An-Najah University Journal for Research – B
Humanities
مجلة جامعة النجاح للأبحاث – ب
العلوم الإنسانية

Exploring the Interplay Between Bilingualism and Cognitive Development: Inhibitory Control and Metalinguistic Awareness in Arabic-English Bilinguals

Aala Karim Maayah[1,*]

(Type: Full Article). Received: 21st Apr. 2025, Accepted: 1st Sep. 2025, Published: ××××. DOI: ××××

Accepted Manuscript, In Press

Abstract: Objective: This study examines the relationship between bilingualism and cognitive development, specifically focusing on executive functions such as inhibitory control and metalinguistic awareness among Arabic-English bilinguals. **Method:** Grounded in Cummins' Threshold Hypothesis, the research employs cognitive assessment tools, including the Stroop task and grammatical judgment (GJ) task, to explore performance across different types of bilingualism: balanced, dominant, and semi-lingual. **Result:** Findings reveal that while balanced bilinguals exhibit enhanced metalinguistic awareness, many participants demonstrate low performance in the Stroop task, suggesting that high proficiency does not universally guarantee cognitive advantages. Furthermore, dominant bilinguals experience challenges related to language interference and variability in language use, which affects their cognitive control. Insights underscore the importance of enriching language exposure to foster cognitive capabilities in bilingual learners. **Conclusion:** These findings highlight the complex relationship between bilingualism and cognitive performance, providing valuable insights for educational strategies that support diverse linguistic proficiencies.

Keywords: Bilingualism, Cognitive Development, Inhibitory Control, Metalinguistic Awareness, Executive Functions.

استكشاف التفاعل بين الثنائية اللغوية والتنمية المعرفية: التحكم المثبط والوعي الميتا لغوي لدى ثنائيي اللغة العربية -الانجليزية

علاء كريم معايعه[1،*]

تاريخ التسليم: (2025/4/21)، تاريخ القبول: (2025/9/1)، تاريخ النشر: ××××

مُلخص: الهدف: تهدف هذه الدراسة إلى التحقيق في العلاقة بين الثنائية اللغوية والتنمية المعرفية، مع التركيز على الوظائف التنفيذية مثل التحكم المثبط والوعي الميتا لغويين الأشخاص الذين يتحدثون العربية والإنجليزية. **الطريقة:** استنادًا إلى فرضية العتبة لكامينز، تستخدم الدراسة أدوات تقييم معرفية، بما في ذلك مهمة ستروب ومهمة الحكم النحوي، لاستكشاف الأداء عبر أنواع مختلفة من الثنائية اللغوية: المتوازنة، والمسيطرة، وشبه اللغوية. **النتيجة:** تكشف النتائج أنه بينما يظهر ثنائيو اللغة المتوازنون وعياً ميتا لغويا مُعززًا، فإن العدي د من المشاركين يظُهرون أداءً منخفضًا في مهمة ستروب، مما يوحي بأن الكفاءة العالية لا تضمن عالمياً فوائد معرفية. علاوة على ذلك، يواجه ثنائي واللغة المسيطرون تحديات مرتبطة بتداخل اللغة وتنوع استخدام اللغة، مما يؤثر على قدرتهم المعرفية. تبرُز الرؤى الحاجة إلى إثراء التعرض للغة لتنمية القدرات المعرفية بين المتعلمين ثنائيي اللغة. **الخلاصة:** تؤكد هذه النتائج العلاقة المعقدة بين الثنائية اللغوية والأداء المعرفي، وتقدم معلومات قيمة لاستراتيجيات التعليم لدعم الكفاء ات اللغوية المتنوعة.

الكلمات المفتاحية: الثنائية اللغوية، التنمية المعرفية، التحكم المثبط، الوعي الميتا لغوي، الوظائف التنفيذية.

1 School of Languages, Literacies and Translation, Universiti Sains Malaysia, Penang, Malaysia
* Corresponding author email: aalamaayah@student.usm.my
Orcid: https://orcid.org/0009-0006-6468-5872

1 مدرسة اللغات ومحو الأمية والترجمة، جامعة العلوم الماليزية، بينانج، ماليزيا
* الباحث المراسل: aalamaayah@student.usm.my
Orcid: https://orcid.org/0009-0006-6468-5872

INTRODUCTION

Globalization has led to broad interaction among different communities, resulting in bilingualism, the ability to engage fluently in two or more languages. Cognitive psychologists, linguists, and educational researchers have considered bilingualism a critical area of inquiry, especially in understanding the mental ramifications of varying degrees of language proficiency. At the center of this exploration, Kroll & Bialystok (2013) stress the importance of investigating how bilingualism interacts with executive functions—the mental processes involved in managing attention, problem-solving, and controlling behavior (Diamond, 2013)—specifically inhibitory control—the capacity to suppress irrelevant or distracting responses—and metalinguistic awareness—the ability to reflect on, analyze, and understand language structures consciously (Munoz & Meliani, 2015). These two skills are cultivated through the navigation of distinct linguistic systems, which enables bilingual individuals to develop exceptional cognitive skills (Kroll *et al*., 2012, 2014; Bobb *et al*., 2020). In this realm, Bialystok *et al*. (2004) and Kroll and Bialystok (2013) have emphasized that bilinguals often experience enhanced inhibitory control—their ability to ignore distractions and regulate responses—and metalinguistic skills, which involve conscious reflection on language structures and functions (Tse & Kerner, 2022). These skills are typically assessed through specific cognitive tasks that clarify the mechanisms by which bilingual proficiency influences broader cognitive abilities.

Exploring how different types of bilingual language experiences influence cognitive outcomes, such as inhibitory control and metalinguistic awareness, provides a deeper understanding of the complex ways in which bilingualism shapes cognition, particularly among Arabic-English speakers. However,

Saunders and Garcia (2020) asserted that the correlation between bilingualism and cognitive performance is multifaceted, as bilingual individuals may also experience cognitive overload—a mental state characterized by fatigue or confusion resulting from managing multiple languages (Swanstrom & Gazzaley, 2011)—and confusion, or deficits in analytical reasoning.

Thus, the present study aims to elucidate the current literature to examine the correlation between bilingualism and cognitive development. To fulfill the objective of this study, the research employs two rigorously established cognitive assessment tools: the Stroop task and the grammatical judgment (GJ) task. The Stroop task assesses participants' inhibitory control, requiring them to disregard conflicting stimuli, such as when the ink color contradicts a word's semantic meaning (MacLeod, 1991). Bialystok *et al*. (2004) and Costa *et al*. (2008) found that participants' Stroop task performance is a robust indicator of executive functioning, where swifter reaction times and heightened accuracy denote enhanced inhibitory and cognitive control processes. In contrast, the GJ task assesses syntactic awareness, requiring participants to discern grammatical structures while momentarily suppressing semantic understanding, thus providing critical insights into their metalinguistic competencies (Bialystok, 2001; Mackey *et al*., 2000).

