

Examining the Impact of Bilingualism on Verbal Fluency

Aurora Micallef

A dissertation presented to the Department of Psychology

University of Malta for the degree of MPsy

May, 2025



University of Malta Library – Electronic Thesis & Dissertations (ETD) Repository

The copyright of this thesis/dissertation belongs to the author. The author's rights in respect of this work are as defined by the Copyright Act (Chapter 415) of the Laws of Malta or as modified by any successive legislation.

Users may access this full-text thesis/dissertation and can make use of the information contained in accordance with the Copyright Act provided that the author must be properly acknowledged. Further distribution or reproduction in any format is prohibited without the prior permission of the copyright holder.



FACULTY/INSTITUTE/CENTRE/SCHOOL Faculty for Social Wellbeing - Department of Psychology

DECLARATIONS BY POSTGRADUATE STUDENTS

Student's Code XXXXXXXXXX

Student's Name & Surname Aurora Micallef

Course Master of Psychology in Neuropsychology

Title of Dissertation

“Examining the Impact of Bilingualism on Verbal Fluency”

(a) Authenticity of Dissertation

I hereby declare that I am the legitimate author of this Dissertation and that it is my original work.

No portion of this work has been submitted in support of an application for another degree or qualification of this or any other university or institution of higher education.

I hold the University of Malta harmless against any third party claims with regard to copyright violation, breach of confidentiality, defamation and any other third party right infringement.

(b) Research Code of Practice and Ethics Review Procedures

I declare that I have abided by the University's Research Ethics Review Procedures.
Research Ethics & Data Protection form code SWB-2024-00521

As a Master's student, as per Regulation 58 of the General Regulations for University Postgraduate Awards, I accept that should my dissertation be awarded a Grade A, it will be made publicly available on the University of Malta Institutional Repository.

Signature of Student

AURORA MICALLEF

Name of Student (in Caps)

26-05-2025

Date

Acknowledgments

I want to begin by sincerely thanking my supervisor, Dr Kristina Bettenezana, and my co-supervisor, Dr Fiona Ambery, for their unwavering support, guidance, and encouragement throughout this research journey. Your valuable feedback and insightful input played a vital role in shaping and bringing this dissertation to fruition.

To my mother, father, brother, and grandparents, thank you for your unconditional love, continuous support, and encouragement throughout this journey. Your belief in me has been a source of strength every step of the way. To my boyfriend, Finn, thank you from the depths of my heart for your constant encouragement throughout this journey. I truly appreciate you.

To my course colleagues and dear friends, thank you for sharing this journey with me. I feel genuinely thankful to have met people who share my passion for neuropsychology. This experience would not have been the same without you.

Finally, my sincere thanks go to all the participants in this study; your involvement made this research possible.

Abstract

Maltese citizens are uniquely distinguished by their ability to switch interchangeably between Maltese and English, making code-switching a common feature of everyday communication. This phenomenon differs from traditional findings in bilingualism, where one language usually exhibits greater dominance over the other. The present study investigated the impact of bilingualism on verbal fluency in the Maltese context, using a quantitative research design. The study examined differences in semantic verbal fluency across three language conditions: *Maltese-Only* ($n = 20$), *English-Only* ($n = 20$), and *No Language Restrictions* ($n = 20$). A total of 60 adults over 18 (females, $n = 41$; males, $n = 19$) were randomly assigned to one of the three groups. Each participant completed a demographic questionnaire, the *Maltese Word Reading Test* (Bartolo, 1988), and the Vocabulary subtest from the *Wechsler Adult Intelligence Scale* (WAIS-IV; Wechsler, 2008) to assess their language proficiency. Participants also performed a semantic verbal fluency task using the three most commonly used measures: animals, fruits, and vegetables. Data was analysed using a One-Way ANOVA. Results showed that the *No Language Restrictions* group achieved the highest mean verbal fluency scores, followed by the *English-Only* and *Maltese-Only* groups. Post-hoc comparisons revealed significant differences between the *No Language Restrictions* group and the *English-Only* and *Maltese-Only* groups. However, no significant differences were found between the *English-only* and *Maltese-only* conditions. Future studies should explore the cognitive and linguistic factors contributing to these group differences. The study findings also highlight the importance of accommodating bilingual language modes during verbal fluency testing.

Key words: bilingualism, code-switching, Malta, verbal fluency, neuropsychology testing,

To my mother, who is also my greatest support and best friend, thank you for always reminding me to dream big and chase those dreams. I love you so much.

Table of Contents

Chapter 1: Introduction	1
Preamble	1
Bilingualism	1
Bilingualism in the Maltese Context	1
The Impact of Bilingualism on Verbal Fluency	2
Rationale for the Study	3
Research Contributions	5
Clinical Contributions	5
Overview of Chapters	6
Chapter 2: Literature Review	7
Chapter Overview	7
Historical Perspectives on Bilingualism	7
Defining Bilingualism in Context	8
Challenges in Operationalising Bilingualism	8
Bilingualism and Cognitive Functioning	9
Neural Effects of Bilingualism Across the Lifespan	10
The Maltese Bilingual Context	11
Lexical Influence and Mixed Language Use	11
Early Language Development and Code-Switching	12
Code-Switching: Cognitive Implications	12
Shifting Attitudes Towards Code-Switching	13
Bilingualism within the Educational System	13
Bilingualism within the Home	14
Verbal Fluency as a Cognitive Measure	15

Clinical and Research Applications	15
Inclusion in Neuropsychological Assessments	16
Phonemic VS Semantic Verbal Fluency Tasks	16
Cognitive Demands and Task Complexity	17
Demographic Influences on Performance	18
Impact of Bilingualism on Semantic Verbal Fluency	19
Methodological Biases in Assessing Bilingual Verbal Fluency	19
Lexical Access and Language Control Mechanisms	19
Interactional Context and Cognitive Adaptation	20
Lexical-Conceptual Links and Bilingual Development	21
Challenging Deficit-Based Assumptions	22
Promoting Inclusive Testing Practices	23
Conclusion	23
Chapter 3: Methodology	25
Introduction	25
Introducing the Theoretical Framework	25
The Research Design	26
Instruments Used	26
Participants	27
The Procedure	28
Measures Used for Data Collection	29
Demographic Questionnaire	29
Vocabulary subtest from the Wechsler Adult Intelligence Scale (Wechsler, 2008)	30
Task Structure and Scoring	30
Psychometric Properties	31

Cultural and Linguistic Validity	31
The Maltese Word-Reading Test (Bartolo, 1988)	31
Task Structure and Scoring	32
Test Interpretation	32
Psychometric Properties	33
The Semantic Verbal Fluency Test	33
The field of Neuropsychology	33
Task Structure and Scoring	34
The Administration Method	34
Psychometric Properties	35
General Procedures and Ethical Considerations	35
Research Hypotheses and Method of Data Analysis	36
Conclusion	38
Chapter 4: Results	39
Introduction	39
Preliminary Analyses	39
Checking for Data Errors, Missing Values, and Outliers	39
Checking for Assumption of Normality and Homogeneity of Variance	41
Normality of Data Distribution	41
Homogeneity of Variance	44
Selecting between Parametric and Non-Parametric Tests	44
Participant Demographics	45
Group Comparisons in Verbal Fluency Performance	48
Post-Hoc Analysis of Group Differences in Verbal Fluency Performance	51
Conclusion	52

Chapter 5: Discussion	53
Introduction	53
Summary of Results	53
Group Differences in Verbal Fluency across Three Language Conditions	53
Overview	53
Cognitive Mechanisms	54
Influence of Code-Switching and the Maltese Context	57
The Role of Early Language Development in Group Differences	59
Educational Background and Language Dominance	60
Contextual Language Preferences in Daily Life	60
The Need for Ecologically Valid Assessment in Bilingual Contexts	61
Conclusion	61
Chapter 6: Conclusion	62
Introduction	62
Summary of Study Findings	62
Strengths of the Study	63
Limitations of the Study	64
Implications of Findings	65
Clinical Implications	65
Research Implications	66
Future Recommendations	66
Conclusion	67
References	68
Appendices	91
Appendix A: Social Media Blurb	91

Appendix B: Participant Demographic Information Sheet	92
Appendix C: Proof of Ethical Clearance	94
Appendix D: Information Sheet	95
Appendix E: Consent Form	100

List of Figures

Figure 1: Flowchart of the participation from interest to inclusion in the study	29
Figure 2: Norms for Reading-Age Scores	32
Figure 3: Histogram Depictions of Verbal Fluency Scores by Language Group	43
Figure 4: Error Bar Graph of Mean Verbal Fluency by Language Group	50

List of Tables

Table 1: Outline of the statistical test used to analyse data	38
Table 2: Shapiro-Wilk Test Results for Verbal Fluency by Language Group	43
Table 3: Results on Levene's test of homogeneity of variance	44
Table 4: Demographic characteristics of participants by language group	47
Table 5: One-Way ANOVA Results for Verbal Fluency Across 3 Language Conditions ...	49
Table 6: Tukey Post-Hoc Comparison of Verbal Fluency Across Language Conditions	51

List of Acronyms

L1	First Language
L2	Second Language
WAIS-IV	Wechsler Adult Intelligence Scale (Fourth Edition)
BFLA	Bilingual First Language Acquisition
MCI	Mild Cognitive Impairment
NMC	National Minimum Curriculum
HLE	Home Literacy Environment
MoCA	Montreal Cognitive Assessment
RBANS	Repeatable Battery for the Assessment of Neuropsychological Status
D-KEFS	Delis-Kaplan Executive Function System
KBNA	Kaplan Baycrest Neurocognitive Assessment
NEPSY	Developmental NEroPSYchological Assessment
ICM	Inhibitory Control Model
BIA+	Bilingual Interactive Activation Plus
ACH	Adaptive Control Hypothesis
RHM	Revised Hierarchical Model

Chapter 1: Introduction

Preamble

The introductory chapter presents a concise outline of the different sections of the study. A background of the study will be presented and the study's rationale will be outlined. The selected methodology and the expected contributions to the field will then be illustrated. The chapter will conclude with an overview of each chapter of the study.

