

## Effect of Bilingualism on the Development of Cognitive Processes among Children

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### Abstract

The aim of this paper was to evaluate the contentions and evidence supporting two divergent views about the existence of advantages offered by bilingualism. It also considered whether a definite conclusion was possible. A qualitative research methodology using the published evidence was adopted. The published evidence supporting or rejecting the advantages of bilingualism was collected using search terms in the Google Scholar search engine. A total number of 64 papers were collected, among which only five challenged the claimed advantages enjoyed by bilingual individuals. The papers were classified by their orientation and discussed. Based on the points derived from the evaluation of evidence, some conclusions were drawn. The overwhelming research support in favour of the existence of supposed bilingual advantage tends to suggest a conclusion in favour of that hypothesis. However, the points raised by critics, such as small sample sizes, inadequate matching of other variables, as well as defective measurements and analysis cannot be ignored as they question the very validity of the studies which support bilingual advantage. Future research needs to pay more attention to these aspects.

*Keywords:* advantages of bilingualism, bilingualism, bilingual acquisition, childhood bilingualism

**Cite as:** Alshahrani, A. (2017). Effect of Bilingualism on the Development of Cognitive Processes among Children. *Arab World English Journal*, 8 (4).

DOI: <https://dx.doi.org/10.24093/awej/vol8no4.31>

**Aim of this paper**

There are two strongly held divergent views among researchers on whether bilinguals have any advantage over monolinguals with respect to cognitive functions. One view, proposed by a large group headed by Bialystok and her associates, presents evidence to show that attention control and a superior capacity to analyse knowledge are two cognitive advantages of bilingualism. The other group has obtained some recent evidence rejecting the idea of any cognitive advantage deriving from bilingualism. The aim of this paper is to evaluate the contentions and evidence proposed by the two groups and examine whether a definite conclusion is possible.

**Background**

Surprisingly, there is relatively little reliable research on the effects of bilingualism on cognitive processes and development, especially in the case of children. This is a nascent area of research and much needs to be done to answer a number of related questions. One of the complexities involved in the research into bilingualism in children is the large array of disciplines that such research involves, including psychology, education and linguistics.

In an edited book on cognitive aspects of bilingualism, Kecskes & Albertazzi (2007) differentiated between the real world and the projected world of cognition. Although information conveyed by a language needs to be about this inner projected (mental) world, this is not shown well in the chapters of the book. Some unexplored areas included in the discussions are: the gender system in bilingual minds, the concept of context and task synergism, blending, and the relationship between lexical and ontological categorisations.

This paper is organised in the following manner. A brief outline of the research methodology used for this paper is given in the next section. This is followed by a section on the evidence in favour of bilingual advantage is discussed. The next section deals with the evidence presented by the opposing group to show that no bilingual advantages exist. The relative merits of the two arguments are discussed in the section following the two theories. Conclusions are drawn in the final section.

**Research Methodology**

Since the topic is dealt by using evidence in favour of and against bilingual advantage, research publications available on both sides of the argument were searched for in the Google Scholar search engine using appropriate search terms. In the first stage, the papers available from the first five web pages of the Google Scholar selection were downloaded and then classified based on their contents, irrespective of the year (any time) of publication. In the second stage, more recent papers were searched for, specifying a publication date range from 2013 to 2017. A total of 64 papers were obtained by these methods, of which 59 research works argued in favour of bilingual advantage while the rest were counter to this theory.

The intention of this paper is to present a simple qualitative discussion rather than a quantitative meta-analysis based on international reviewing standards like Cochrane.

### **The evidence in favour of the bilingual advantage**

A large majority of the papers offering support for a theory of bilingual advantage belong to the Bialystok group. For convenience, works supporting the likelihood of bilingual advantage are discussed more or less chronologically, deriving mutual support from related works wherever applicable.

#### *Early works*

Ianco-Worrall (1972) notes that bilinguals developed the ability to separate word sound from word meaning earlier than monolinguals. The conclusion is derived from the results of a test on 4-9 year old children. In this study, bilingualism is defined as dual language acquisition in an environment of one child, from one language home. Out of three hypotheses connecting bilingualism with various abilities, only one related to cognitive ability of a kind is verified in the dissertation work of Ben-Zeev (1972).