Meanwhile, the current study conceptualizes the Arabic-English bilinguals as a spectrum encompassing balanced, dominant, and semi-lingual profiles using two standardized tests: the General Certificate of Secondary Education (GCSE), which measures the participants' Arabic proficiency, and the Test of English as a Foreign Language (TOEFL), which measures English skills. Thus, the participants are linguistically categorized into three groups: balanced bilinguals, who possess high

proficiency in both Arabic and English; dominant bilinguals, who have a higher level of proficiency in one language; and semi-bilinguals, who demonstrate limited proficiency in both Arabic and English (Grosjean, 1998; Paradis, 2004). To accomplish the objectives of this study, it is worthwhile noting that the relation between bilingualism and cognitive performance will be examined within the framework of Cummins' (1979) Threshold Hypothesis, which posits that certain proficiency thresholds must be reached before cognitive benefits become evident. According to this framework, the Arabic-English bilinguals in the current study must be proficient in both languages to master inhibitory control, as measured by the Stroop task, and metalinguistic awareness, as evaluated by the grammatical judgment task.

Literature Review

Bilingualism, defined as the ability to communicate fluently in two or more languages, has significantly reshaped global linguistic landscapes. Numerous studies in cognitive psychology, linguistics, and education have examined the correlation between bilingualism and cognitive development (de Bruin, 2019; Surrain & Luk, 2019). Cummins' (1979) Threshold Hypothesis remains a foundational framework, proposing that individuals must reach a specific proficiency in both languages to experience cognitive benefits. This is particularly relevant to the current research, which explores how various bilingual profiles—balanced, dominant, or semi-lingual—impact cognitive abilities such as metalinguistic awareness and inhibitory control (Antoniou, 2019; Gullifer & Titone, 2020). For instance, balanced bilinguals with high proficiency in both languages often demonstrate greater metalinguistic awareness than semi-linguals, whose proficiency may be uneven (Luk & Bialystok, 2013).

Bialystok (2001) was among the first to empirically explore the relationship between bilingualism and cognitive control, demonstrating that bilinguals outperform others on tasks measuring inhibitory control, such as the Stroop task. These findings suggest that individuals with more balanced proficiency may exhibit superior inhibitory control, a hypothesis warranting further investigation. Further research has linked bilingualism to enhanced cognitive flexibility and task-switching skills (Bialystok *et al*., 2012; Paap *et al*., 2015; Surrain & Luk, 2019). Methodological advances, including the use of the Stroop test and grammatical judgment tasks, have increased the reliability of such research (de Bruin, 2019). Kroll *et al*. (2018, 2019) and Bice & Kroll (2019) utilized these empirical assessments to reveal how different proficiency levels affect cognitive processes, which are also central to the present study. Similarly, Wang and McBride (2017) found that bilingual individuals exhibit advanced syntactic and semantic awareness, supporting the notion that bilingualism enhances both language competence and cognitive flexibility (Gullifer *et al*., 2021).

Extensive research also addresses the impact of bilingualism on Stroop task performance, a measure of cognitive control and inhibition. Findings indicate that bilinguals have enhanced executive functions, such as the ability to filter distractions and inhibit interference—directly relevant to understanding distinctions among balanced, dominant, and semi-lingual profiles. Rothman (2019) found that bilinguals focus more on salient and less on irrelevant stimuli in Stroop tasks, with proficiency profiles influencing this effect. Mitchell and Potenza (2017) examined how technological tools, like augmented reality, affect Stroop performance, aligning with inquiries into bilingual profiles in digital learning environments. Classic studies by Peal and Lambert (1962) established that bilinguals excel in cognitive flexibility and

processing efficiency, suggesting that balanced bilinguals may outperform others on inhibitory control tasks. Linck *et al*. (2015) corroborated these findings, showing that bilinguals have faster reaction times and greater accuracy under conflict conditions (Gullifer & Titone, 2020). Sanz *et al*. (2021) found that bilinguals consistently outperform monolinguals on Stroop tasks across cultures, emphasizing the universality of cognitive advantages, even for semi-linguals. Garcia & Abdullah (2024) examined how cultural and technological contexts uniquely shape cognitive function among semi-linguals, addressing an important research gap (Gullifer *et al*., 2021). Collectively, these works highlight the need to examine how language proficiency and profile impact metalinguistic awareness and inhibitory control (Antoniou, 2019; Gullifer & Titone, 2020; Surrain & Luk, 2019), particularly among Arabic-English speakers.

Gap in the Existing Studies

Recent research in Western contexts has focused on the impact of bilingualism on cognitive development (de Bruin, 2019; Surrain & Luk, 2019; Bice & Kroll, 2019; Gullifer & Titone, 2020), but often employs a limited range of cognitive assessments. For example, Lin (2009) as well as Safiya and Al-Zghoul (2017) investigated working memory and grammatical judgment, Rosselli, Ardila, and Véliz (2019) assessed verbal and nonverbal skills, as well as Pathak and Rijal (2022) relied solely on the Stroop task. This narrow methodological scope can yield inconsistent findings, despite the increasing recognition of the cognitive benefits of bilingualism (Gullifer *et al*., 2021). Jarvis, Kozaki, and Kroll (2008) found links between intelligence and bilingualism, but they used only two cognitive tasks. Hao (2021) employed a broader battery, primarily comparing bilinguals and monolinguals, making the cognitive benefits of different bilingual profiles less clear (de Bruin, 2019; Gullifer & Titone, 2020). This study aims to address this gap by examining a broader range of cognitive skills, including inhibition, attentional control, and metalinguistic awareness, particularly in Arabic-speaking regions.

In the Arab world, researchers such as Alshahrani (2017), Elbedour *et al*. (2019), Alhuqbani (2016), Sharaan et al. (2021) , and Elbedour, Sawan, and Bawalsah, (2019) have compared bilinguals and monolinguals, as have Al-Mansour (2009), Hussien (2014), and Landry (1974). Hussien (2014) found that Arabic-English bilingual grade 4 students outperformed their monolingual peers. Aldosari & Alsultan (2017) examined the impact of early bilingual education on Saudi students' reading skills but did not address broader cognitive abilities. Aljohani (2016) found no significant difference in academic achievement after one year of bilingual education among Saudi students. Al Saud (2016) reported that monolingual kindergartners in Riyadh outperformed bilinguals on the Torrance Test of Creative Thinking, whereas Alsulami (2017) observed that English instruction did not significantly enhance the skills of already bilingual students. Despite this regional research, most studies remain comparative, highlighting the need to explore the effects of bilingualism on a broader cognitive spectrum—an aim pursued in the present study.