Bilingualism

Researchers estimate that over half of the world's population speak more than one language (Ellajosyula et al., 2020). Moreover, with globalisation enabling the migration of millions each year, the number of bilingual and multilingual individuals worldwide will probably keep rising in the future (Giovannoli et al., 2020). According to the *Linguistic Society of America*, a bilingual individual speaks two languages (Birulés et al., 2018). Similarly, the Merriam-Webster online dictionary explains bilingualism as the capability to speak two languages or the regular use of both (Merriam-Webster, 2018).

Bilingual individuals are often asked about their linguistic background and abilities, including when, how, and why they learnt more than one language. However, measuring the degree of bilingualism in a person is particularly difficult, as bilingualism exists in many different forms (Marian & Hayakawa, 2021). An individual's bilingual status is not a characteristic that can be directly quantified, like someone's height (Kremin & Byers-Heinlein, 2021). Instead, researchers typically assess bilingualism using a range of factors, such as language proficiency and exposure, highlighting its nature as a multidimensional construct or a construct made up of several interrelated attributes (Anderson et al., 2018).

Bilingualism in the Maltese Context

Although most countries accommodate the use of multiple languages, official bilingualism remains relatively rare. As a matter of fact, Malta is among the few nations

within the European Union's 27 member states that are officially bilingual (Sciriha, 2021). Malta presents a distinctive and remarkable sociolinguistic setting characterised by widespread bilingualism in Maltese and English. More than 95% of the population are ethnic Maltese and use Maltese as their first language in daily life, in simultaneous co-existence with English. Notably, over 85% of the population is also proficient in English (Camilleri Grima, 2016).

Based on J.A. Fishman's (1967) traditional framework of languages, the Maltese context reflects bilingualism without diglossia, as both languages are used across different social contexts and given equal value. Although English has clearly shaped the Maltese language in various linguistic aspects, such as morphology and vocabulary, and the variety of English spoken in Maltese is often referred to as Maltese English, it would be inaccurate to assert that Maltese has been overtaken or absorbed by this dominant international language (Camilleri Grima, 2016). Instead, the success of bilingualism in Malta lies in a balanced dynamic where Maltese is valued as a marker of identity and cultural preservation. At the same time, English is embraced for instrumental purposes, such as engaging with the broader world (Camilleri Grima, 2015).

The Impact of Bilingualism on Verbal Fluency

Verbal fluency tasks are typically used in neuropsychological assessments due to their sensitivity to demographic and clinical variables (Filippi et al., 2022). In these tasks, participants are usually asked to generate as many words as possible within a limited time frame based on specific prompts related to semantics, letters, or phonemes (Kassir et al., 2023). These tasks engage both language abilities and executive control functions, including inhibitory mechanisms that require participants to suppress irrelevant responses (Godefroy et al., 2018).

Research suggests that a person's first language (L1), typically learned during early childhood, plays an important role in shaping how they approach the learning of a second language (L2) later in life (Ahmed & Roberts, 2018). This influence can be seen particularly in how individuals develop phonological skills and build depth in their vocabulary (Thompson & Martinez, 2017). For example, bilingual individuals have been observed to generate fewer word associations in their second language than monolinguals, suggesting a potentially weaker semantic grasp of the second language (Mohammed & Aljabr, 2023). Notably, numerous studies have examined verbal fluency tasks in monolinguals and contrasted their performance to that of bilinguals when using their dominant language. Findings often show that monolinguals outperform bilinguals in semantic verbal fluency, whereas both groups perform similarly on phonemic verbal fluency tasks (Soltani et al., 2021). This discrepancy can be explained by the way bilinguals manage two language systems. Unlike monolinguals, bilinguals have two distinct language systems, which leads to notable differences in how lexical information is structured. While the two languages share conceptual meanings, each maintains a distinct vocabulary (Wang et al., 2020). Both languages are activated simultaneously during lexical access, resulting in competition when retrieving the target word. Therefore, when bilinguals use their second language (L2), the simultaneous activation of their first language interferes with processing, often causing longer response times than monolinguals (Cui et al., 2018). However, only a few studies have investigated verbal fluency in both languages spoken by bilingual individuals.

Rationale for the Study

Most existing research on bilingualism in relation to verbal fluency tasks has focused on contexts with a clear distinction between a first language (L1) and a second language (L2). Moreover, a large body of research highlights that monolinguals often outperform bilinguals on semantic verbal fluency tasks. To the best of the researcher's knowledge, no studies have

specifically explored the Maltese context, an environment in which Maltese and English are acquired from an early age and are afforded equal sociolinguistic status.

The aim of this study is to examine the impact of bilingualism on verbal fluency. In particular, this study will focus on the Maltese context, where speakers are uniquely adept at switching between Maltese and English. Bilingual participants will be randomly assigned to one of three language conditions: Maltese-only, English-only, and No Language Restrictions.

To guide the direction of this study, two main research questions and two secondary hypotheses were formulated. The central research questions underpinning the study were as follows:

- Does restricting bilingual individuals to one language affect their ability to produce words?
- How do verbal fluency outcomes vary among Maltese-only, English-only, and the No Language Restrictions speakers?

The secondary hypotheses, developed in response to these research questions, were:

- H_1 : Participants in the No Language Restrictions groups will produce more words than those in the Maltese-only or English-only groups.
- H_2 : Participants in the English-only group will produce more words than those in the Maltese-only group.

To address the primary research questions and test the proposed hypotheses, the study employed a quantitative experimental design with a between-groups comparison structure. A non-probability sampling strategy was used, with convenience sampling allowing all individuals who met the inclusion criteria to participate. To enhance the sample's diversity, a snowball sampling technique was also utilised. Inclusion criteria specified that participants must be at least 18 years of age, of any gender and bilingual in Maltese and English.

The aims of this study were investigated using standardised neuropsychological assessments, specifically the *Maltese Word-Reading Test* (Bartolo, 1988) and the Vocabulary subtest from the *Wechsler Adult Intelligence Scale* (WAIS-IV^{uk}; Wechsler, 2008), to evaluate participants' proficiency in Maltese and English. Additionally, participants completed the Semantic Verbal Fluency Test per their assigned language condition. A demographic questionnaire was also carried out to collect information on participants' age, gender, and highest completed level of education. A total of 60 participants were recruited for the study and were asked to complete the aforementioned tests. The data collected from all measures were analysed using the most recent version of Statistical Package for the Social Sciences (SPSS), Version 29.0.

Research Contributions

This study aims to challenge the conventional distinction between first and second languages often central to bilingualism research and broaden the understanding of how bilingualism operates in more balanced bilingual contexts, such as Malta. This study also seeks to explore the underlying reasons why bilingual individuals may underperform compared to monolinguals on semantic verbal fluency tasks. By examining Malta's unique linguistic landscape, this study offers perspectives that may enrich the broader field of bilingualism research. The insights gained could also help shape approaches in education, cognitive science, and clinical practice across other multilingual contexts.

Clinical Contributions

This study explores the ways in which bilingualism shapes verbal fluency in the Maltese context and points to the importance of using assessment practices that take cultural and linguistic factors into account. The results may be particularly helpful for neuropsychologists by offering insights into how language background can affect test performance. Taking these factors into account could help reduce the likelihood of

misdiagnosis and support the creation of fairer, more reliable assessment tools for bilingual populations, particularly for Malta.

Overview of Chapters

Chapter One introduced the study by presenting key literature related to the main research questions and providing a general overview of the research. Chapter two will delve further into the relevant literature to offer a more detailed foundation for the study. Furthermore, Chapter Three will explain the methodology in detail, including who was included in the study, how participants were recruited, what tools were used to collect data, the research hypotheses, and the statistical tests chosen. Chapter four will present the results, with particular attention to any differences observed between groups, whilst in Chapter five, these findings will be discussed with relevant literature. Finally, Chapter Six will conclude the study by summarising the primary outcomes, reflecting on its strengths, limitations and implications of the study, and suggesting directions for future research.

Chapter 2: Literature Review

Chapter Overview

This chapter introduces the concept of bilingualism, its significance within the Maltese context, and its connection to verbal fluency. The first part of the chapter will explore the historical and global perspectives on bilingualism and then examine its cognitive and neural implications across the lifespan. The second part of the chapter will discuss how bilingualism is manifested and institutionalised in Malta, including its role in education and the home environment. This chapter will also examine verbal fluency as a neuropsychological measure by discussing its structure, uses, and relevance in bilingual populations. Lastly, it considers the impact of bilingualism on verbal fluency performance and the cognitive processes involved.

Historical Perspectives on Bilingualism

Before the 1960s, it was widely argued that alternating more than one language in one individual's mind initiated ambivalence in the developing child, possibly leading to harmful consequences (Panchenko & Bilous, 2023). In the most severe claims, some reported that bilingualism might not only exacerbate cognitive abilities but could even lead to the development of intellectual disabilities (Goodenough, 1926). As some research has outlined, although it is fitting to hypothesise that switching between two languages may pose some cognitive challenges, the pre-1960s perspective on bilingualism was primarily shaped by disregarding the global prevalence of bilingualism (Bayram et al., 2021). Since the 1960s, researchers have shifted their approach to the conceptualisation and study of bilingualism.

Globally, bilingualism has long been the standard mode of language competence (Wagner et al., 2022). As a result, since a significant proportion of the global population is bilingual or multilingual, it is unjustifiable to deduce that acquiring more than one language would impede typical child development (Lohndal et al., 2019). Moreover, as long as clear

and consistent differences can be ascribed to bilingual versus monolingual children whilst considering co-occurring variables like socioeconomic status, the notion that bilingualism results in developmental difficulties lacks credibility. At present, there is no empirical evidence to support such an argument (Polinsky & Scontras, 2020).