In a very early study, Slobin (1973) proposes that children must have preliminary internal structures to assimilate both linguistic and non-linguistic inputs. He argues that the development of semantic intentions stems from general cognitive development. He uses linguistic input to identify intended meaning, drawing on his theories about the nature of language use and general cognitive-perceptive strategies. He also takes note of limitations enforced by operative memory. In Slobin's model, information from existing information structures are assimilated and absorbed into new inputs. Increasing age expands these realms into new dimensions.

Cummins (1976) tries to resolve the inconsistency between earlier reports and current reports regarding the relationship of bilingualism to cognitive consequences. Earlier studies have reported a negative relationship between the two. The current results reported a positive relationship. The contrasting results are partly due to the fact that the recent studies were conducted on balanced bilinguals in what were claimed to be additive bilingual settings. In these cases, the bilingual subjects had attained a high level of competence in their second language without affecting their competence in their first language. In earlier studies, in bilinguals from minority groups, the competency in the first language was being gradually replaced by competence in second language. Thus, the bilinguals in these cases paid for their competence in the second language by lowering competence in the first language. The author proposed a hypothesis Based on this difference: the level of language competence attained by a bilingual child may mediate the effects of the bilingual learning experience on cognitive growth. A threshold level of linguistic competence may exist, beyond which the bilingual child needs to attain a certain level of both competencies to avoid cognitive deficits and to allow potential benefits of bilingualism to affect general cognitive functioning. There is no indication that the hypothesis was verified by any other work.

The objective of the Irish study by Cummins (1978) was to assess the level of metalinguistic awareness and the ability to evaluate contradictory and tautological statements among children. A test to evaluate this was administered to grade Three and grade Six English-Irish bilingual children and to control groups of unilingual children matched on Intelligence Quotient, Socio-Economic Status, gender, and age. The findings showed a greater awareness of certain properties of language and a better ability to evaluate contradictory statements among both

grades of the bilingual children compared to the control group. Thus, it was proposed that bilingualism can increase a child's metalinguistic awareness and promote an analytic orientation to linguistic input.

In a later paper, Cummins (1979) further proposes the developmental inter-dependence hypothesis. According to this hypothesis, "the development of competence in a second language (L2) is partially a function of the type of competence already developed in L1 by the time that intensive exposure to L2 begins" (p.3, abstract). The threshold hypothesis proposed in the earlier work was reiterated. Thus, the hypothesis states that "there may be threshold levels of linguistic competence which a bilingual child must attain both in order to avoid cognitive disadvantages and allow the potentially beneficial aspects of bilingualism to influence his cognitive and academic functioning." (p.3, abstract) The two hypotheses were combined to propose that "a cognitively and academically beneficial form of bilingualism can be achieved only on the basis of adequately developed first language (L1) skills." (p.3, abstract).

In their work, Potter, So, Von Eckardt, & Feldman (1984) do not obtain support for a simple word association hypothesis, but have found support for a meaning mediation hypothesis to explain the association between equivalent words in the two languages of a bilingual person. Thus it is suggested that the only connection between words in two languages is through an underlying conceptual system to which pictured objects also have access. In this paradigm a certain time seems to be needed to identify the word for a stimulus picture in the first language and possibly also a certain time is needed to translate from the first to second language.

### ***Cognitive aspects of bilingualism advantages***

In one of E. Bialystok's early works (Bialystok, 1987), she proposes a framework in which metalinguistic awareness consisted of two processing components: the analysis of linguistic knowledge, and the control of linguistic processes. In this model, global assessments of metalinguistic ability by bilingual subjects are said to lead to conflicting results due to the enhancement of only the latter of these processing components in a bilingual environment. Attention control and the analysis of knowledge are two processes found to develop differently in monolingual and bilingual children when solving linguistic problems (Bialystok, 1988).