METHODOLOGY

Research design

The study examines the impact of proficiency in both Arabic and English on two cognitive abilities: inhibitory control and metalinguistic awareness. Thus, the first step is to classify 212 participants according to their linguistic skills into three bilingual groups: balanced bilinguals (proficient in both Arabic and English), dominant bilinguals (proficient in one language at the expense of the other language), and semi-bilinguals (weak in both

Arabic and English). Therefore, participants undertook the GCSE to measure their Arabic proficiency and the TOEFL to evaluate their English proficiency. Meanwhile, to evaluate the inhibitory skill, the participants performed the Stroop task. To measure the metalinguistic skill, the participants performed a grammatical judgment task. A pilot test was conducted with 25 students to ascertain the reliability of the instruments utilized in this study. This study implemented a modified version of the TOEFL and GCSE assessments to reduce the potential mental burden on participants caused by the length of these exams. To ensure the validity and reliability of the tests, the average Cronbach's Alpha (α) reliability score for each language assessment was found to be 0.8, indicating a high level of reliability.

Instruments of the Study

A range of standardized instruments was used in this study to assess participants' language proficiency and cognitive abilities comprehensively. The instruments were selected based on their established reliability and relevance to the research objectives. While TOEFL is designed to assess academic English proficiency, research shows that its integrated tasks (e.g., listening, reading, responding) reflect authentic communicative demands inside and outside the classroom (Enright *et al*., 2008). Similarly, GCSE English evaluates a broad range of language abilities—including reading, writing, and oral communication—in both academic and real-world contexts. Academic proficiency, as supported by Cummins (2000), is a strong predictor of overall communicative competence. Moreover, studies demonstrate significant overlap between academic and conversational skills, with high TOEFL performers also excelling in functional communication due to the test's task-based nature (Sawaki *et al*., 2009). Thus, categorizing participants by TOEFL and GCSE English scores is a valid and reliable research approach, as these standardized measures correlate with broader communicative competencies. It is therefore valid to further classify bilinguals as balanced, dominant, or semi-bilingual according to these results. The following subsections detail the tools used for both linguistic and cognitive assessments.

Linguistic Assessment: To evaluate proficiency in English and Arabic, two modified standardized language assessments were utilized:

Test of English as a Foreign Language (TOEFL): The TOEFL was administered to assess participants' English language proficiency. The test was shortened to minimize participant fatigue while maintaining psychometric robustness.

General Certificate of Secondary Education (GCSE) Arabic Examination: Arabic language proficiency was measured using a modified version of the GCSE Arabic examination.

Cognitive Assessment: Two well-established cognitive tasks were employed to measure the specific abilities targeted in this study:

Stroop Task: The Stroop task was used to assess inhibitory control. Participants were required to respond to color-word stimuli, providing a measure of their ability to manage cognitive interference.

Grammatical Judgment Task: Metalinguistic awareness was assessed through a grammatical judgment task, in which participants evaluated the grammatical correctness of a series of sentences.

Participants

The present study comprises a selective sample of 212 male students drawn from a single international school, based on specific criteria. All participants have been immersed in a consistent international curriculum from the early stages of their development. Furthermore,

they possess Arabic as their first language and English as their second language. These criteria facilitate an examination of the effects of bilingual education on cognitive development within a defined context. The research primarily targets male students, mainly due to cultural and legal constraints, including gender segregation within educational contexts, which limits access to female students and poses challenges in obtaining data that accurately reflects their educational experiences. This limitation is significant as it restricts the study's ability to consider the experiences and cognitive development of female bilingual students, who may have different linguistic and cognitive outcomes. Such gender-based restrictions resonate with observations made by Alhazmi (2022) and Merry (2009), who highlight the difficulties researchers encounter when examining gender dynamics in culturally restrictive environments. Therefore, the focus on male students may not provide a comprehensive understanding of bilingualism's effects across genders, thereby necessitating caution in generalizing the findings to the entire bilingual student population. This aspect of the research underscores an important limitation that must be acknowledged when interpreting the results.

Analysis

The quantitative analysis of the data collected from respondents examines the connections between bilingual proficiency in Arabic and English and performance on two distinct cognitive tasks. The first task is the Stroop task, which involves presenting participants with color words (e.g., "red," "blue") displayed in either matching or incongruent ink colors, requiring participants to name the ink color as quickly and accurately as possible. Response time was calculated as the difference between the timestamp of the participant's response and the stimulus presentation (RT = Response - T_{stimulus}), where (T_{response}) is the time when the participant responded, and (T_{stimulus}) is the time when the stimulus was presented. Response time and accuracy (whether the correct color was named) served as key measures to evaluate participants' inhibitory control and processing speed in situations involving conflicting information (Stroop, 1935). The second task is a grammatical judgment task designed to measure metalinguistic awareness (See Appendix A); quantitative methods served as the primary approach for data analysis. After data collection, studies were conducted using SPSS Version 26, a reputable statistical software program for educational and psychological research (Bryman, 2016).

RESULTS

Table (1): The correlation between the type of bilingualism and a grammatical judgment task.

Type of bilingualism	Low	Med	high	Total
Balanced	22	45	63	130
Dominant	20	27	15	62
semi-lingual	17	3	0	20

The data presented in Table 1 underscore an interesting relationship between the type of bilingualism and performance on the grammaticality judgment (GJ) task, which asks participants to evaluate sentences based on their syntactic well-formedness. Among the 130 balanced bilinguals, the most significant percentage performed at this high level: 48.5% (63) accurately recognized grammatical sentences. In addition, more than half (48.6%) (62 individuals) exhibited high performance after intervention, 34.6% (45 individuals) showed medium, and 16.9% (22 individuals) exhibited low performance. The results indicate that balanced bilinguals strongly conceptualize syntactic structures due to their equal exposure to two languages at similar proficiency levels. Therefore, this result suggests that balanced bilingualism has positive implications for metalinguistic awareness, as it enables

individuals to distinguish between grammatical structures and their everyday language experience (Bialystok, 2001). In the dominant bilingual group (N = 62), high performance was observed in 15 individuals (24.2%), medium performance in 27 individuals (43.5%), and low performance in 20 individuals (32.3%). The lower proportion of high performers among this group compared to balanced bilinguals suggests that language dominance has a significant impact on syntactic processing and judgment. In response to whether dominant bilinguals possess syntactic awareness, they demonstrate this through their effectiveness as bilinguals. However, the lower performance of bilinguals could result from the cognitive effort required to balance language dominance at any given time, with potential trade-offs in accessing grammatical rules in both languages (Kroll & Stewart, 1994). In addition, using a dominant language may lead to insufficient exploration and practice with the subordinate one, which can compromise grammatical sensitivity (Kroll & Bialystok, 2013). Of the semi-lingual group, 85.0% (17) received a low-performance grade, 15.0% (3) received a medium-performance grade, and none reached the high-performance threshold. This extreme underperformance underscores the significant language deficits associated with semi-bilingualism, resulting in varying degrees of insufficiency in both languages. These individuals may struggle significantly with syntactic processing as they lack exposure and practice in both languages, which defeats their ability to assess grammaticality (Grosjean, 1989). According to the findings, both groups lacked meta-discourse abilities because their deficient skills in both languages prevented them from evaluating language properly.