Defining Bilingualism in Context

Bilingualism refers to more than one language system in an individual, whereas monolingualism denotes proficiency in one language (Rothman et al., 2023). Bilingualism may arise from growing up in bilingual communities, such as multilingual regions in Europe, like Catalonia in Spain, or urban centres with large immigrant populations. This differs from bilingualism acquired through growing up in an officially bilingual country like Malta, where both English and Maltese are institutionally supported and used daily (López et al., 2021). It is worth noting that code-switching tends to be the dominant mode of communication among Maltese speakers rather than pure bilingualism. The diverse manifestations of bilingualism across contexts highlight the challenges researchers face when attempting to operationalise bilingualism.

Challenges in Operationalising Bilingualism

Across disciplines concerned with bilingualism research, key criteria for identifying bilingual individuals, such as acquired proficiency in the languages, frequency of language use, and the number of spoken languages, remain complex due to their lack of specificity (Schwieter & Festman, 2023). The age of acquisition is recognised and frequently used by researchers, including linguists, neuropsychologists, and cognitive neuroscientists. It is generally believed that early bilingualism lies in early childhood; however, the precise age remains indefinite, with some researchers identifying the cut-off around age three, while others propose age six (Gunnerud et al., 2022). De Houwer (1996) distinguished between *bilingual first language acquisition* (BFLA) and *bilingual second language acquisition*. BFLA pertains to consistent

exposure to two languages from the first month of life, while the latter describes language exposure that begins after the first month but before the age of two (Montrul, 2023).

A more current life-span approach to language acquisition and learning provides a comprehensive classification of subgroups, encompassing both early and late language learners, including those in adolescence, middle adulthood, and advanced adulthood (Schwieter & Festman, 2023). For example, Pfenninger et al. (2023) suggested that overall language use, frequency of use, and language-switching behaviours can differ throughout the lifespan due to social environments, mobility, and evolving circumstances in speech communities and professional settings. Based on the different factors that influence bilingual acquisition, learning, and usage, each bilingual individual has a distinct profile of linguistic characteristics (Gregersen & Mercer, 2021).

Bilingualism and Cognitive Functioning

Studies comparing the cognitive abilities of healthy monolingual and bilingual adults have led to considerable debate. After a recent finding that bilingual middle-aged and older adults outperformed their monolingual peers on the Simon task, a widely used measure of executive function, the results generated significant interest (Bialystok, 2021). Conversely, subsequent studies, especially those involving young adults, failed to find significant performance variations on tasks assessing executive functions and working memory between bilinguals and monolinguals (Antón et al., 2019). These discrepancies led researchers to query the validity of the original findings, implying that previously reported bilingual advantages resulted from methodological biases such as small sample sizes or lack of control for variables such as socioeconomic status. Nonetheless, growing evidence suggests that bilinguals perform better than monolinguals, not only in tasks assessing executive functions but also in areas such as memory recall, working and semantic memory, and overall intelligence (Arce et al., 2019).

A substantial number of psycholinguistic studies indicate that both languages remain continuously active in the brain, regardless of situational demands or intentional use (DeLuca et al., 2020). To address this dual activation functionally, bilinguals rely on a cognitive skill known as *language control*. The mental processes and brain structures supporting language control are believed to partly overlap with those involved in higher-order functions, strengthening bilinguals' executive functioning behaviourally and neurologically (Lehtonen et al., 2023). In the same vein, since bilinguals rarely make intrusion errors from the non-target language, it has been extensively presumed that inhibitory control is central in suppressing the language not presently in use (Pereira Soares et al., 2022). Additionally, brain images have revealed that overlapping neural networks are implicated in both language and non-verbal selection, implying that inhibitory processes are enhanced in bilingual individuals (Li et al., 2021).

Neural Effects of Bilingualism Across the Lifespan

Neuroimaging research has revealed that bilinguals preserve greater neurostructural integrity than monolinguals as they age. In particular, bilingualism-related neuroplasticity reflected in grey and white matter density changes has been observed primarily, though not excessively, in regions associated with the language control network (Quiñones et al., 2024).

Population-level and neuroimaging research found that bilingualism plays a protective role in pathological ageing by delaying and alleviating the impact of symptoms (Gallo et al., 2022). This concept coincides with the theory of brain reserve, which is frequently observed in healthy individuals and correlated with enriching lifestyle factors, such as higher education and regular physical activity (Pernecky et al., 2019). Bilingualism is also recognised as a promising contributor to brain reserve, as the cognitive demands involved in maintaining, managing, and using multiple languages overlap with neural mechanisms similar to those activated by other enriching lifestyle factors (Ritchie et al., 2020). Subsequently, a growing

number of studies indicate that bilingualism may help delay the clinical manifestation of neurodegenerative diseases, most notably Alzheimer's disease or Mild Cognitive Impairment (MCI) (Liu & Wu., 2021).

The Maltese Bilingual Context

The Maltese context is represented by a long-established history of bilingualism in Maltese and English, with both languages being officially accepted in Malta's constitution in 1934 (Vella et al., 2022). Furthermore, the *National Curriculum Framework* acknowledges Maltese and English as official languages of instruction within the educational system (Ministry for Education, 2012). In everyday life, Maltese and English are used by approximately 95% and 85% of society, respectively, and feature prominently across various societal domains (Camilleri Grima, 2016).

Lexical Influence and Mixed Language Use

Camilleri Grima (2016) highlights the dual role of bilingualism in Malta, emphasising the importance of Maltese for identity and cultural preservation and English for instrumental functions, enabling integration into global contexts. Although bilingual speakers can communicate fully in Maltese, their speech often reflects different levels of English influence. This influence is most evident at the lexical level, where English words are commonly integrated into Maltese discourse and often pronounced according to Maltese phonological norms (Żammit, 2025). This continuous interaction between the two languages has given rise to hybrid linguistic varieties such as *Manglish*, *Mixed English Maltese*, or *Maltese English (MaltE)*, where Maltese and English are used alternately, in parallel, or a blended form (Panzavecchia, 2023). The blending of languages is also evident in the vocabulary retained by the British administration. Such vocabulary has remained in its original form without efforts to replace it with Maltese equivalents. Moreover, these terms now appear fully integrated into the Maltese grammatical system (Camilleri Grima, 2013).

Vella (2013) characterises this “rich and complex” linguistic environment where English and Maltese are routinely used side by side as “a continuum of use, along which speakers shift as a function of different variables” (p. 548). Numerous elements influence this fluid language use, such as work, the topic being discussed, the person being talked with, and the social situation (Sciriha, 2021). However, this widespread integration raises questions about whether the Maltese population is code-switching or employing a more mixed code.

Early Language Development and Code-Switching

According to the *Language Education Policy Profile* (2015), individuals who report using solely Maltese or English are still likely to engage in some form of code-switching. An example that illustrates the considerable influence of English on language use is the tendency of young children to incorporate vocabulary from both Maltese and English in their early speech. This highlights that code-switching emerges organically during the earliest language acquisition and development stages (Camenzuli et al., 2022). Furthermore, Maltese children often prefer counting and referring to numbers in English, even though Maltese equivalents are available, suggesting early internalisation of both linguistic systems (Camilleri Grima, 2018).

Code-Switching: Cognitive Implications

Code-switching, or the alternating use of two or more languages within one conversation, is a fundamental aspect of bilingualism and dramatically influences the cognitive control skills of bilingual individuals (Rayo et al., 2024). According to earlier research, frequent code-switching correlates with improved cognitive control ability (Barbu et al., 2018). However, the evidence is mixed, as some studies found no clear link between cognitive control performance and the frequency of code-switching (Kang & Lust, 2019).

While switching between languages is common among bilingual speakers, it can sometimes come with behavioural costs, like slower response times or greater mental effort

(Carpenter et al., 2021). As a matter of fact, Meuter and Allport (1999) introduced the concept of *asymmetric switching costs*, suggesting that bilingual speakers experience more difficulty when switching from their less dominant second language (L2) back to their more dominant first language (L1).

Shifting Attitudes Towards Code-Switching

Code-switching between Maltese and English was often viewed unfavourably. In Caruana's (2002) study, respondents viewed code-switching as arrogant. However, Calleja's (2019) more recent study suggests a change in viewpoint, suggesting a more contemporary understanding of the phenomenon. Calleja's study investigated the reason behind code-switching among Maltese speakers and deduced that, rather than being superficial, most code-switching served particular conversational purposes. Furthermore, the *National Minimum Curriculum* (NMC) recognises that, in specific contexts, code-switching is not only inevitable but necessary (Ministry for Education, 1999).

Bilingualism within the Educational System

Since the beginning of formal education in the nineteenth century, the Maltese education system has followed a bilingual framework (Camenzuli et al., 2022). The National Minimum Curriculum (Ministry of Education, 1999, p.37) “considers bilingualism as the basis of the educational system” and all institutions are expected to “adopt the policy of using two languages.” Consequently, government policy mandates that Maltese and English must be incorporated into the school curriculum, with the objective that all students achieve proficiency in both languages (Sciriha, 2024).

While academic instruction in primary and secondary schools is delivered in Maltese and English in roughly equal measure, the prominence of English tends to increase as students advance through the educational system (Caruana et al., 2019). Moreover, the predominant language of instruction in Maltese schools is influenced, to some extent, by the

type of school attended (Sciriha, 2024). Research shows that state schools and, to a limited extent, church schools primarily use Maltese as the language of instruction. In contrast, independent schools are characterised by a stronger emphasis on English (Vassallo & Sciriha, 2020).

Both students and teachers frequently use code-switching. However, code-switching is prohibited in the context of the MATSEC examinations for Maltese and English. As a result, candidates are expected to adhere strictly to the language of the examination, and any instances of code-switching are subject to penalisation. Consequently, from a national viewpoint, individuals are expected to demonstrate monolingual fluency in Maltese and English (Camilleri Grima, 2018).

Bilingualism within the Home

However, language proficiency differs significantly among individuals. For example, various factors may shape oral competence, including geographical locations, parental educational levels, and socio-economic status (Camenzuli et al., 2022). In a study on home language use in Malta, 40 Maltese participants were asked to complete the statement “When at home, I mostly speak,” selecting from English, Maltese, or both. The results showed that only 15% chose English, 67.5% reported speaking exclusively in Maltese, and 17.5% indicated using both languages in daily communication (Moreno Thobo-Carlsen, 2019).