According to the theory of cognitive complexity and control (CCC) proposed by Zelazo & Frye (1997), preschool children lack the necessary conscious representation and executive functioning to solve problems based on conflicting rules. Related to this, in a later work, Bialystok & Majumder (1998) evaluate the effect of different degrees of bilingualism on the non-verbal problem solving abilities of children in grade three. In their study, a French-English and a Bengali-English bilingual group are compared with an English monolingual group. The problem solving task is designed to measure the subject's control of attention and analysis of knowledge. In earlier studies, these capabilities have been shown to be different for monolingual and bilingual children when it came to solving linguistic problems. Language proficiency tests show the French-English group to be relatively more balanced bilinguals and the Bengali-English group to be partially balanced bilinguals. The results show the balanced French-English group to be better in solving non-linguistic tasks requiring the control of attention. However, there is no difference among the three groups with respect to the ability to analyse representational structures. Thus,

balanced bilinguals do appear to carry their linguistic advantages to non-linguistic tasks requiring close attention.

In the studies of Bialystok (1999), she identifies analysis (manipulating representations) and control (selective attention) as the two main components of language processing. One of these, control, is shown to develop earlier in bilingual children than in monolinguals. The author also identifies the role of attentional control in cognitive development, thus supporting CCC theory.

Depending upon discourse demands, at some level bilinguals need to control two languages during speech. This affects their attentional networks. Fan, McCandliss, Sommer, Raz, & Posner (2002) discuss three types of attentional networks among bilinguals. These three attentional networks are: becoming alert, orienting and executive control. Bilinguals are faster in performing tasks and specifically are more efficient at becoming alert and managing executive networks. More content is added by bilinguals on presentation of an alerting cue and it is more useful to resolve conflicting information. Their switching cost between trials is less than that of monolinguals. The most efficient attention mechanisms appear to be produced by young adults who are at the peak of their attention capabilities. In another work by Bialystok, Craik, Klein, & Viswanathan (2004), the ability to control processing among bilinguals decreases less with age than among monolinguals. Thus, bilingualism effectively helps to off-set age-related loss of the ability to control some executive processes.

One experiment compares monolingual and bilingual children who either do or do not have much experience with playing computer games. The experiment is done on specially designed Simon tasks by (Bialystok, 2006). Video-game playing children are faster under most conditions. They are even better when control conditions do not include conflict from irrelevant positions. On the other hand, bilinguals are faster only when the most controlled attention is required to resolve conflict between the position and the stimulus. The potential of experience to modify performance and subtle differences in the processing of different versions of the Simon task are clear in these results.

In the continuing work on bilingual development in relation to cognitive abilities, Bialystok (2007) observes that the experience of controlling attention to two languages accelerates executive control processes in early childhood. It continues to sustain the cognitive control advantages through adulthood. During advanced age, it protects from the decline of these processes. In the findings reported by Carlson & Meltzoff (2008), native bilingual children perform significantly better on the executive function. They are better than both other groups, especially in the tasks that appear to call for managing conflicting attentional demands (Conflict tasks), but not impulse control (delay) tasks.

Based on a review and meta-analysis, Adesope, Lavin, Thompson, & Ungerleider, (2010) find that bilingualism is associated with many cognitive outcomes. These included increased attentional control, working memory, abstract and symbolic representation skills and metalinguistic awareness. The term metalinguistic awareness refers to the ability to think about the language. Even when bilinguals speak one language while suppressing the other language, both

languages are active. Using many assessment tools, Hilchey & Klein (2011) observe higher cognitive abilities among bilinguals than is the case with the monolingual group.

The findings of Morales & Bialystok (2013) show that working memory is better in bilingual children, especially if the task contained additional executive function demands. In a comparative study, all bilinguals perform executive control tasks similarly. Language tasks are performed better by the bilingual groups whose instructional language is the same as the test language. Thus, specific bilingual experience influenced performance in verbal tasks (Barac & Bialystok, 2012). The results obtained by Morales, Calvo, & Bialystok (2013) confirm the advantages of executive functioning and working memory among bilingual children compared to monolinguals. The cognitive effects of bilingual advantages are highlighted by Kroll & Bialystok (2013) as bilinguals outperform their monolingual counterparts on tasks that required ignoring irrelevant information, task switching, and resolving conflict.

