p-ISSN: 2184-2205 e-ISSN: 2184-3414 ISBN: 978-989-35106-6-7 © 2024

# THE INFLUENCE OF BILINGUALISM ON LEXICAL ACCESS AND CATEGORIZATION PROCESS IN PRIMARY SCHOOL CHILDREN

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## Abstract

Studies have highlighted that bilingualism appears to facilitate communication (Dieguez & Hemmerle, 2014; Bialystok, 2017) and has beneficial effects on the emergence and development of cognitive abilities (Kail, 2015). Children who just start using two languages, frequently switch between languages, namely code switching. They used words from both languages and these seem to play an important part on language acquisition process. Bialystok & Martin (2004) have shown that bilinguals develop the ability to inhibit one language while using the other, thus accelerating cognitive development which includes perception, attention, memory, inhibition, cognitive flexibility, programming, planning. Other studies (Bialystok et al., 2008) have also demonstrated that exposure to two linguistic systems may enhance flexibility and cognitive inhibition capacities in bilingual individuals, which can confer an advantage during categorization tasks requiring changes in categorization criteria and the suppression of irrelevant information or responses. The aim of the present study is to examine whether bilingual children aged between 6 and 8 years-old could access to lexico-semantic store more easily than monolinguals. Firstly, drawing upon existing theories and empirical evidence, it is posited that bilingualism potentially enhances access to the lexico-semantic store due to the necessity of engaging with and navigating two linguistic systems. By investigating this phenomenon in young children, this study aims to ascertain whether these purported advantages in lexical access are discernible at an early developmental stage. Secondly, this research is predicated on the hypothesis that bilingual children, within this age range, exhibit a heightened comprehension of words and their meanings across both languages. It is conjectured that the comparatively facile access to the lexico-semantic store could serve as an indicator of an early and robust development of linguistic competencies in bilingual children, suggesting a more advanced level of language comprehension and cognitive engagement compared to their monolingual counterparts. In this study, 20 French-Arabic Bilingual children and 20 French Monolingual children aged between 6 to 8 years-old (all participants lived in France and were recruited in primary school: grades 1 and 2) performed a verbal Fluency Task (Cardebat et al., 1990; Abdelgafar & Moawad, 2015). The verbal fluency task is a short test of verbal functioning. It consists of two tasks: category fluency (semantic fluency) and letter /lexical fluency (phonemic or lexical fluency). Participants are given 2 min to produce as many words as possible within a semantic category (category fluency) or starting with a given letter (letter fluency). The participant's score in each task is the number of unique correct words. The results of the study show for the categorical fluency task an advantage for a bilingual for accessing categorical lexico-semantic storage. No difference was observed in the lexical fluency task.

***Keywords:*** *Bilingualism, fluency task, lexical access, cognitive flexibility and inhibition, children.*

## 1. Introduction

During the first years of life, children develop many language skills. These skills play a fundamental role in child cognitive and social development. These skills extend beyond mere verbal elements (words) to encompass a range of non- and para-verbal elements of communication such hand gesture, eye movement, body posture, facial expressions and intonations. Regarded as a psychosocial perspective, also language could facilitate the transmission of informations within communicative interactions, thus constituting both an individual behavior and a social process.

### 1.1. Language and Cognitive Construction

This understanding of language is rooted in the works of the linguist and anthropologist Dell Hymes (1972), who emphasized that a complete understanding of language can only occur when it is contextualized within its social and cultural environment. Viewing language as an interconnected process between the individual and society, this study aims to explore the access abilities to the lexico-semantic store in bilingual and monolingual children. Inspired by Lammel's (1997) study which explore the relationship between culture and categorization, this research aims could help to understand how linguistic experiences influence the mental construction of lexicon and the elaboration of concepts, in children.

### 1.2. Bilingualism and Cognitive Development

Within this study, particular attention will be dedicated to the intricate phenomenon of bilingualism in children, where the acquisition of two distinct languages creates a unique linguistic context. Bilingualism, as a daily reality for a growing number of children, raises significant questions regarding how these individuals structure and categorize their cognitive lexicon. Theories of bilingualism have often oscillated between perspectives that consider languages as separate and independent (Grosjean, 1998) versus those that perceive them as interconnected and mutually influencing cognition Kroll & Bialystok, 2013). This dichotomy prompts relevant inquiries into how bilingualism could modulate cognitive development in children, especially in a context where languages can coexist and interact (Bialystok, 2009). The aim of this current research is to explore whether bilingual children aged between 6 and 8 years access the lexico-semantic store more easily than their monolingual counterparts It is conjectured that the comparatively facile access to the lexico-semantic store could serve as an indicator of an early and robust development of linguistic competencies in bilingual children, suggesting a more advanced level of language comprehension and cognitive engagement compared to their monolingual counterparts. To attempt to validate this hypothesis, a verbal fluency task (lexical/letter and categorical) was administered to two groups of children (monolinguals and bilinguals) aged from 6 to 8 years-old.