The home environment typically serves as the primary context for the initial development of literacy skills (Muscat & Grech, 2024). Research shows that the home literacy environment (HLE) is critical in fostering language and literacy development in monolingual and bilingual children (Lau & Richards, 2021). Whether children grow up with one language or several, the quality and quantity of literacy-related activities at home are strongly linked to their vocabulary, reading comprehension, and other literacy skills (Li et al., 2023). Additionally, research has outlined that bilingual children are frequently exposed to similar

HLEs, with literacy activities taking place in their home language and the additional language they acquire (Jochimsen, 2022). However, because this input is divided between two languages, bilingual children often receive less exposure to each language than their monolingual counterparts (Muscat & Grech, 2024). As a result, the divided linguistic input may contribute to lower proficiency levels in each language (Sciriha, 2024).

However, Malta exhibits a distinctive form of bilingualism, often characterised as bilingualism without diglossia (Panzavecchia, 2024). In such a context, Maltese and English coexist within the exact communicative domains rather than being assigned functional roles. This results in a robust bilingual environment where children are exposed to both languages from an early age, though to varying degrees (Grech, 2023). As noted by Vella et al. (2018), it is uncommon for children in Malta to be raised monolingually, given the pervasive presence of Maltese and English in daily life.

Considering the varied ways bilinguals use and are exposed to language is fundamental to understanding how this shapes cognitive skills, including verbal fluency.

Verbal Fluency as a Cognitive Measure

Clinical and Research Applications

Verbal fluency tests are used in clinical settings to assess an individual's ability to generate words quickly within specific conditions (Villalobos et al., 2023). Since their introduction by Thurstone (1938), verbal fluency tests have grown exponentially and are now regarded as one of the most classical instruments in neuropsychological evaluation. Despite their easy and quick administration, verbal fluency tests give the clinician helpful information on an individual's cognitive status (Villalobos et al., 2023). Additionally, verbal fluency tests are used to evaluate cognitive impairment in neurodegenerative diseases such as Alzheimer's disease or Parkinson's disease (Farzanfar et al., 2018). These tests are also helpful in the assessment of individuals with acquired brain injuries, especially those resulting from stroke

or traumatic brain injury (Schmidt et al., 2017). It is important to note that verbal fluency tests typically do not exhibit ceiling effects when administered to neurologically healthy individuals. This suggests that verbal fluency tests are appropriately challenging to prevent most individuals from achieving top scores, making such tasks reliable in a wide range of testing situations. For instance, they are often used in the cognitive assessment for healthy adults and children (Jacobsen et al., 2017). Interestingly, verbal fluency tests are also used to evaluate cognitive functioning, such as executive function, attention, and processing speed, in individuals with mood disorders and psychiatric conditions, specifically schizophrenia (Akiyama et al., 2018).

Inclusion in Neuropsychological Assessments

Due to their cognitive efficiency and broad applicability, verbal fluency tests are commonly included in brief cognitive screening tools like the Montreal Cognitive Assessment (MoCA; Nasreddine et al., 2005) and the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS; Randolph, 1998). Verbal fluency tests are also included in more specialised batteries assessing executive functions, such as the Delis-Kaplan Executive Function System (D-KEFS; Delis et al., 2001). They are also included in tools evaluating general cognitive abilities, like the Kaplan Baycrest Neurocognitive Assessment (KBNA; Leach et al., 2000), and in assessments of children's neuropsychological development, such as the Developmental NEuroPSYchological Assessment (NEPSY-II; Korkman et al., 2007).

Phonemic VS Semantic Verbal Fluency Tasks

Most verbal fluency tests fall into two types: phonemic, where individuals generate words beginning with a specific letter, and semantic, where they produce words related to a particular category. In both cases, individuals are typically given one minute to list as many relevant words as possible (Lezak et al., 2012). The letters "F, A and S" are commonly used to evaluate phonemic verbal fluency, yet other letters may be chosen based on the

individual's language. For example, "P, M and R" are more suitable for Spanish-speaking individuals (Rivera et al., 2019). These letters work better for testing phonemic fluency in native speakers because they match how the language is used. Choosing letters that fit the language helps make sure the test reflects real verbal ability rather than being constrained by the structure of a different language (Olabarrieta-Landa et al., 2024). In contrast, for semantic verbal fluency tasks, the category "animals" is the most frequently used and often the only one included. However, other categories, such as "fruit" or "vegetables", are occasionally used (Rivera et al., 2019). A more detailed explanation is provided in the Methodology chapter.

Cognitive Demands and Task Complexity

Semantic fluency is generally easier than phonemic, with individuals typically achieving higher raw scores on semantic tasks (Strauss et al., 2006). Even though the specific reason for this benefit remains uncertain, phonemic fluency tasks are thought to demand more effortful cognitive processes, like strategic organisation and response inhibition (Zigiotto et al., 2022). Unlike phonemic fluency, semantic fluency is supported by the hierarchical organisation of semantic memory, which enables more structured word retrieval. For example, when naming items in the "animals" category, individuals can easily shift between subcategories, such as farm animals and sea animals (Schmidt et al., 2017).

Specific adaptations of the letter and category fluency tasks have been developed to increase the executive function demands involved in the assessment. For example, alternating fluency tasks require individuals to switch between different categories, such as "fruit" and "colours," between letters, for instance, words starting with "C" and "P," or even between a letter and a category, for example, the letter "F" and "animals" (Lezak, 2012). Additional modifications, such as excluded letter fluency tasks, prompt individuals to produce words that

omit a particular letter, for instance, generating words that do not include the letter “A” (Gonzalez-Recober et al., 2023).

Demographic Influences on Performance

As with most cognitive assessments, different demographic variables influence performance in verbal fluency tasks (Ardila, 2019). Phonemic and semantic fluency improve during childhood and adolescence and mildly decrease in advanced age, but both declines may vary (Strauss et al., 2006). The improvement from childhood to adulthood has been linked with remarkable gains in semantic memory and executive functions (Marques et al., 2022). Studies have shown that the decline of verbal fluency in advanced adults is associated with decreased processing speed (Frankenberg et al., 2021).

Performance on both phonemic and semantic fluency tasks is significantly associated with educational attainment, with individuals who have further education typically achieving greater results (Aziz et al., 2017). Educational attainment also plays a key role in shaping the qualitative aspects of task performance, like clustering and switching, which support a more structured and efficient word retrieval (Pereira et al., 2018). Moreover, numerous studies have found minimal evidence of gender-based variations in the number of words produced in phonemic or semantic fluency tasks. Nonetheless, some studies argue that females might outperform males in phonemic fluency tasks (Hirnstein et al., 2023).

Furthermore, cultural and linguistic variables have a significant and occasionally undervalued effect on neuropsychological assessment (Strauss et al., 2006). In a seminal study, Kempler et al. (1998) explored verbal fluency in different ethnic groups. They found that Spanish speakers scored lower than Vietnamese speakers, a difference explained by the generally longer word length in Spanish compared to Vietnamese (Kempler et al., 1998). However, a subsequent study comparing Finnish and English speakers found no group differences even though Finnish words were longer (Pekkala et al., 2009). These studies

highlight that word length alone cannot fully describe differences in verbal fluency performance and that different cognitive, linguistic, and sociocultural factors shape the outcome (Bushnell et al., 2022).

Impact of Bilingualism on Semantic Verbal Fluency

Methodological Biases in Assessing Bilingual Verbal Fluency

There is ongoing debate in the literature regarding whether and how linguistic differences manifest between monolingual and bilingual speakers (Patra et al., 2019). While findings from verbal fluency studies comparing both groups have been inconsistent, monolinguals often outperform bilinguals on semantic verbal fluency tasks. A common explanation is that bilinguals may have a smaller vocabulary size in each language owing to a diminished frequency of use across two language systems (Giovannoli et al., 2020). However, such an explanation may oversimplify the issue. This bilingual disadvantage is frequently amplified when utilising assessment tools that fail to include conceptual scoring, hence underestimating the bilinguals' combined vocabulary knowledge across both languages. Consequently, this highlights important concerns about test validity, arguing that observed differences may reflect methodological biases rather than cognitive deficits. Supporting this, studies have shown that performance disparities between monolinguals and bilinguals tend to diminish when groups are matched on receptive vocabulary (Paap et al., 2017). This challenges the notion that executive dysfunction underlies bilinguals' lower fluency scores and instead points to vocabulary size as a more plausible factor. However, this perspective does not fully account for the cognitive demands of bilingual language processing.

Lexical Access and Language Control Mechanisms

The *Inhibitory Control Model* (ICM) proposed by Green (1998) provides a compelling theoretical framework for interpreting these dynamics. According to the model, when a speaker intends to speak, words from both languages become activated and compete for selection. The

ICM thus characterises bilingual speech production as reliant on inhibition, control schemas, and a higher-level attentional system (Green, 1998). While essential for managing cross-language interference, this process can also result in slower or more error-prone lexical retrieval (Schwieter & Ferreira, 2016). From this standpoint, the fluency disparity may be better understood due to the bilinguals' language processing mechanisms and not a lack of linguistic competence (Li et al., 2021).

Similarly, the *Bilingual Interactive Activation Plus* (BIA+) model posits that bilinguals maintain an integrated lexicon. When a letter string is presented, it triggers the activation of orthographic, phonological, and semantic information across both language systems. Again, this dual activation imposes an additional cognitive load, which may slow lexical retrieval or increase error rates during verbal fluency tasks (Dijkstra & Van Heuven, 2002). The BIA+ model questions the notion that lower verbal fluency scores in bilinguals indicate limited linguistic ability but suggests that such assessment tools are designed for monolinguals. These assessment tools typically presume activation within a single language, failing to consider the cognitive demands of managing parallel activation across two linguistic systems (Zhang et al., 2024). As a result, traditional verbal fluency tools may not reliably reflect bilingual individuals' actual language proficiency but rather uncover the challenges inherent in navigating a more complex language architecture.