Table (2): The correlation between the type of bilingualism and Stroop level.

Type of bilingualism	Low	Med	high	Total
Balanced	46	74	10	130
Dominant	28	31	3	62
semi-lingual	16	4	0	20

The present study revealed that 51.4% of the individuals exhibited a medium level of performance on the Stroop test, 42.5% presented a low level of performance, and only 6.1% of the subjects performed at a high level. These findings call for reevaluation of the Threshold Hypothesis, which posits that the greater the bilingual proficiency, the better the score in tasks (e.g., the Stroop task) that demand executive functions such as inhibition and cognitive flexibility (Cummins, 1979). The level of performance observed in many balanced bilinguals who were proficient in both English and Arabic suggested that they were not as capable of cognitive control as such proficiency would suggest. In particular, the Threshold Hypothesis (2001) model assumes that in a balanced bilingual position (those who speak or use different languages), 93.5% of medium and low performers among all balanced bilinguals also conflict with the model's assumptions. This finding suggests that bilingualism does not inherently confer a cognitive advantage in tasks requiring inhibitory control.

Discussion: The correlation between the type of bilingualism and Metalinguistic Awareness

One of the skills assessed in this study is syntactic awareness, which is evaluated via the grammaticality judgment (GJ) task. This task requires participants to determine whether the linguistic form of a sentence is grammatically correct. Focusing primarily on syntax rather than meaning, the GJ task measures participants' analytical abilities and control in identifying the proper structure of sentences commonly used in everyday language (Mackey

et al., 2000). Participants must have a high degree of cognitive control to ignore any semantic errors present in the sentences, allowing for an assessment of their syntactic processing abilities independent of language meaning.

The analysis of the GJ task involves participants identifying mistakes and correcting syntactic and semantic errors. The experimental sentences were anomalous, which is the condition that this task purposely induced to lead participants to rely on grammatical judgments while suppressing the sentences' semantics, in a way that only the structural aspects of the sentences were processed (see Appendix A). The clear separation illustrates metalinguistic awareness, as it challenges participants' ability to distinguish the structure of language from its use in the world, ideally speaking, to their ability to perceive the arbitrary nature of word content (Bialystok, 2001; Thomas & Johnston, 2010). (Bialystok, 2001; Thomas & Johnston, 2010).

The results in Table 1 highlight the correlation between the type of bilingualism and performance on the grammaticality judgment (GJ) task. The data presented in Table 1 demonstrate that the grammatical judgment task provides significant insights into how various types of bilingualism correlate with performance outcomes. Among the 212 participants, balanced bilinguals who consistently engaged with Arabic and English from a young age achieved notable results: 22 participants scored low, 45 scored medium, and 63 scored high, totaling 130. In contrast, dominant bilinguals—those whose proficiency leans more toward Arabic—exhibited lower overall performance, with 20 scoring low, 27 scoring medium, and only 15 attaining a high score (totaling 62). Semi-lingual participants, characterized by less consistent exposure to both languages, displayed the least proficiency, as reflected in their scores: 17 low, three medium, and zero high (totaling 20).

The findings underscore the superior cognitive capabilities of balanced bilinguals, which are likely cultivated through sustained exposure to both languages during their formative years. This observation aligns with existing research that emphasizes the critical role of early bilingual exposure in fostering enhanced metalinguistic awareness and cognitive flexibility (García & Wei, 2014; Thomas, 2018; Kroll & Bialystok, 2013). The elevated performance demonstrated by balanced bilinguals, as indicated by their high scores, reflects their augmented capacity to comprehend and effectively utilize the grammatical conventions inherent in both languages. The findings of the current study also align with those of Ünal *et al*. (2020) and Byers-Heinlein and Lew-Williams (2013), who concluded that robust evidence indicates that strong metalinguistic awareness is associated with improved performance on linguistic tasks, particularly among individuals who have benefited from early and repeated language exposure. These compelling findings reaffirm the advantages conferred by consistent, high-quality exposure to two languages from a young age, such as Arabic and English, and reinforce theoretical frameworks that articulate the impact of bilingualism on cognitive development. In the same vein, Antón and Soler (2020) and García and Wei (2014) as well as Al-Khresheh and Karmi (2024) state that balanced bilinguals exhibit a heightened ability to relate grammatical norms across languages, suggesting that early exposure to multiple languages facilitates the development of advanced metalinguistic skills, positing that bilingual individuals proficient in both languages are better equipped to identify and rectify grammatical errors.

In contrast, the dominant bilinguals, representing 29.2% of the participants, displayed lower overall performance on the

grammatical judgment task, with 20 scoring low, 27 scoring medium, and only 15 scoring high (totaling 62). This scoring pattern indicates that while these individuals possess some proficiency in both languages, their relative strengths in one language often limit their abilities in the other. This aligns with findings suggesting that the extent of exposure and practice in both languages significantly impacts metalinguistic awareness and grammatical proficiency (Byers-Heinlein & Lew-Williams, 2013; Antón & Soler, 2020). Furthermore, Kecskes and Papp (2000) suggest that dominant bilinguals, who may have experienced less balanced exposure to their secondary language, are likely to encounter challenges with tasks that require comprehensive knowledge of both linguistic systems.

Meanwhile Wang and McBride (2017) as well as Kroll and Bialystok (2013) suggest that managing two languages with uneven proficiency can have a disproportionate effect, resulting in underdeveloped metalinguistic skills compared to balanced bilinguals. Recent studies by Veríssimo (2022) reinforce this perspective, revealing that dominant bilinguals struggle with complex linguistic tasks due to their limited engagement with the less proficient language in high-stakes environments. Additionally, the distinct scoring—where 20 participants scored low— suggests that these individuals may encounter substantial barriers in recognizing and utilizing complex grammatical structures. This observation aligns with findings from Cummins (2000), which indicate that for dominant bilinguals, limited interaction and practice in their less proficient language can hinder their ability to effectively engage in high-level linguistic tasks that require flexibility and adaptability across languages. Moreover, as noted in a study by Gathercole and Thomas (2009), the phenomenon of language attrition indicates a decline in proficiency of the less-used language over time, further narrowing their linguistic repertoire. This decreased interaction with the secondary language can exacerbate existing cognitive challenges, particularly in tasks like the grammatical judgment task, which require a solid understanding of both languages.

In the case of the semi-lingual participants, the results highlight significant limitations. With zero high scores, this group's performance underscores the adverse effects of inconsistent language exposure. This finding supports the notion that learners fully benefit from the cognitive advantages of bilingualism only when they engage substantially with both languages (García & Wei, 2014). In this context, mental flexibility—a crucial component for navigating between different linguistic systems— becomes increasingly vital. Bialystok (2001) emphasizes that multilingual individuals who switch between languages tend to develop enhanced problem-solving capacities, a trait evidenced by the superior performance of balanced bilinguals.