### 1.3. Verbal Fluency Task and Involved Executive Functions

The verbal fluency tasks are employed to assess rapid access to the lexical and semantic reservoirs in long-term memory, concurrently evaluating the executive processes associated with this lexico-semantic access. Categorical fluency task relies on semantic categories commonly used in everyday language, whereas letter fluency task is based on phonological criteria to access the lexicon. In categorical fluency task, participants generate a maximum of words belonging to a specific category, such as animals. For letter fluency task, participants articulate words starting with a specific letter, such as 'P'. These two tasks engage executive processes essential for verbal retrieval and production from the lexico-semantic store (Lezak, 2004; Seron & Van der Linden, 2014) and on search strategies in long-term memory. These tasks also involve inhibiting process to suppress activation of repeated and/or irrelevant responses. The observed transition process in categorical fluency tasks requires cognitive flexibility to shift from one semantic grouping to another (Troyer et al., 1997; Henry et al., 2004). A research from Bigler (2012) have shown a greater production of correct words during Categorical fluency task compared to letter fluency task, both in children and adults. This discrepancy suggests enhanced access to semantic networks during letter fluency task, likely due to the use of less controlled retrieval strategies. However, during letter fluency task, more rigorous executive strategies appear to be engaged to evoke words. This analysis of recall mechanisms in letter fluency task raises questions about the relationship between verbal fluency and the ability for switching.

### 1.4. Verbal Fluency and Switching

Switching, the ability to shift from one sub-category to another, is influenced by the functioning of the frontal lobe. It involves the implementation of search strategies and spontaneous flexibility, considered a cognitive effort that relies on controlled processes. Optimal performance in verbal fluency involves the ability to group words and switch to a new category once the first one is exhausted. Differences in production are observed between phonemic and semantic fluencies, with larger word clusters and fewer switches for semantic fluency, while phonemic fluencies are characterized by smaller clusters but associated with a greater number of switches. These findings regarding the role of switching and clustering strategies in different verbal fluency task performances highlight the interest in exploring the relationship between oral verbal fluency and semantic memory. The intricate relationship between cognitive processes involved in switching, clustering strategies, and their impact on verbal fluency tasks underscores the significance of exploring the interplay between oral verbal fluency performance and the domain of semantic memory.

### 1.5. Oral Verbal Fluency and Semantic Memory

Semantic memory plays a crucial role in tasks involving fluent verbal production, particularly those requiring the manipulation of meanings, thereby assessing access to lexical and semantic knowledge. These tasks involve the activation and utilization of semantic memory networks to extract and articulate specific words related to a defined category (Lezak, 2004). According to Seron and Van der Linden (2014), these fluent verbal production tasks necessitate the involvement of semantic memory to access stored information about concepts, categories, and word relationships. Semantic memory is responsible for representing knowledge related to word meanings, objects, actions, and conceptual relationships—crucial elements for tasks involving fluent verbal production, where individuals must generate words associated with a specific category (De Oliveira Santana & Pimentel, Dos Santos, 2015). Research underscores that performance in these tasks relies on the richness of an individual's personal semantic network and the quantity of available elements in the language for a given category (Gierski & Ergis, 2004). Understanding the pivotal role of semantic memory in tasks requiring fluent verbal expression and the intricate cognitive processes involved, the ensuing section delineates the methodology employed to investigate the dynamic interaction between semantic memory networks and verbal fluency tasks.