Interactional Context and Cognitive Adaptation

The *Adaptive Control Hypothesis* (ACH) builds on the earlier Inhibitory Control Model by proposing a more dynamic framework for understanding bilingual language control (Green & Abutalebi, 2013). Rather than assuming a static cognitive mechanism, the ACH argues that control processes adapt to the specific interactional contexts in which bilinguals use their languages. According to the ACH, bilinguals typically operate in one of three contexts: *single-language*, *dual-language*, or *dense code-switching settings* (Green & Abutalebi, 2013). In

single-language settings, bilingual individuals must use one language exclusively, necessitating continuous inhibition of the non-target language to avoid interference. This type of setting aligns with the core ideas of the ICM, which sees inhibition as the key to selecting the correct language. In dual-language environments, bilinguals regularly switch between languages depending on the situation, requiring even more mental effort to keep the non-target language in check (Han et al., 2023). In contrast, dense code-switching environments allow free and flexible language switching within the same interaction. This setting places less reliance on inhibition, as both languages are simultaneously active and accessible, promoting cooperative rather than competitive processing (Spinelli & Sulpizio, 2024).

Critically, the ACH explains that not all bilinguals engage in the same cognitive control, undermining the frequent practice of viewing bilinguals as a homogenous group in cognitive and verbal fluency research (Ng & Yang, 2021). As a result, traditional verbal fluency tasks fail to capture the natural processing strategies used in dense code-switching settings. Hence, test performance reflects a mismatch between assessment demands and the speaker's real-world control adaptations. This raises important concerns about the ecological validity and fairness of using monolingually normed assessments to evaluate bilingual cognition (Dash et al., 2021).

Lexical-Conceptual Links and Bilingual Development

The *Revised Hierarchical Model* (RHM) (Kroll & Stewart, 1994) provides important insight into the cognitive mechanisms involved in bilinguals' performance on semantic verbal fluency tasks. Instead of perceiving slower or less accurate responses in bilinguals as signs of linguistic difficulties, the Revised Hierarchical Model suggests that these patterns may stem from the developmental stage of lexical-to-conceptual connections, particularly in the non-dominant language (Williams & Naganuma, 2024). For bilinguals with lower proficiency in the non-dominant language, accessing meaning through translation via the dominant language

can increase cognitive effort and lead to delayed word retrieval, especially in timed tasks. For example, an English-dominant bilingual with lower Spanish proficiency asked to name animals in Spanish may first think of “dog” in English, then translate it to “perro”, adding an extra step that slows retrieval. Even highly proficient bilinguals may still experience subtle asymmetries in conceptual access across their two languages (Sperl et al., 2024), which can hinder fluency under standard test conditions. Consequently, these findings underscore that when semantic fluency tasks overlook the efficiency of bilinguals accessing conceptual knowledge, they risk misinterpreting slower retrieval as a lack of understanding (Schwartz, 2021).

Challenging Deficit-Based Assumptions

The ICM, BIA+, ACH, and RHM offer compelling evidence that semantic verbal fluency tasks, as traditionally designed, fail to provide a valid or comprehensive measure of bilingual language competence. Rather than capturing core linguistic ability, these models tend to reflect the underlying cognitive demands of managing two co-activated language systems, which are fundamentally different from those experienced by monolinguals (Zeng et al., 2019). Supporting this, Grosjean (1989) stated, “Bilinguals are not two monolinguals in one person” (p. 3). Moreover, the assumption that bilinguals can be fairly evaluated using tools developed for monolingual speakers lack theoretical justification and introduces systematic bias into assessment outcomes (Anderson et al., 2017).

These theoretical frameworks draw attention to a persistent limitation within the field—the ongoing reliance on monolingual norms as the benchmark for evaluating bilingual performance (Grundy et al., 2017). Such an approach neglects key bilingual-specific processes, including the concurrent activation of both languages, the need to inhibit the non-target language, and the role of interactional context in shaping language control. As a result, monolingual norms fail to account for the complex and dynamic nature of bilingual cognitive processing (Rosselli et al., 2016).

Future research and assessment design must go beyond superficial measures such as vocabulary size or response rate and engage with the mechanisms that shape bilingual verbal fluency (Declerck & Koch, 2023). Bilingual-sensitive methodologies should integrate insights from the mentioned theoretical models, consider the developmental and contextual variability of bilingual experience, and apply conceptual scoring and ecologically valid task formats (Jevtović et al., 2020). Without these adjustments, the field risks perpetuating inaccurate interpretations of bilingual ability, ultimately reinforcing inequities in educational, clinical, and research settings (Ardila et al., 2019).

Promoting Inclusive Testing Practices

This study highlights the critical need for neuropsychological assessments in bilingual contexts to account for the linguistic diversity and sociolinguistic complexity of the populations they aim to evaluate. In Malta, where bilingualism is shaped by frequent code-switching and mixed code, standardised tools must move beyond monolingual assumptions to ensure fairness and accuracy. Implementing approaches like conceptual scoring, designing tasks that mirror naturalistic language practices, and establishing localised normative data can substantially improve the ecological validity of these assessments tools. The findings from this study aim to offer practical and theoretical guidance for developing context-sensitive and culturally responsive assessment frameworks, to ensure valid and equitable evaluation in Malta and similarly complex bilingual settings.

Conclusion

In conclusion, this chapter reviewed literature on bilingualism, especially within the Maltese context and its relationship to verbal fluency. This chapter has outlined bilingualism by tracing its historical roots, global prevalence, and cognitive effects throughout different stages of life. This chapter also focused on Malta's distinctive bilingual setting, emphasising how bilingualism is embedded in the country's educational system, home environment, and

broader social context. Additionally, the chapter introduced verbal fluency as a key neuropsychological measure to evaluate language and cognitive functioning, with particular attention to its relevance in bilingual populations. Finally, the chapter explored how bilingualism influences verbal fluency performance and the underlying cognitive mechanisms.

The following chapter will explore the methodology used in this study to examine the impact of bilingualism on verbal fluency.

Chapter 3: Methodology

Introduction

This chapter presents the methodology used to examine the impact of bilingualism on verbal fluency. First, the theoretical framework, research design, and study sample are outlined, followed by a review of the instruments used for data collection. Next, the general procedures, including the ethical considerations and research approval, are explained. Ultimately, the study's formulated hypotheses and the analytical tools used to analyse the findings and test these hypotheses are discussed.

Introducing the Theoretical Framework

Positivism is a philosophical approach based on the view that knowledge stems from sensory perception and observable empirical evidence. Moreover, positivism forms the foundation of the quantitative research paradigm (Sale et al., 2002). The positivist paradigm is also often called the scientific paradigm (Mack, 2010). Positivists maintain that research should be value and bias-free, context-independent, and capable of replication (Plack, 2015). Ontologically, positivism merges with realism, emphasising that entities exist independently from the self. From this standpoint, researchers must act as objective and value-neutral observers of an external, objective reality (Moñivas et al., 2005).

Furthermore, the post-positivist perspective challenges the positivist idea that researchers are entirely objective observers. Post-positivists assume that a researcher's ideas and identity form their observations, potentially influencing their conclusions (McGlinchey, 2022). Rather than denying these influences, post-positivism seeks objectivity by recognising and addressing such biases through developing theories and knowledge (Sukamolson, 2007).

In light of the study's epistemological stance, the post-positivist paradigm is suitable for examining the impact of bilingualism on verbal fluency. This approach acknowledges the

prone to unavoidable errors in quantitative research and recognises the limitations of fully capturing reality through empirical findings.

The Research Design

The study adopted a quantitative methodology for data collection and analysis, allowing the researcher to recruit a large participant sample and examine potential relationships to allow for broader generalisation within the local context. In addition, an experimental research design was selected to examine the impact of bilingualism on verbal fluency within the Maltese context. An experimental design with a between-groups comparison structure was chosen, as it allows for the controlled comparison of outcomes across different conditions, enabling the researcher to identify relationships between language use and verbal fluency performance (Kazdin, 2021).

The participants were recruited using convenience sampling, a non-probabilistic sampling method in which individuals are selected based on availability and ease of access (Golzar et al., 2022). This sampling method was suitable due to the study's exploratory nature and the focus on bilingual individuals in the general population (Naderifar et al., 2017). Furthermore, a snowballing technique was used, where some participants were referred by participants who had already participated in the study. This technique assisted in improving sample diversity (Hossan et al., 2023).

Instruments Used

To conduct the assessment procedure of this study, the researcher selected a combination of language-related tests and a demographic questionnaire.

The language-related tests included the Maltese Word Reading Test (Bartolo, 1988), the Vocabulary subtest from the Wechsler Adult Intelligence Scale (WAIS-IV^{uk}; Wechsler, 2008), and the Semantic Verbal Fluency Test. It is important to note that the WAIS-IV^{uk} and the Semantic Verbal Fluency Test are not standardised for the Maltese population. In

contrast, the Maltese Word Reading Test is one of the few assessments developed and standardised locally. These measures were chosen to assess participants' English and Maltese proficiency and to evaluate their word generation ability across three specific categories, depending on their allocated group. Furthermore, given the large sample size, test selection also considered the duration of administration. Consequently, subtests that could be administered more quickly were prioritised over those requiring longer administration times.

The following sections will explore the research methodology in more detail.

Participants

The recruitment process was primarily conducted via social media platforms, particularly Facebook, which served as the main medium for reaching a wide range of individuals from the general population who met the study's inclusion criteria (Appendix A).

The inclusion criteria for eligibility to participate in this study were as follows.

- Participants were required to be 18 years of age or older to meet ethical research standards.
- Participants could be male, female, or other gender identities.
- Participants were required to be bilingual in Maltese and English, as the chosen tests assessed proficiency in both languages, and participants could be randomly assigned to any language group for the Semantic Verbal Fluency Test.

The exclusion criteria of this study included the following.

- Participants who were monolingual. This exclusion criteria was applied because being fluent only in either English or Maltese could compromise the validity of the Semantic Verbal Fluency Test, particularly if participants were randomly assigned to a group requiring proficiency in the language they did not speak.