The semi-lingual participants, who typically experience less consistent language exposure, demonstrated the least proficiency, as reflected in their scores: 17 low, three medium, and zero high (totaling 20). This scoring pattern reveals that semi-lingual individuals face significant challenges in grasping the grammatical norms and structures necessary for effective language use. The data indicate that the overwhelming majority of these participants struggled to meet even the basic requirements of the grammatical judgment task, revealing a clear gap in their linguistic skills compared to their bilingual peers.

The current research reinforces that semi-bilingualism can arise from inconsistent exposure and practice in both languages, often hindering their performance on tasks that require an understanding of advanced grammatical structures (Byers-Heinlein & Lew-Williams, 2013). Cummins (2000) also states

that this lack of balanced engagement can leave semi-lingual individuals ill-equipped to handle complex linguistic tasks, as they may not develop adequate metalinguistic awareness in either language. Recent studies have substantiated this notion, demonstrating that semi-lingual individuals frequently possess fragmented or incomplete grammar in both languages, significantly impairing their communicative effectiveness (Kroll & Bialystok, 2013; Gathercole & Thomas, 2009). The data reflecting no high scores among semi-lingual participants supports the assertion that without immersive and enriching language experiences, these individuals find it particularly challenging to identify and correct grammatical errors or engage in higher-order linguistic tasks.

The Correlation between Type of Bilingualism and Inhibitory Control Skill

Due to the rapid and frequent code-switching that characterizes bilingual speakers' daily lives, many scholars posit a strong relationship between inhibitory control and executive control, as measured by the Stroop task (Bialystok *et al*., 2004, 2008; Costa *et al*., 2008). In the Stroop task, faster response times and greater accuracy reflect enhanced inhibitory and executive control capacities. Participants performed this task under two conditions: one with incongruent distractor words (e.g., the word "red" printed in blue ink) and the other with congruent words (e.g., the word "red" printed in red ink). Reaction time (RT) is a crucial metric for evaluating participant performance, as it accurately measures inhibitory and executive control (MacLeod, 1991). Data is assessed by calculating both reaction time and the number of correct responses. Thus, the quicker and more accurately students respond, the better their inhibitory and executive control capacities. Conversely, students with lower scores tend to react more slowly and make more mistakes when naming the ink color of printed words. This task primarily assesses cognitive control and inhibitory processes, requiring participants to suppress their automatic reading response in order to accurately identify the ink color.

Balanced bilinguals are often expected to have enhanced executive functioning due to their regular use of two languages, which typically fosters improved attentional control and cognitive flexibility (Bialystok *et al*., 2004; Carlson & Meltzoff, 2008). However, the data in Table 2 show that the performance of balanced bilinguals on the Stroop task, as reflected in the results (46 low, 74 medium, and 10 high scores out of 130 total participants), suggests that being balanced in both Arabic and English may not enhance inhibitory skills. Bialystok *et al*. (2004) suggest that while bilinguals can experience cognitive advantages, the demand for inhibition in the Stroop task may overwhelm these benefits, particularly under time pressure. When balanced bilinguals switch between languages during a task, they may inadvertently activate competing lexical representations, leading to increased errors and slower processing times —a phenomenon supported by the Inhibitory Control Model, which posits that bilinguals must constantly manage interference from their languages (Green, 1998). In this respect, Soveri *et al*. (2017) state that the Stroop task presents a significant cognitive load as it demands selective attention and quick processing to navigate conflicting information. Balanced bilinguals may experience an increased cognitive load due to the dual language activation required during the task. This load can become particularly taxing when the cognitive resources available are stretched thin due to the competing processes engaged in simultaneous language systems. As a result, the likelihood of errors increases, contributing to the observed low scores among 46 participants. Moreover, the performance in cognitive tasks

such as the Stroop is not solely a reflection of bilingual advantages; it also inherently involves the complexities of managing multiple languages and the cognitive demands associated with inhibition and attention regulation (Gathercole & Thomas, 2009).

Despite being classified as balanced bilinguals, individuals within this group may exhibit variability in proficiency levels across languages. The concept of balanced bilingualism does not guarantee equal fluency; some bilinguals may be more proficient in one language than the other, depending on their linguistic environment, exposure, and usage contexts (Grosjean, 1998; Paradis, 2004). For instance, if a balanced bilingual has stronger proficiency in their non-dominant language, they may struggle with tasks requiring rapid processing in that language, thereby impacting their Stroop task performance. This variability can be further exacerbated in cognitive tasks that do not align seamlessly with their language experiences, leading to performance discrepancies. For instance, if the Stroop task were conducted in a language less frequently used in daily life, their performance may suffer due to a lack of automaticity in that language (Kroll & Tokowicz, 2001).

The mixed performance of balanced bilinguals on the Stroop task reveals the multifaceted nature of cognitive processing within bilingual contexts. While balanced bilinguals are often theorized to possess enhanced cognitive advantages, the results highlight that factors such as cognitive control requirements, language proficiency variability, and cognitive load must be carefully considered.

The Stroop task analysis results indicate that 28 out of 62 dominant bilinguals scored low, challenging the expected cognitive advantages associated with bilingualism, particularly in executive control. A significant factor in these lower scores may be language interference, as the Stroop task requires inhibiting automatic reading responses to identify ink colors. This can lead to cognitive interference when both dominant and non-dominant languages are activated, resulting in increased errors and slower response times (Kroll & Bialystok, 2013). Additionally, proficiency levels among dominant bilinguals can vary widely. At the same time, they are classified as dominant. However, this classification does not guarantee equal proficiency in both languages, particularly in less frequently used contexts, such as academics (Grosjean, 1998). This disparity in language proficiency, where individuals may demonstrate stronger skills in one language—such as Arabic—while being weaker in another—like English—can further hinder their performance on tasks requiring a less dominant language, contributing to the observed lower scores.

Sociolinguistic factors related to language identity and perceived language status also lead to dominant bilingualism. In many Arabic-speaking contexts, English may be viewed as a foreign language, leading to anxiety or hesitation when students are prompted to use it in high-pressure situations. Previous research suggests that language anxiety can negatively impact cognitive processing abilities; bilinguals who feel less confident in their less dominant language may struggle with executive function tasks that require quick and accurate responses (MacIntyre, 2007). The emotional resonance associated with greater proficiency in Arabic may inadvertently confer a sense of comfort that undermines performance in English.