## 2. Methods

In the context of numerous investigations exploring the effects of bilingualism on executive functioning, a noteworthy gap exists in studies specifically examining French-Arabic Bilinguals. The frequent coexistence of these two languages in the Seine-Saint-Denis department (93) motivated to focus on these languages. To address the research gap, an experiment was conducted involving French-Arabic Bilingual children and French monolingual children from 6 to 8 years old. The aim of this study is to observe whether bilingual children access the lexico-semantic store more easily than monolinguals. In regard, we intend to compare the linguistic productions of French-Arabic Bilinguals children with those of monolingual French monolingual children aged from 6 to 8 years old. The choice of this age range was motivated by considering crucial phases of linguistic and cognitive development in children. The specific period, spanning from 6 to 12 years old, has been identified as a decisive phase where children are actively engaged in acquiring and developing their vocabulary and linguistic skills. Furthermore, it corresponds to a critical phase where significant variations in the ability to access the lexico-semantic store are often observed, directly linked to the progressive and continuous development of linguistic and cognitive abilities in children. The study's issue is as follows: Do bilingual (French-Arabic) children aged between 6 and 8 show differences in accessing lexical and semantic knowledge compared to monolingual (French) children of the same age group? The fundamental objective of this research is to compare the performance of French-Arabic Bilingual and French Monolingual children, aged 6 to 8, on tasks evaluating their linguistic competencies, specifically categorical fluency and letter fluency. This comparative approach aims to highlight the potential advantages resulting from the acquisition of two languages (French and Arabic) in accessing the lexico-semantic store in children.

### 2.1. Participants

This study involved the participation of 40 children, aged between 6 and 8 years (M= 7.4, SD = 0.67). This group contained 20 Bilingual children exposed to both languages (French and Arabic) from birth due to their parents' immigration; children from mixed families; and children with African origin (M= 6.8, SD= 0.6) and 20 French Monolingual children (M= 7, SD = 0.80).

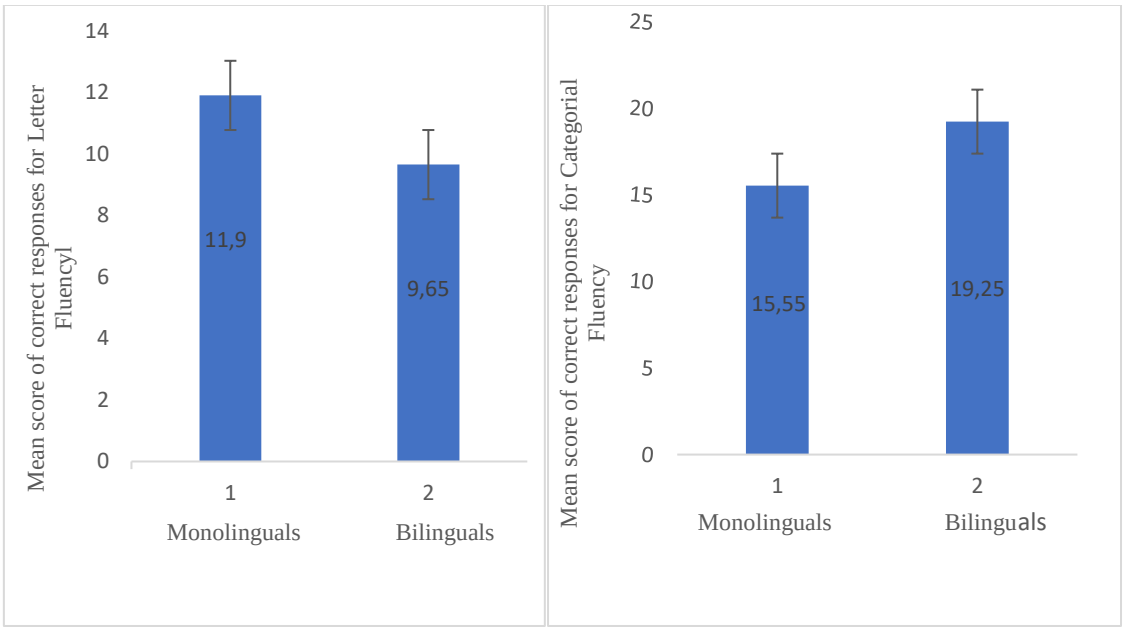
### 2.2. Material

Two oral verbal fluency tasks were employed in this study: the categorical fluency task and the lexical fluency task (Cardebat et al., 1990). The aim of these tasks was to assess the children's ability to access their lexical repertoire. The letter and categorical fluency tasks were selected to evaluate the subjects' ability to access their lexical repertoire, aligning these assessments with the specific purpose of this study, which aimed to explore differences in terms of mental flexibility and cognitive inhibition between bilingual and monolingual children. The letter fluency task required participants to verbally generate as many words as possible within a two-minute timeframe, starting with a specified letter, such as the letter "P". The categorical fluency task required participants to verbally generate as many words as possible within a two-minute timeframe. During these tasks, the experimenter, situated in front of the participant, meticulously recorded all oral responses provided by the participants, thereby offering a precise means of evaluating their ability to access and mobilize their lexical repertoire.