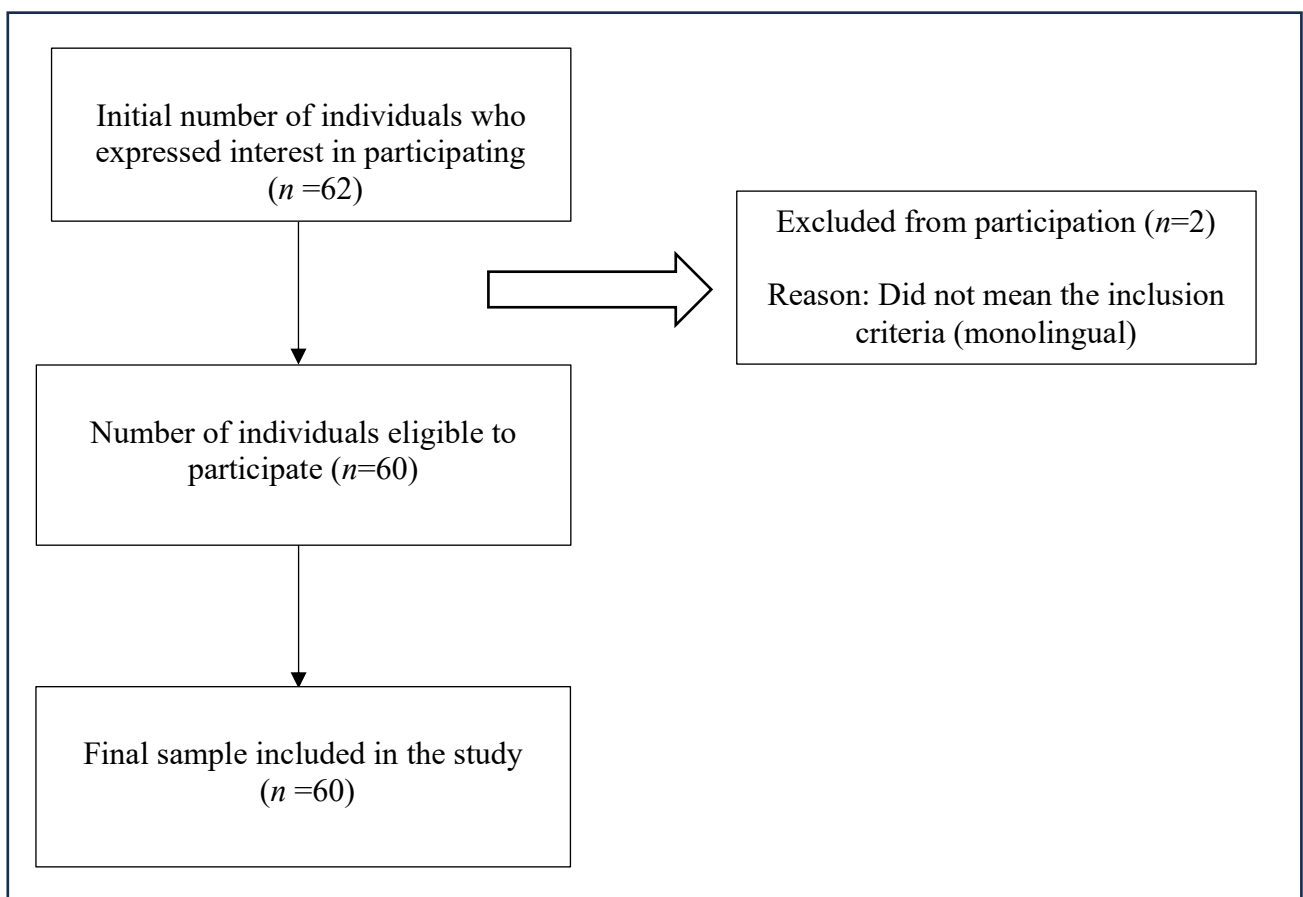
The Procedure

Before the data collection, the researcher carried out a brief pilot study with two individuals from the population to review the assessment procedure. The brief pilot study helped to evaluate the clarity of instructions, estimated completion time, and overall practicality. Feedback obtained throughout this stage was used to improve instructions, verify the practicability of electronic forms, and certify that task requirements were clearly understood. Even though the data from the pilot participants was not added to the final analysis, the brief pilot study helped optimise the assessment process and minimise possible mistakes during the main study. Initially, a total of 62 participants expressed interest in participating in the study. However, two were excluded based on the exclusion criteria of being monolingual. As a result, the total sample size consisted of 60 participants. A total of 41 participants were female ($n=41$, 68.3%), and the remaining 19 were male ($n=19$, 31.7%).

The recruitment process, from initial interest to final participation, is shown below in Figure 1.

Figure 1

Flowchart of the participation from interest to inclusion in the study



Measures Used for Data Collection

The sections below offer a detailed overview of each measure used to collect relevant data for this study.

Demographic Questionnaire

The researcher developed a demographics questionnaire that gathered the participants' demographics (Appendix B). The questionnaire consisted of three questions, which each participant was required to fill out. The researcher included only demographic information considered applicable to the study. Additionally, participants were informed that they could ask questions if they encountered any difficulties understanding the questions. Participants were required to indicate their gender and age for standardised scoring purposes. They were also asked to note their highest education level. Educational level is a key indicator of cognitive reserve, which may impact performance on the measures selected in this study (Wilson et al., 2019). Furthermore, higher levels of education have been associated with improved verbal fluency, likely due to enhanced lexical access (Lubrini et al., 2022).

Vocabulary subtest from the Wechsler Adult Intelligence Scale (WAIS-IV^{uk}; Wechsler, 2008)

The Vocabulary subtest is part of the Wechsler Adult Intelligence Scale (Fourth Edition) (WAIS-IV^{uk}, Wechsler, 2008), one of the most widely used measures of intelligence quotient. Although the fifth edition (WAIS-V^{uk}), is the most recent and advanced version of the test, the WAIS-IV^{uk} Vocabulary subtest was used in this study due to unavailability. Within the WAIS-IV^{uk}, the Vocabulary subtest may be administered as part of the entire assessment battery or as a measure of the Verbal Comprehension Index (VCI).

Task Structure and Scoring. The Vocabulary subtest involves asking individuals to define up to 30 words. The subtest begins at item five and the administration continues until three consecutive zero scores are noted. If a score of zero or one is obtained on either items

five or six, earlier items are administered in reverse order until two consecutive scores of two points are attained. It is worth mentioning that items five and six serve as teaching items; thus, corrective feedback is provided when an individual's response does not meet the criteria for a two-point score (Wechsler, 2008). During the subtest, the researcher reads each word aloud whilst simultaneously pointing to the words in the stimulus book so that the individual can follow along. Words may be repeated as needed but not altered in any way.

Items one to three are picture-based, scored as one for correct and zero for incorrect or no response within 30 seconds. Whilst items four to 30 are verbal, scored two for a response demonstrating strong understanding, one for a correct but vague response, and zero for an incorrect answer. In certain instances, when an individual's response is ambiguous, too vague, or marked with a (Q) in the sample responses, the researcher prompts the individual for additional clarification (Wechsler, 2008). The maximum raw score is 57, which is later converted to a scaled score based on the individual's age by using the WAIS-V_{uk} manual. Scaled scores of eight to 12 are considered average, below eight as below average, and above 12 as above average relative to same-age individuals (Wechsler, 2008).

Psychometric Properties. While the theoretical foundations of the WAIS-V_{uk} have been subject to critique, the psychometric evidence in the technical and interpretive manual offers empirical justification for drawing clinical conclusions on an individual's intellectual functioning (Benson et al., 2010). The WAIS-V_{uk}'s subtest reliability coefficients demonstrate strong internal consistency, ranging from .78 for Cancellation to .94 for Vocabulary (Wechsler, 2008b). One study found that the Vocabulary subtest was the only subtest to demonstrate the highest level of reliability and precision at a point slightly below the average ability level, specifically around $\theta = -0.6$ (Abdelhamid et al., 2021). As a result, the Vocabulary subtest demonstrates optimal reliability and accuracy in assessing individuals

with slightly below-average verbal ability rather than those with average or above-average proficiency.

Cultural and Linguistic Validity. Although the WAIS-V_{uk} Vocabulary subtest was chosen due to its widespread application in measuring expressive vocabulary and verbal reasoning, it is important to note that the tool has not been standardised for use with the Maltese population (Shuttleworth-Edwards, 2016). The test items were developed within the sociolinguistic and cultural framework of American English. Therefore, the subtest may include culturally embedded language, references, or expectations that do not fully correspond to the bilingual realities of Maltese individuals. Consequently, its cultural and linguistic appropriateness may be diminished. Therefore, extreme caution is crucial when interpreting scores. Moreover, the lack of Maltese-specific norms is a methodological bias that may influence cultural fairness.

The Maltese Word-Reading Test (Bartolo, 1988)

The Maltese Word Reading Test is a standardised instrument developed to assess single-word reading ability in Maltese-speaking children (Bartolo, 1988). Its emphasis on single-word reading makes it notably effective for detecting specific reading difficulties such as dyslexia and guiding tailored interventions (Gatt, 2012).

Task Structure and Scoring. The test consists of 60 Maltese words presented to individuals, with each response noted under one of the following categories: “s” if sight-read without pause, “a” if analysed audibly or silently, “o” if omitted, and “i” for incorrectly read; where the incorrect word is written (Bartolo, 1988). The total number of correctly read words, sight-read and analysed, is summed to produce a total score, which is then converted into a reading-age score. Figure 2 is adapted from the Maltese Word-Reading Test manual and presents the norms linking raw scores to corresponding reading ages in years and months.

