stimuli(p. 118-119); however, the results of the study are limited by the special frame, taking into account the characteristics of the sample, and the tools used.

We will make wider research and a larger sample with linguistic and cultural diversity in the future.

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