## 3. Results

The average score of correct responses on the Letter Fluency task is higher for monolinguals (M=11.9; SD=3.09; Range=11) compared to that of bilingual children (M=9.65; SD=4.29; range=17). However, despite this disparity, the independent Student's t-test results indicate a slight but non-significant variation, $t_{(38)} = 1.90$; p=0.06 (cf. Figure 1).The average score of correct responses on the Categorical Fluency task (animals) is higher for bilingual children (M=19.25; SD=6.06; Range=22) compared to monolinguals (M=15.55; SD=5.02; Range=16). The results of the independent Student's t-test demonstrate a significant difference, $t_{(38)} = 2.10$; p = 0.04 (cf. Figure 1).

*Figure 1.* Average scores of correct responses (standard error) on both letter and categorical verbal fluency tasks on Monolingual and Bilingual children.




*Letter Fluency* *Categorial Fluency*

## 4. Discussion

In relation to the obtained result for letter fluency, although monolingual children exhibit a higher average score of correct responses compared to bilingual children, the observed difference does not surpass the conventional threshold of significance (p<0.05). Nevertheless, this marginal (p=0.06) suggests a noteworthy trend, emphasizing the relevance for a more comprehensive exploration within broader contexts or with larger samples. Nuances in the mental construction of the lexicon among bilingual children might become more evident with an increased diversity of linguistic experiences. It is important to note, however, that the relative ease in detecting effects in this study could be attributed to the nature of the task itself, which is relatively simpler. Letter fluency, despite providing intriguing indications, represents a limited measure of linguistic processing complexity. Consequently, subtle differences in the mental construction of the lexicon among bilingual children might be more apparent in more complex tasks or contexts requiring deeper analysis. The significance of further explorations in more demanding conditions remains crucial for a comprehensive understanding of the specifics of lexical development among bilingual children. Regarding categorical fluency, focused on the 'animals' category, it reveals a statistically significant difference between the two groups (p=0.04). Bilingual children present a significantly higher average of correct responses, highlighting a potential advantage in the categorization of specific concepts, despite exposure to two distinct languages. This reversal of results between lexical and categorical fluency may be attributed to the distinct nature of these two cognitive tasks. Letter fluency, centered on word production within a given time frame without thematic constraints, might less highlight differences between monolingual and bilingual children when the latter possess equivalent lexical skills in each language. Conversely, categorical fluency, centered on the specific categorization of words, as in our study on animals, engages cognitive processes of classification and generalization. Bilingual children may benefit from an advantage in this task due to their enhanced ability to conceptualize and categorize information,

thus extending beyond mere lexical skills. Thus, these different results emphasize the importance of considering how different cognitive tasks elicit distinct facets of linguistic and cognitive skills among bilingual children. This suggests that bilingualism may differentially influence lexical categorization processes in children, with distinct nuances between letter and categorical fluency.

## 5. Conclusion

This study makes a significant contribution to our understanding of the intricate interactions between bilingualism and lexical categorization in children. The observed results underscore the importance of considering the specific nature of the cognitive tasks used to assess linguistic and cognitive abilities. Highlighting an advantage for bilingual children in categorical fluency, especially in the categorization of specific objects like animals, suggests greater cognitive flexibility and an enhanced capacity for generalizing concepts within defined categories. However, it is crucial to note that differences between monolingual and bilingual groups may vary depending on the specific task characteristics and linguistic contexts. Hence, further in-depth investigations involving larger and more representative samples from diverse bilingual populations are necessary to consolidate and broaden these conclusions. These future studies could also explore potential effects of linguistic dominance, proficiency levels in each language, and different language acquisition modes on lexical categorization in bilingual children. Moreover, a more thorough consideration of cultural aspects and diversified linguistic experiences within bilingual populations could provide richer insights into how these factors influence the mental construction of the lexicon and conceptual categorization. Furthermore, these studies could explore how varied linguistic environments shape the underlying cognitive processes involved in manipulating and classifying lexical informations.

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