Figure 2

Norms for Reading-Age Scores

Table 3.2: Norms for Reading-Age Scores

<u>Raw Score</u>	<u>Reading Age</u>
(Total correct)	(years:months)
1- 8	< 6:00
9-14	6:00
15-19	6:03
20-23	6:06
24-28	6:09
29-32	7:00
33-37	7:03
38-40	7:06
41-42	7:09
43-44	8:00
45	8:03
46-47	8:06
48	8:09
49	9:00
50	9:03
51	9:06
52-60	> 9:11

Test Interpretation. By nine years and six months, average word-reading scores appear to reach a ceiling, implying that the test could no longer effectively distinguish between higher-performing readers. Bartolo (1988) noted that this effect may be partially due to the fact that higher-achieving readers had already progressed to more advanced schools, such as junior lyceums. Additionally, the ceiling effect is likely influenced by the phonological consistency of the Maltese language, which enables proficient readers to read both familiar and unfamiliar words with ease.

Psychometric Properties. Although specific psychometric data are unavailable, the test's frequent application in educational contexts indicates its practical effectiveness in evaluating reading abilities.

The Semantic Verbal Fluency Test

The field of Neuropsychology. Verbal fluency tests based on phonological and semantic cues are widely used in clinical and experimental neuropsychology to evaluate

executive functioning, lexical access, and word production abilities (Villalobos et al., 2023). The Semantic Verbal Fluency test, also known as the list generation test, is widely employed to assess lexico-semantic and cognitive functioning. It offers a quick and efficient method for examining processes related to semantic memory retrieval and access (Aziez et al., 2020).

Clinically, the Semantic Verbal Fluency test holds diagnostic value in identifying cognitive deficits associated with conditions like Alzheimer's disease, Parkinson's disease, traumatic brain injury, and different forms of aphasia (Marra et al., 2021). Performance on this test can uncover particular deficits in semantic memory access, processing speed, and executive control, making it a beneficial tool in differential diagnosis and monitoring the disease's prognosis (Wright et al., 2023).

In the context of bilingual individuals, Semantic Verbal Fluency tests have also become important for understanding how dual-language systems affect cognitive functioning (Giovannoli et al., 2023). The present study contributes to this field by examining how language context constraints: Maltese-only, English-only, or No Language Restrictions influence Semantic Verbal Fluency test performance in Maltese-English bilinguals.

Task Structure and Scoring. In the semantic verbal fluency test, “animals” is the most frequently used and often the only category used (Becker et al., 2019). However, other categories are sometimes administered, like “fruit or vegetables”, “things in the kitchen”, “clothes”, or “first or proper names” (Jebahi et al., 2021; Lubrini et al., 2021; Nogueira et al., 2017; Rivera et al., 2019). In most task versions, participants are instructed to generate as many words as possible within 60 seconds per category (Ardila, 2019). In semantic fluency tests, when a participant produces a superordinate term and a specific example (e.g., “fish” and “shark”), only the exemplar is credited. Similarly, when variants related to sex (e.g., “hen” or “rooster”) or age (e.g., “dog” and “puppy”) are given, only one of the items is credited. These scoring guidelines are commonly applied when the primary aim is to assess

executive functioning (Dubé & Thordardottir, 2024). However, if the objective is to evaluate a participant's ability to produce distinct lexical items, it is argued that such variations represent unique vocabulary entries and should, therefore, be considered in estimating vocabulary size (Dubé, 2019).

The Administration Method. In this study, the selected semantic categories included “animals”, “fruit”, and “vegetables”. Such categories were chosen because they are extensively used in verbal fluency studies, culturally neutral, and relevant to linguistic backgrounds (Lezak, 2012). Additionally, these categories are commonly used because of their semantic richness and accessibility, which permits fairer comparisons between language groups (Carpenter et al., 2021). Participants were instructed to generate as many relevant words as possible within a 60-second time frame per category, according to their randomly assigned language condition: Maltese-only, English-only, or No Language Restrictions. Random allocation was done using an online random group generator, which guaranteed that participants were allocated equally and without bias across the three experimental groups. This method was necessary for maintaining internal validity by controlling for confounding variables about participant characteristics (Creswell & Creswell, 2018).

To minimise potential practice effects between categories, given that each participant across all groups was required to complete all three categories, a longer interval was introduced between each task. Additionally, as this study focuses on the impact of bilingualism on verbal fluency, all lexical variations were counted in the scoring process, provided that they adhered to the language specified by the participant's randomly assigned group.

Psychometric Properties. Normative data for semantic fluency tasks are language- and population-specific, varying according to each population's linguistic and cultural characteristics. Furthermore, broadening the range of valid responses can result in higher raw

scores; hence, available norms may no longer be appropriate (Patra et al., 2020). The inclusion of lexical variations alters the focus of the Semantic Verbal Fluency Test from primarily measuring executive functions to measuring lexical access and vocabulary range. While this may strengthen content validity in the context of bilingual vocabulary research, it can also restrict comparability with established Semantic Verbal Fluency norms (Friesen et al., 2021).

General Procedures and Ethical Considerations

The study commenced following the acknowledgement of the research ethics application by the Faculty Research Ethics Community (FREC) on May 22nd, 2024 (Appendix C). As the study involved no self-assessment issues and participants were recruited from the general population, no additional ethical clearance was necessary.

Each participant received an electronic Information Sheet (Appendix D) outlining detailed study information, including participation procedures and ethical considerations. Participants were also given the opportunity to ask any questions they had about the study. Participation was entirely voluntary, meaning that any eligible individual could participate. After voluntarily agreeing to participate, all participants were provided with a consent form (Appendix E) and informed written consent was obtained electronically before the assessment. A mutually convenient date and time for the assessment was decided between the researcher and each participant. Additionally, the assessments were carried out in settings designed to minimise distractions and reduce the potential influence of confounding variables. On average, the assessment lasted around 15 minutes. However, the exact duration varied depending on how long each participant required to comprehend and complete the tasks, particularly the Vocabulary subtest and the Maltese Word-Reading Test, as both were untimed. The data collection phase of the study was carried out between October 2024 and March 2025.

All participants had the right to accept, refuse, or withdraw from participation at any point in the research without providing any reason and without any repercussions. However, participants were advised that if they decided to cease participation in the research, data from their assessment could only be deleted, provided it was physically feasible. All procedures followed the ethical guidelines established by the University and complied with data protection standards, including the General Data Protection Regulation (GDPR). Therefore, anonymity and confidentiality of participation were guaranteed by storing participant assessment scores in anonymised files separate from their signed consent forms. Furthermore, there were no specific risks to the participants.

Participants were also given the option to indicate whether they wished to receive an electronic copy of the dissertation upon its publication by providing their personal email addresses.

Research Hypotheses and Method of Data Analysis

This study primarily aimed to examine the impact of bilingualism on verbal fluency. Following informed written consent, participants were randomly assigned to one of three groups: Maltese-only, English-only, or No Language Restrictions. Participants completed the Vocabulary subtest and the Maltese Word-Reading Test to evaluate their proficiency in English and Maltese. Participants also completed the Semantic Verbal Fluency Test according to their assigned language condition.

The data was collected and analysed using the latest Statistical Package for the Social Sciences (SPSS, Version 29.0). The null hypothesis posits that no statistically significant difference exists between the mean verbal fluency and the language groups. If the p-value exceeds the predetermined threshold for significance ($p > 0.05$), the null hypothesis is retained. Conversely, if the p-value falls below the significance level ($p < 0.05$), the null

hypothesis is rejected in favour of the alternative hypothesis, which asserts that the language groups differ in mean verbal fluency.

The study aimed to examine the impact of bilingualism on verbal fluency by exploring two research questions. The research questions guiding this study were:

- Does restricting bilingual individuals to one language affect their ability to produce words?
- How do verbal fluency outcomes vary among Maltese-only, English-only, and bilingual (Maltese and English) speakers?

The secondary hypotheses were derived from the two research questions of this study:

- H₁: Participants in the No Language Restrictions group will produce more words than those in the Maltese-only or English-only groups.
- H₂: Participants in the English-only group will produce more words than those in the Maltese-only group.

After evaluating the assumption tests for violations and identifying potential outliers, a parametric statistical test was chosen to analyse the collected data and test the research hypotheses. The normality was assessed using the Shapiro-Wilk test and a graph illustration, which help determine whether the distribution of scores conforms to a normal distribution or deviates from it. Table 1 presents an overview of the statistical test used in this study.

Table 1*Outline of the statistical test used to analyse data*

Statistical Test	Purpose
One-Way ANOVA Test	- To compare the number of words generated across the “Maltese-Only,” “English-Only,” and “No Language Restrictions” groups.

Note. A one-way ANOVA was conducted to examine group differences in verbal fluency performance based on language condition.

Conclusion

This chapter provided an overview of the theoretical foundations, the research design, and the procedures employed for this study. It also described the sample and outlined the research questions, hypotheses, and data analysis. The following chapter will present the results of the normality and homogeneity of variance tests, along with the results of the statistical analysis outlined above.

Chapter 4: Results

Introduction

This study examined the impact of bilingualism on verbal fluency, with a specific emphasis on the Maltese context, where individuals skilfully switch between Maltese and English. This chapter presents the outcomes of the statistical tests used to test the research hypotheses. It begins with an overview of the preliminary data checks, including the detection of outliers, identification of missing data, and evaluation of the assumptions of normality and homogeneity of variance. This is followed by a summary of the participants' demographic characteristics. The second part reports the results of the One-Way ANOVA used to explore group differences in word generation. Finally, a deeper analysis of the groups is presented.

Preliminary Analyses

Checking for Data Errors, Missing Values, and Outliers

In natural and social science research, dealing with missing data and outliers is a common obstacle during data collection. Missing information often occurs when participants fail to respond to certain items, withdraw from the study, or when data is lost, factors that can lead to a smaller sample size and reduce the overall reliability of the research outcomes. Conversely, outliers refer to extreme data points that deviate markedly from the general distribution of the dataset (Kwak & Kim, 2017).

Following a visual examination of the boxplots, the verbal fluency scores across the three language groups fell within the expected range, confirming that no errors in the data entry were made. No missing values were presented for the variable used in the statistical analyses, as all verbal fluency scores were included. Consequently, the entire sample ($n=60$) was retained for the statistical analyses conducted in this study.