According to Macnamara & Conway (2014), experience in engaging general cognitive mechanisms to manage two languages can explain the bilingual advantage. Also, bimodal (signed language–spoken language) bilinguals do not exhibit this advantage due to the reduction of conflict and control demands by distinct language modalities. The mechanism behind bilingual advantages may arise from a combination of the magnitude of bilingual management demands and the amount of experience managing those demands. In an experiment, bimodal bilinguals are given the experience of managing high bilingual management demands. These participants outperform themselves from two years previously on demonstrating the cognitive advantages of bilingualism. High socio-economic status and bilingualism are independently associated with better language performance and executive function in a study by Calvo & Bialystok (2014).

In an investigation of US Latino students by Riggs, Shin, Unger, Spruijt-Metz, & Pentz (2014), bilingualism significantly predicts an advantage in the summary executive function score and working memory. Bilingual proficiency is positively related to executive function. While controlling for a potential third variable in bilingualism, prospective associations between bilingualism and executive function are demonstrated in this study, together with a significant role for working memory in the relationship. In their study, Singh et al (2015) compare 114 monolingual and bilingual infants in a very basic task of information processing and visual habituation at 6 months of age. The results show a generalized cognitive advantage in bilingual infants that is broad in scope, early to emerge, and not specific to language.

Monolinguals and bilinguals with or without reading difficulties are compared for executive functioning by Jalali-Moghadam & Kormi-Nouri (2015). Reading difficulty reduces executive control more prominently in bilingual children than monolingual children with reading difficulty. Thus, although bilinguals show general superiority in executive functioning with respect to normal reading, they fail to show superiority when they have reading difficulties. Executive functioning is important for both reading skills and bilingualism.

The study reported by Poarch & Bialystok (2015) consist of 203 children, 8–11 years old, who are monolingual, partially bilingual, bilingual, or trilingual performing a flanker task. The results show that bilingualism affects multitasking. Bilingual children outperformed monolinguals

on the conflict trials in the flanker task. This result confirms the existence of a bilingual advantage in executive functioning. The inclusion of partial bilinguals and trilinguals set limits on the role of experience. Partial bilinguals perform closer to monolinguals and trilinguals perform closer to bilinguals. These results suggest that degrees of experience are not well calibrated to improve executive functioning. Because both languages of bilinguals are constantly active, the model hypothesizes that bilinguals need to manage attention to the target language and avoid interference from the non-target language. This process is likely to be carried out by recruiting the executive function (EF) system, a system that is also the basis for multitasking.

In a review, Bialystok (2015) argues that attention, as a component of executive function, emerges early in the developmental process and initiates the differences in bilingual children from their infancy.

### ***Linguistic and other aspects of cognitive advantage of bilingualism***

Lexical production in early sequential bilinguals (Spanish-English) is studied by Kohnert, Bates, & Hernandez (1999). Spanish is learned as the first language at home. Formal English learning starts at the age of five. Although both languages develop with age, the initial dominance of Spanish in the youngest children gives way progressively (with age) to relatively balanced skills in both Spanish and English in middle childhood and culminate in a clear English dominance among adolescents and young adults. The response time for these lexical effects decrease with increasing age. The developmental changes in the speed-accuracy trade-offs in the bilingual condition can be due to a change in the ability to resist cognitive interference during word production.

A common belief is that there is a stage among children learning two languages simultaneously during infancy, at which, they cannot differentiate their two languages. Almost all studies show bilingual children mixing elements from both languages. These results are assumed to provide evidence for a unitary, undifferentiated language system, known as the unitary language system hypothesis. However, Genesee (1989) questioned this assumption, pointing out that bilingual children developed differentiated language systems from the beginning and could use their developing languages in contextually sensitive ways. The possible role of parents was suggested as an area for future research.