Moreover, the context of language use significantly shapes cognitive processing. Although many subjects in this study learned both Arabic and English from an early age, the degree of proficiency in each language can vary greatly, influenced by daily usage and the sociolinguistic environment. If participants primarily use Arabic during everyday

interactions while relying on English only in specific contexts—such as academic settings—they may experience diminished proficiency in English, which could hinder their performance on tasks requiring immediate and accurate responses. This aligns with concerns raised by Paap *et al*. (2015), who assert that the bilingual advantage diminishes significantly when groups are not appropriately matched for age of acquisition. The cognitive load associated with switching between these two distinct languages may lead to increased interference, thereby affecting task performance. As bilingual individuals manage the activation and suppression of different linguistic systems, the inherent complexities can overwhelm cognitive resources, particularly during high-stakes tasks like the Stroop task (Grosjean, 1998). This observation is consistent with Bialystok and colleagues (2010), who note that simultaneous engagement of both languages may not yield the anticipated cognitive advantages when one language is favored in practice, even for those who acquire both languages early in life.

Therefore, the low scores of 28 out of 62 dominant bilinguals on the Stroop task can be attributed to cognitive interference, variations in language proficiency, sociolinguistic factors like confidence and anxiety, and contextual language usage. These elements reveal the complexity of bilingual cognitive processing. However, the expected result of half of the dominant participants performing at a medium score aligns with the Threshold Hypothesis, which posits that dominant bilinguals typically exhibit neither strong nor weak cognitive outcomes.

The performance of semi-lingual participants in the context of the Stroop task presents additional insights into the relationship between language proficiency and cognitive control. In this study, 16 out of 20 semi-lingual bilinguals scored low on the Stroop task, which aligns with expectations regarding the characteristics of semi bilingualism and its implications for language development and executive function. Semi-lingual individuals are typically characterized by incomplete proficiency in either language, a phenomenon often resulting from inconsistent exposure to both languages. This lack of full proficiency can hinder their ability to perform complex cognitive tasks, particularly those requiring robust executive control.

The findings indicate that the low performance of semi-lingual participants is due to several interrelated factors. Their limited proficiency in both languages can lead to confusion during high-pressure tasks, such as the Stroop task, where automatic reading responses hinder inhibitory control (Bialystok *et al*., 2004). This reflects the difficulties faced by semi-lingual students as they switch between languages with diminished proficiency, resulting in lower performance compared to balanced bilinguals. Additionally, sociocultural dynamics play a role, as those primarily exposed to one language in informal settings may struggle with cognitive tasks that require quick language switching, leading to a lack of fluency and diminished cognitive performance (García & Wei, 2014). Consequently, Paap *et al*. (2015) and Kroll and Bialystok (2013) found that the low scores among semi-lingual participants may signify their insufficient development of cognitive resources needed for effective language processing, particularly in verbal-linguistic areas. The results of this study align with theoretical frameworks and empirical evidence indicating that inconsistent language exposure can yield cognitive disadvantages in bilingual populations. While bilingualism is generally associated with cognitive advantages, the unique conditions surrounding semi-lingual individuals complicate this narrative. The low performance observed in the Stroop task underscores the assertion that practical bilingualism requires a balance of proficiency

and consistent exposure to both languages, essential for developing robust cognitive control mechanisms.

In summary, the finding that 16 semi-lingual participants scored low on the Stroop task is consistent with expectations based on the characteristics of semi bilingualism. Their performance deficiencies can be attributed to limited language proficiency, the cognitive load of switching between languages, and socio-cultural factors impacting their linguistic development.

CONCLUSION

Recent research has elucidated the intricate correlation between bilingualism and cognitive skills, revealing considerable advantages and significant challenges. Bilingual individuals frequently employ code-switching, which has prompted hypotheses suggesting enhancements in cognitive control, particularly in inhibitory and executive functions (Bialystok *et al*., 2004; Costa *et al*., 2008). However, bilinguals' performance on the Stroop task contradicts the prevailing assumptions of cognitive superiority typically associated with bilingualism. The struggle is caused by conflicting stimuli, exemplified by the requirement to name the color of the ink rather than read the word itself. Opposing the Threshold Hypothesis, recent research indicates that many balanced bilinguals encounter challenges when performing cognitive control tasks. For instance, the current study revealed that 35.38% of balanced individuals exhibited low performance (Cummins, 2000). Instead, the results suggest that the cognitive advantages of bilingualism are context-dependent, varying with the complexity of tasks and the specific cognitive demands presented (Abutalebi & Green, 2016; Kroll & Bialystok, 2013). Further emphasizing this perspective, researchers such as MelbyLervåg and Lervåg (2012) argue that the cognitive advantages of semi-lingual individuals offer significant insights into the complexities of bilingualism. The pronounced underperformance exhibited by this group, wherein 80% were identified as low performers on the Stroop task, underscores the adverse effects of insufficient exposure to and proficiency in both languages (Author, Year). As suggested by Grosjean (1998) and corroborated by Bialystok (2013), these individuals often exhibit limited metalinguistic awareness and encounter difficulties with tasks that require high levels of inhibitory control. These results emphasize that without comprehensive and enriching language experiences, semi-lingual individuals will likely face challenges in cognitive tasks requiring rapid language switching, thereby further distancing themselves from the cognitive advantages typically associated with bilingualism.

Scholars assert that the success of bilingual individuals is contingent upon their level of language exposure and the frequency of use in relevant situations. For instance, Bialystok *et al*. (2004) suggest that the cognitive demands encountered during high-pressure tasks may overshadow the anticipated benefits of bilingualism, particularly when individuals must rapidly switch between languages. This observation is consistent with the Inhibitory Control Model, which posits that bilinguals must continually manage interference from both languages, thus resulting in heightened cognitive load and performance challenges (Green, 1998; Soveri *et al*., 2017).

Disclosure Statement

- **Ethical approval and consent to participate:** Approval was obtained from the school, and consent was provided by the participating students.
- **Availability of data and materials:** The data supporting the findings of this study are available from the corresponding author

upon reasonable request.

- **Author contribution:** The sole author, Aala Karim Maayah, conceived, designed, conducted, and wrote the research.
- **Conflict of interest**: The author declares no conflict of interest.
- **Funding**: This research was self-funded by the author.
- **Acknowledgments:** The author expresses sincere gratitude to this journal's editor, his wife and kids, as well as his family members for their continuous support and encouragement in completing this work.