The objective of a study by Bialystok (2001) was to evaluate the differences in metalinguistic development between monolingual and bilingual children in terms of their awareness of words, their syntax and phonology. The difference between monolinguals and bilinguals with respect to the types of tasks they perform better are identified. In all three tasks, there was no uniform superiority demonstrated by either mono or bilingual children. Different degrees of analysis and control affecting the tasks differently among either mono or bilingual children may account for the observed variations.

From a comparison of English and Mandarin Chinese monolinguals and Mandarin-English bilinguals, Goetz (2003) notes a significant superiority of bilinguals to monolinguals in all tasks. Greater inhibitory control, greater metalinguistic understanding, and a greater sensitivity to sociolinguistic interactions with interlocutors were proposed as reasons for the bilinguals being

relatively superior. In a similar vein, in two studies involving identification of the alternative image in a reversible figure, Bialystok & Shapero (2005) note that bilingual children were more successful than monolinguals in seeing the other meaning in the images.

According to Bialystok (2007) some aspects of reading ability, notably phonological awareness, are rooted in general cognitive mechanisms and transfer easily across languages, whereas others, such as decoding, are more language dependent and language-specific and need to be relearned with each new writing system. Writing systems and the differences between them have a greater impact on children's acquisition of literacy than previously believed. Not surprisingly, this relationship between writing and literacy has also been found to be related to emerging ability with phonological awareness, and such factors have a subtle influence on children's emerging concepts of print.

Based on their cumulative research, Bialystok, Craik, & Luk (2008) note that younger participants performed certain tasks better than the older ones. This confirms the effect of the ageing process. There is no difference between monolinguals and bilinguals regarding working on memory tasks. Monolinguals perform better in lexical linguistic tasks. Bilinguals perform better on executive control tasks. The author uses bilinguals from many languages with English as part of the samples.

The benefits and costs of the bilingual experience on the cognitive and linguistic performance of individuals across their lifespans are discussed by Bialystok & Craik (2010). The costs are associated with bilinguals having lower formal language proficiency than monolinguals. The benefits are related to the enhanced executive control in nonverbal tasks requiring conflict resolution.

In the studies by Bialystok (2010), the bilingual advantage is found not only for traditionally demanding conditions, but also in processing complex stimuli in those tasks requiring executive processing components for conflict resolution. These include switching and updating, even when no inhibition appeared to be involved. The significant effect of bilingualism in eight-year old children as shown by superior performances in spatial complex reasoning tasks in the context of academic achievement is discussed by Greenberg, Bellana, & Bialystok (2013). A significant level of problem-solving ability is implied in these performances, which is an essential requirement of high academic achievement.

The gradual development of metalinguistic advantages is noticed by Bialystok, Peets, & Moreno (2014) among children in a French immersion programme. Tasks requiring more executive control, in terms of grammaticality judgments, appear later. Performance in some tasks improve with age, but do not exceed the performance of monolinguals. For example, advanced verbal fluency develop only when bilinguals reach the fifth grade.

According to Blom, Küntay, Messer, Verhagen, & Leseman (2014), bilingualism increases working memory among children from low social economic status in a Turkish-Dutch population. Working memory tasks involving both storage and processing increase independently of language, but proficiency is also related to verbal tasks. These findings support the hypothesis that experience

with dual language management influences the central executive control system that regulates processing across a wide range of task demands.

Based on a research on bilingual deaf children, McQuarrie & Parrila (2014) conclude that a signed-language phonological system facilitate the establishment of a “functional” representational base to support reading acquisition for bilingual deaf learners.

According to Aguilar-Mediavilla, Buil-Legaz, Pérez-Castelló, Rigo-Carratalà, & Adrover-Roig (2014), a sample of bilingual Spanish-Catalan children with specific language impairment (SLI) exhibits a delay in processing abilities when they are aged six. Both comprehension and letter identification are affected, but there is no problem with visual attention. Normally, at the kindergarten stage, phonological awareness and verbal fluency can predict the reading outcomes at school age.