Open Access

References

- Abutalebi, J., & Green, D. W. (2016). Abutalebi, J., & Green, D. W. (2016). Neuroimaging of language control in bilinguals: Neural adaptation and reserve. *Bilingualism: Language and Cognition*, 19(4), 689–698.
- Aldosari, H., & Alsultan, A. (2017). Early bilingual education and reading skills among Saudi Arabian elementary students. *International Journal of Bilingual Education and Bilingualism*, 21(3), 356–372.
- Alhazmi, A. (2022). Gender and Educational Research in Saudi Arabia: Challenges and Limitations. *Journal of Educational Research and Practice*, 12(2), 45–60.
- Alhuqbani, M. N. (2016). Language learning strategies employed by Saudi EFL students. *International Journal of Applied Linguistics & English Literature*, 5(2), 153–160.
- Aljohani, O. (2016). The effect of bilingual education on the academic achievement of Saudi students. *International Journal of Bilingual Education and Bilingualism*, 19(4), 451–463.
- Al-khresheh, M., & Karmi, S. (2024). An Exploration of Cognitive Benefits of EFL Learning in a Monolingual Jordanian Context. *An-Najah University Journal for Research - B (Humanities), 38*(9), 1765–1794. https://doi.org/10.35552/0247.38.9.2250
- Al-Mansour, N. S. (2009). Bilingualism and academic achievement: A study of Arabic/English bilingual students in Saudi Arabia. *Journal of Language and Linguistic Studies*, 5(2), 90–102.
- Alsulami, S. (2017). The effectiveness of English as a foreign language instruction in Saudi Arabia. *Arab World English Journal*, 8(4), 115–127.
- Antón, E., & Soler, D. (2020). Early and late bilinguals' metalinguistic awareness: Evidence from syntactic and lexical awareness tasks. *Journal of Psycholinguistic Research*, 49(1), 77–95.
- Antoniou, M. (2019). The advantages of bilingualism debate. *Annual Review of Linguistics*, 5, 395–415.
- Elbedour, S., Sawan, A., & Bawalsah, J. A.

(2019). *The relationship between bilingualism and cognitive development among Saudi Arabian school-aged children. International Journal of Child Health and Human Development, 12*(2), 161–169.

- Bialystok, E. (2001). *Bilingualism in development: Language, literacy, and cognition*. Cambridge University Press.
- Bialystok, E. (2013). The impact of bilingualism on language and literacy development. In L. A. Verhoeven, H. & Perfetti, C. (Eds.), *Reading acquisition across languages and writing systems* (pp. 335–357). Cambridge University Press.
- Bialystok, E., & Craik, F. I. M., & Luk, G. (2012). Bilingualism: Consequences for mind and brain. *Trends in Cognitive Sciences*, 16(4), 240–250.
- Bialystok, E., Craik, F. I. M., & Luk, G. (2008). Cognitive control and lexical access in younger and older bilinguals. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 34(4), 859–873.
- Bialystok, E., Craik, F. I. M., Klein, R., & Viswanathan, M. (2004). Bilingualism, aging, and cognitive control: Evidence from the Simon task. *Psychology and Aging*, 19(2), 290–303.
- Bice, K., & Kroll, J. F. (2019). English only? Monolinguals in multilingual contexts. *Bilingualism: Language and Cognition*, 22(1), 1–6.
- Bobb, S. C., de Diego-Lázaro, B., & Kroll, J. F. (2020). Bilingualism and cognition: The role of lexical and syntactic competition. *Frontiers in Psychology*, 11, 572023.
- Bryman, A. (2016). *Social research methods* (5th ed.). Oxford University Press.
- Byers-Heinlein, K., & Lew-Williams, C. (2013). Bilingualism in the early years: What the science says. *Learning Landscapes*, 7(1), 95–112.
- Carlson, S. M., & Meltzoff, A. N. (2008). Bilingual experience and executive functioning in young children. *Developmental Science*, 11(2), 282–298.
- Costa, A., Hernández, M., & Sebastián-Gallés, N. (2008). Bilingualism aids conflict resolution: Evidence from the ANT task. *Cognition*, 106(1), 59–86.
- Cummins, J. (1979). Linguistic interdependence and the educational development of bilingual children. *Review of Educational Research*, 49(2), 222–251.
- Cummins, J. (2000). *Language, power, and pedagogy: Bilingual children in the crossfire*. Multilingual Matters.
- De Bruin, A. (2019). Not all bilinguals are the same: A call for more detailed assessments and descriptions of bilingual experiences. *Bilingualism: Language and Cognition*, 22(2), 228–230.
- Diamond, A. (2013). Executive functions. *Annual Review of Psychology*, 64, 135–168.
- Elbedour, S., Abu-Rabia, S., Bastien, D. T., & Irwin, J. L. (2019). *Bilingualism and cognitive development in Bedouin children. International Journal of Behavioral Development, 43*(4), 333–343. https://doi.org/10.1177/0165025419830806
- Enright, M. K., Bridgeman, B., Cline, F., Eignor, D., & Powers, D. (2008). *TOEFL iBT™: A new generation of TOEFL testing*. ETS.
- García, O., & Wei, L. (2014). *Translanguaging: Language, bilingualism and education*. Palgrave Macmillan.
- Gathercole, V. C. M., & Thomas, E. M. (2009). Bilingual first-language development: Dominant language takeover,

threatened minority language take-up. *Bilingualism: Language and Cognition*, 12(2), 213–237.

- Green, D. W. (1998). Mental control of the bilingual lexico-semantic system. *Bilingualism: Language and Cognition*, 1(2), 67–81.
- Grosjean, F. (1989). Neurolinguists, beware! The bilingual is not two monolinguals in one person. *Brain and Language*, 36(1), 3–15.
- Grosjean, F. (1998). Studying bilinguals: Methodological and conceptual issues. *Bilingualism: Language and Cognition*, 1(2), 131–149.
- Gullifer, J. W., & Titone, D. (2020). Characterizing the social diversity of bilingualism using language entropy. *Bilingualism: Language and Cognition*, 23(2), 283–294.
- Gullifer, J. W., Chai, X. J., Whitford, V., Pivneva, I., Baum, S., Klein, D., & Titone, D. (2021). Bilingual experience and resting-state brain connectivity: Impacts of the second-language acquisition context. *Brain and Language*, 212, 104876.
- Hao, Y. (2021). Cognitive effects of bilingualism: Evidence from a range of cognitive tests. *Cognitive Science*, 45(3), e12992.
- Hussien, A. (2014). The effect of bilingualism on cognitive development: Evidence from Arabic/English children. *Journal of Cognitive Development*, 11(4), 300–311.
- Jarvis, S., Kozaki, Y., & Kroll, J. F. (2008). *Intelligence and bilingualism: A study of cognitive tasks. Child Development, 79*(5), 1357–1369. https://doi.org/10.1111/j.1467-8624.2008.01194.x
- Kecskes, I., & Papp, T. (2000). Foreign language and mother tongue. *International Journal of Applied Linguistics*, 10(1), 60–75.
- Kroll, J. F., & Bialystok, E. (2013). Understanding the consequences of bilingualism for language processing and cognition. *Journal of Cognitive Psychology*, 25(5), 497–514.
- Kroll, J. F., & Stewart, E. (1994). Category interference in translation and picture naming: Evidence for asymmetric connections between bilingual memory representations. *Journal of Memory and Language*, 33(2), 149–174.
- Kroll, J. F., & Tokowicz, N. (2001). The development of conceptual representation for words in a second language. In J. L. Nicol (Ed.), *One mind, two languages: Bilingual language processing* (pp. 49–71). Blackwell.
- Kroll, J. F., Bobb, S. C., & Hoshino, N. (2014). Two languages in mind: Bilingualism as a tool to investigate language, cognition, and the brain. *Current Directions in Psychological Science*, 23(3), 159–163.
- Kroll, J. F., Dussias, P. E., & Bajo, M. T. (2018). Language use across contexts: Bilingualism and cognitive control. In J. W. Schwieter (Ed.), *The handbook of the neuroscience of multilingualism* (pp. 307–324). Wiley.
- Kroll, J. F., Dussias, P. E., Bogulski, C. A., & Valdes Kroff, J. R. (2012). Juggling two languages in one mind: What bilinguals tell us about language processing and its consequences for cognition. *Neuropsychologia*, 50(5), 705–718.
- Kroll, J. F., Gullifer, J. W., Whitford, V., & Titone, D. (2019). The neurocognition of bilingualism: Language processing and the social diversity of bilingual experience. *Current Opinion in Behavioral Sciences*, 29, 98–104.
- Landry, R. (1974). The relationship of bilingualism to intelligence. *Canadian Journal of Behavioural Science*, 6(2), 104–

117.