In a research comparing the comprehension of active and passive English sentences in 7–10 year old bilingual and monolingual children, Filippi et al. (2015), obtain results supporting the association of bilingualism with better accuracy in comprehending syntactically complex sentences in the presence of linguistic noise.

Based on a meta-analysis, Prevoo, Malda, Mesman, & van IJzendoorn (2016) propose a task-dependent bidirectional transfer hypothesis. The hypothesis states that the strength of cross-language transfer depends on the type of language proficiency task and the type of school outcomes which are aimed for. Therefore, stimulation of oral language proficiency in both languages might improve the school outcomes of bilingual children with immigrant backgrounds.

### ***Inhibitory control***

The results of three studies reported by Bialystok & Martin (2004) indicate that bilinguals have a more sufficient inhibitory control to ignore impinging perceptual information compared to monolinguals. However, they are not more skilled in representation, which confirms earlier findings. The critical difficulty in solving this task is the lack of ability by some subjects to ignore an obsolete display feature.

Cross-language activity, selection of the language to speak, planning of speech, language selection and the word production steps of bilinguals' speeches using a single language are discussed by Kroll (2008). Language selection models hold that bilinguals develop the ability to selectively use the intended language even if both languages are active. In an alternative model, both languages compete for selection, requiring that cross-language activity modulates to select the required language only. In this case, the non-target language needs to be inhibited. Some works report on such inhibitory mechanisms. Three studies are done by Martin-Rhee & Bialystok (2008) to assess the degree and type of inhibitory control through which bilingual children demonstrate an ability to excel in tasks (Simon tasks as cited in Bialystok, Craik, Klein, and Viswanathan, 2004) by ignoring misleading perceptual cues. The studies involve the activation of inhibitory controls leading to an inhibition of habitual responses. Bilingual children maintain their advantage on tasks that require the control of attention but show no advantage on tasks that require the inhibition of responses.

***MEG and genetic basis***

In another study by Bialystok et al. (2005) magnet-encephalography (MEG) is used in evaluating Simon tasks by Bilingual Cantonese–English, bilingual French–English and monolingual English speakers. Any faster reaction time for congruent trials compared to incongruent trials is recorded. The Cantonese group is faster than the other two groups, while the differences between the other two groups are not significant. According to MEG data, all three groups are characterised by the same pattern of activity, which involve signal changes in left and medial prefrontal areas. However, the two bilingual groups differ from the monolingual group due to greater activity in superior and middle temporal, cingulate, and superior and inferior frontal brain regions located largely in the left hemisphere. In the case of monolinguals, faster reaction times are associated with activation in the middle frontal brain regions. Thus, the management of the two language systems leads to systematic changes in frontal executive functions.

Recent neuro-imaging results appear to show that bilingualism can compensate for the degeneration of other cognitive functions associated with dementia and thus postpone the onset of symptoms, (Bialystok, 2015). However, based on a study on 1,067 Spanish-English bilinguals in the Washington/Hamilton Heights Inwood Columbia Aging Project (WHICAP), Zahodne, Schofield, Farrell, Stern, & Manly (2014) report that bilingualism is not independently associated with rates of cognitive decline or dementia conversion.

Using whole head magnetoencephalography (MEG), Ferjan Ramírez, Ramírez, Clarke, Taulu, & Kuhl (2017) investigate brain responses to Spanish and English syllables in Spanish-English bilingual and English monolingual 11-month-old infants. Monolingual infants are sensitive to English. On the other hand, bilingual infants are sensitive to both languages. Neural responses achieved by a slower transition from acoustic to phonetic sound analysis, together with an adaptive and advantageous response to increased variability in language input, have been responsible for this dual sensitivity of the bilingual brain. These bilingual neural responses extend into the prefrontal and orbitofrontal cortex, which may be related to the bilingual advantage in executive function skills.

Allelic differences between monolinguals and bilinguals for frequencies of the DRD2/ANKK1 taq1A polymorphism noticed by Hernandez, Greene, Vaughn, Francis, & Grigorenko (2015) also raises the possibility of genetic differences between the two groups.