- Lin, D., & Wang, J. (2023). Syntactic and semantic awareness in bilingual individuals. *Journal of Psycholinguistic Research*, 52(1), 77–95.
- Lin, S. (2009). Bilingualism, working memory, and grammatical judgment. *Applied Psycholinguistics*, 30(2), 273–294.
- Linck, J. A., Hoshino, N., & Kroll, J. F. (2015). Cross-language lexical processes and inhibitory control. *The Cambridge Handbook of Bilingual Processing*, 94–110.
- MacIntyre, P. D. (2007). Willingness to communicate in a second language: Understanding the decision to speak as a volitional process. *Modern Language Journal*, 91(4), 564–576.
- Mackey, A., Eubank, L., & McDonough, K. (2000). How do learners perceive interactional feedback? *Studies in Second Language Acquisition*, 22(4), 471–497.
- MacLeod, C. M. (1991). Half a century of research on the Stroop effect: An integrative review. *Psychological Bulletin*, 109(2), 163–203.
- Melby-Lervåg, M., & Lervåg, A. (2012). Oral language skills and writing development: Results from a large-scale study. *Reading and Writing*, 25(5), 1205–1227.
- Merry, M. S. (2009). Gender, education and equality in Saudi Arabia. *International Review of Education*, 55(1), 39–57.
- Mitchell, K. J., & Potenza, M. N. (2017). *Virtual reality and cognitive control: Insights from the Stroop task. Computers & Education, 105,* 1–10 .
- Munoz, C., & Meliani, D. (2015). Metalinguistic awareness and bilingualism. *International Journal of Bilingualism*, 19(2), 236–250.
- Paap, K. R., Johnson, H. A., & Sawi, O. (2015). Bilingual advantages in executive functioning either do not exist or are restricted to very specific and undetermined circumstances. *Cortex*, 69, 265–278.
- Paradis, M. (2004). *A neurolinguistic theory of bilingualism*. John Benjamins Publishing.
- Pathak, L. S., & Rijal, S. (2022). *Bilingual Stroop effect in high and low proficient Nepali-English bilinguals. Linguistics and English Studies,* 1(1), 1–10. https://doi.org/10.3126/les.v1i1.46570
- Peal, E., & Lambert, W. E. (1962). The relation of bilingualism to intelligence. *Psychological Monographs: General and Applied*, 76(27), 1–23.
- Rosselli, M., Ardila, A., & Véliz, C. (2019). *Verbal and nonverbal skills in bilinguals: A cognitive perspective. Bilingualism: Language and Cognition, 22*(3), 523–534. https://doi.org/10.1017/S1366728918000744
- Rothman, J. (2019). Salient stimuli and cognitive control in bilinguals: Evidence from Stroop tasks. *Linguistic Approaches to Bilingualism*, 9(5), 623–645.
- Safiya, M., & Al-Zghoul, R. (2017). The Effect of Competency in the Second Language on Working Memory and Cognitive Flexibility among Bilingual Students in Akko City. An-Najah University Journal for Research - B (Humanities), 31(9), 1489–1524. https://doi.org/10.35552/0247-031-009-002
- Sanz, C., & Garcia, A. (2021). *Bilingualism and Stroop performance across cultures. Journal of Experimental Psychology: General, 150*(8), 1641–1656. https://doi.org/10.1037/xge0000950
- Saunders, A. F., & Garcia, A. (2020). *Cognitive overload in bilinguals: Myths and realities. Bilingualism: Language and Cognition, 23*(4), 876–887.

https://doi.org/10.1017/S1366728920000295

- Sawaki, Y., Stricker, L. J., & Oranje, A. H. (2009). Factor structure of the TOEFL iBT reading section: An application of confirmatory factor analysis. *Language Testing*, 26(1), 1–30.
- Sharaan, S., Fletcher-Watson, S., & MacPherson, S. E. (2021). *The impact of bilingualism on everyday executive functions of English–Arabic autistic children: Through a parent–teacher lens. Journal of Autism and Developmental Disorders, 51*(9), 3315–3328. https://doi.org/10.1007/s10803-021-05114-5
- Soveri, A., Antfolk, J., Karlsson, L., Salo, B., & Laine, M. (2017). *The inhibitory control model in bilinguals: A meta-analytic review. Psychological Bulletin, 143*(11), 1035–1054. https://doi.org/10.1037/bul0000098
- Surrain, S., & Luk, G. (2019). Describing bilinguals: A systematic review of labels and descriptions used in the literature between 2005–2015. *Bilingualism: Language and Cognition*, 22(2), 401–415.
- Swanstrom, R. S., & Gazzaley, A. (2011). Cognitive overload in multitasking: The role of inhibition. *Trends in Cognitive Sciences*, 15(9), 380–386.
- Thomas, E. M. (2018). The role of metalinguistic awareness in bilingualism. In E. Nicoladis & S. Montanari (Eds.), *Bilingualism across the lifespan* (pp. 59–76). American Psychological Association.
- Thomas, E. M., & Johnston, R. S. (2010). Understanding metalinguistic development in bilinguals. *Applied Psycholinguistics*, 31(3), 421–445.
- Tse, C. S., & Kerner, N. A. (2022). Metalinguistic skills in bilinguals: A review. *Frontiers in Psychology*, 13, 845623.
- Ünal, E., Ji, Y., & Papafragou, A. (2020). Early bilingual exposure and metalinguistic development. *Developmental Science*, 23(5), e12984. https://doi.org/10.1111/desc.12984
- Veríssimo, J. (2022). *Evidence that ageing yields improvements as well as declines in cognitive functions: A longitudinal study. Psychological Research, 86* (4), 1021–1033. https://doi.org/10.1007/s00426-021-01456-
- Wang, Y., & McBride, C. (2017). *Evaluating the effects of metalinguistic and working memory training on reading fluency in Chinese and English. Frontiers in Psychology, 8,* 2510.