**Negative results**

From a comparative study of the effect of bilingualism on the language proficiency and reading skill development in two systems of writing, Bialystok, McBride-Chang, & Luk (2005) observe that both language exposure and instruction are responsible for the development of phonological awareness. However, once established, these skills can be transferred across languages in the case of both bilinguals and second language learners. On the other hand, decoding ability develops separately for each language as a function of both proficiency and the nature of instruction in that language. This skill is not transferred to the other language. Thus, there is no overall effect which is obvious from this research on bilingualism effect on learning to read. The performance depend entirely on the structure of the language, proficiency in that language and

instructional experiences with that writing system. The comparison involves monolingual English, bilingual English-Chinese and Chinese children beginning to learn English as a second language.

In their study to evaluate the effect of bilingual advantage on inhibitory skills, Duñabeitia et al. (2014) use verbal and non-verbal versions of the Stroop task. The results show that bilingual and monolingual participants perform equally in the two types of tasks across all the indices of inhibitory effect on the skills explored. The absence of difference extend to all the age ranges tested. There is no modulatory effect from any of the independent factors. Thus, bilingual children do not seem to exhibit any specific advantage in simple tasks which elicit inhibition as compared to monolinguals.

Analysing executive function and cognitive reserve, Valian (2015) proposes that the term “executive function” includes a complex set of cognitive processes, the components of which are sometimes minimally correlated with each other, depending on the task. Bilingualism is inconsistently correlated with superior executive function. There are non-linguistic ways of improving executive function. Benefits from bilingualism, and all other cognitively challenging activities, are inconsistent due to variations in the number and kinds of experiences of individuals promoting superior executive function. The author contends that executive function is a narrow interpretation how bilingualism hinders or helps cognition.

In a carefully matched large sample study, Antón et al. (2014) do not observe any bilingual advantages at all. This finding supports the contention that the reported positive bilingual advantages can be due to small or unmatched samples.

The meta-analysis of works done on bilingual advantage in executive functioning by Paap, Johnson, & Sawi (2015) show that such advantages either do not exist or are noticeable only in very specific and undetermined conditions. The studies conducted after 2011, either do not give any result or utilise small sample sizes. Some others produce group differences when inappropriate tests of the critical interaction or baselines are used. In a few others, demographic factors are imperfectly matched. Also in a few other studies, questionable use of the analysis-of-covariance is evident, apparently in order to control for problematic factors. Direct replications are under-utilized and even if they are attempted, the results of seminal studies cannot be reproduced. Measures and tasks used in the tests do not demonstrate convergent validity. Any significant differences in performances may not have been able to differentiate any task-specific mechanism from the domain-free abilities of executive functions. There is only modest support from brain imaging studies in evaluating the bilingual-advantage hypothesis. This is mainly because the neural differences do not align with the behavioural differences and/or the neural measures are ambiguous with respect to the magnitudes required to cause increases or decreases in brain performance. There are cumulative effects of confirmation biases and common research practices which lead to a belief that a phenomenon exists when it really does not, or has inflated the frequency and effect size of a genuine phenomenon that can emerge only occasionally and in restricted and undetermined circumstances.

## Conclusion

The number of works reporting negative results is far outnumbered by the number of works indicating positive results for the hypothesis of bilingual advantages. Although the tendency will be to conclude that bilingual advantage exists, the points raised by the critics regarding small sample size, inadequacy of matching other variables, as well as measurement and analysis problems need to be considered seriously in future research on the topic. After all, in the issue of supporting one side or the other, the validity of the research work is arguably the most important consideration in accepting or rejecting any research conclusions.

## About the Author:

**Dr. Abdulaziz Alshahrani** is an assistant professor of Applied Linguistics, graduated from the University of Newcastle, Australia. He was admitted to the degree of MA with distinction in Applied Linguistics from the same institution. His works are related to the fields of language acquisition, psycholinguistics, the roles of the social variables and other topics. At the moment, he works as an assistant professor at the Faculty of Arts and Humanities, Albaha University, in Saudi Arabia.

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