Given the potential impact outliers may have on the reliability and validity of the statistical analyses, an inspection for outliers in the verbal fluency scores across the three language groups: Maltese-only, English-only, and No Language Restrictions was carried out (Sullivan et al., 2021). Outliers can significantly influence statistical results, often pushing the mean higher or lower than it should be. Therefore, it is important to identify and handle any outliers before running analyses (Kwak & Kim, 2017). This study used two methods to check for outliers more accurately: visually inspecting box plots and analysing z-scores.

Soetewey (2020) claims that some researchers use z-scores less than -3.29 or greater than 3.29 to identify outliers. The idea behind this value is that, in a normal distribution, only one observation out of every 1000 would generally go outside this range. As a result, a commonly used technique for assessing whether possible outliers are concerning is to convert raw scores into z-scores. This method helps uncover values that significantly deviate from the distribution by quantifying the number of standard deviations (Merza & Al-Anber, 2021). No outliers were found when the box plots in this study were examined, and the raw scores were converted into z-scores.

When outliers are detected, several strategies have been recommended to minimise their impact on the results. There are generally three main approaches to handle outliers. The first involves removing the outliers through trimming. Although removing outliers is frequently thought to be the most effective method of eliminating extreme data points, the general integrity of the dataset may be compromised (Kwak & Kim, 2017). The second method involves substituting the outliers or modifying their influence via outlier weight adjustments. Winsorization, for example, is a frequently used substitution technique that substitutes the closest non-outlier for an outlier. The last approach estimates outlier values using robust statistical methods. When the characteristics of the population distribution are

known, this method is considered suitable because it provides estimators that are both robust to outliers and statistically consistent (Dash et al., 2023).

Checking for Assumption of Normality and Homogeneity of Variance

To verify if the assumptions necessary for parametric statistical methods were met, the data were analysed using tests for normality and homogeneity of variance. An assessment of normality is necessary for many statistical tests, as normal data is a fundamental premise in parametric testing. If the assumption of normality is not met, it is advisable to use non-parametric tests, also known as distribution-free tests. A non-parametric test is a hypothesis test that does not rely on assumptions about specific parameters of the population's distribution (Jiang, 2021). In contrast to parametric tests, which require the data to be normally distributed, non-parametric tests are ideal when the data are highly non-normal or not easily corrected through transformation (Smeeton et al., 2025). While non-parametric tests hold more statistical power when the assumptions of parametric tests are not satisfied, they are typically viewed as less effective in finding significant differences between groups (Nussbaum, 2024). Nevertheless, using parametric tests on data that do not follow a normal distribution can increase the risk of overlooking significant differences.

Normality of Data Distribution. There are two primary approaches for evaluating normality, including graphical and numerical methods (Bland, 2015). Graphical illustrations offer the benefit of visual judgment, which can be especially useful when numerical tests may be over- or under-sensitive. However, assessing normality through graphical methods requires considerable experience to avoid misinterpretation. Without such expertise, depending on numerical methods is generally more reliable (Mishra et al., 2019). The two most widely used tests for assessing normality are the Shapiro-Wilk and Kolmogorov-Smirnov tests. The Shapiro-Wilk test is considered more suitable for small sample sizes (< 50 samples), though it can also be applied to larger samples. In contrast, the Kolmogorov-

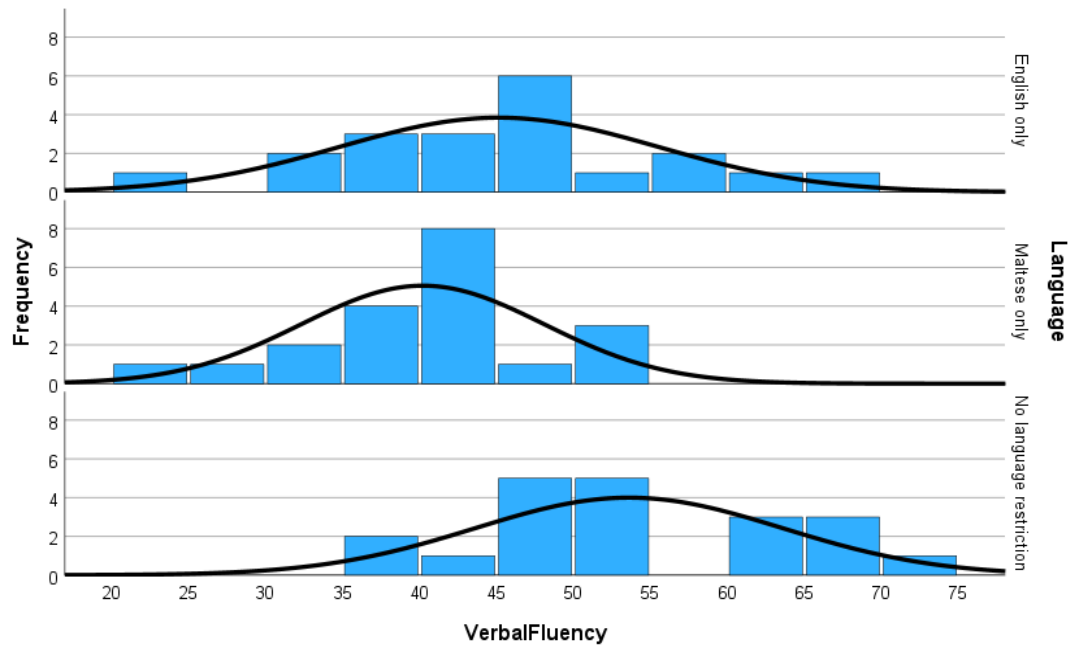
Smirnov test is typically used for larger sample sizes ($n \geq 50$). For both tests, the null hypothesis assumes that the data comes from a normally distributed population, whilst the alternative hypothesis states that the score distribution is skewed. If the p-value is greater than 0.05, the null hypothesis is accepted, and therefore, the data can be considered normally distributed (Yang & Berdine, 2021). On the other hand, the alternative hypothesis is accepted if the p-value is less than 0.05. Another way to assess normality is by examining skewness and kurtosis values. Skewness indicates the degree of asymmetry in distribution, while kurtosis reflects the sharpness or flatness of its peak. The data are symmetrically distributed across the centre in a normal distribution, with the mean, median, and mode coinciding. In such cases, the skewness and kurtosis value is 0 (Demir, 2022). A distribution is normal if the skewness and kurtosis values fall between -1 and +1. However, this method is less reliable for small to moderate sample sizes (i.e., $n < 300$) because it does not account for standard errors (Mishra et al., 2019).

For this study, normality was assessed using the Shapiro-Wilk test and a graphical illustration. These analyses were conducted to evaluate the distribution of verbal fluency scores across the three language groups: Maltese-only, English-only, and No Language Restrictions. A total of 20 participants were assessed for their verbal fluency performance in each of the three language groups. As illustrated in Figure 3, the histograms depict the distribution of verbal fluency scores across the three language groups. The English-only group shows a roughly bell-shaped and symmetrical distribution, with most scores clustering around the centre. For the Maltese-only group, the distribution appears slightly skewed to the right. The No Language Restrictions group exhibits a symmetrical pattern resembling a normal distribution. Overall, visual examination indicates that the English-only and No Language Restrictions groups largely resemble normality, while the Maltese-only group

exhibits a mild deviation from normality. The Shapiro-Wilk test was used as a complementary statistical measure to verify these observations.

Figure 3

Histogram Depictions of Verbal Fluency Scores by Language Group



As shown in Table 2, all the Shapiro-Wilk test values (0.601, 0.895, and 0.392) exceed the level of significance, indicating that the normality assumption is satisfied. Hence, parametric tests will be used to analyse the data further.

Table 2

Shapiro-Wilk Test Results for Verbal Fluency by Language Group

Language Group	Statistic	df	p-value
Maltese-Only	.963	20	.601
English-Only	.977	20	.895
No Language Restrictions	.952	20	.392

Note. The Shapiro-Wilk test assessed the normality of verbal fluency scores within each group. All p-values are greater than .05, indicating that normal distribution assumptions were met.

Homogeneity of Variance. Parametric tests assume that score variances are approximately equal across groups. This assumption is typically assessed using Levene's test (Levene, 1960). Since all the p -values in Table 2 exceed 0.05 ($p > 0.05$), the assumption of homogeneity was not violated (Knief & Forstmeier, 2021), indicating that the variances across the three groups can be considered equal.

Table 3

Results on Levene's test of homogeneity of variance

Test Basis	Levene's Statistic	df ₁	df ₂	p -value
Based on mean	.726	2	57	.488
Based on median	.602	2	57	.551
Based on median (adjusted df)	.602	2	54.182	.552
Based on trimmed mean	.709	2	57	.496

Note. All p -values were above 0.05, indicating that the assumption of homogeneity of variance was met across the language groups.

Selecting between Parametric and Non-Parametric Tests

Parametric tests are theoretically grounded in the assumption that the analysed data follow a normal distribution (Antonopoulos & Kakisis, 2019). This theorem posits that as sample size increases, the distribution of the sample mean will likely approximate a normal distribution, regardless of the population's actual shape (Stojanović et al., 2018). When data from a population is normally distributed, its graphical representation typically resembles a bell-shaped curve, also known as the Gaussian distribution. In contrast, non-parametric data often exhibit skewness, irregular gaps, or outliers (Okoye & Hosseini, 2024).

In the current study, no outliers were detected in the dataset. Although slight skewness was observed in the Maltese-only group during the visual examination, the Shapiro-Wilk test results supported the normality assumption. Furthermore, the Levene's test

results satisfied the assumption of homogeneity of variance. Consequently, the use of a parametric test was deemed appropriate.

Participant Demographics

The study sample consisted of 60 participants ranging from 18 to 73 years of age, with a mean age of 31.5 years ($SD=12.9$). Out of the 60 participants, 36.7% participants ($n=22$) were within the 18-24 age band, 40.0% ($n=24$) were within the 25-34 age band, 8.3% ($n=5$) were within the 35-49 age band, 11.7% ($n=7$) were within the 50-64 age band, and 3.3% ($n=2$) were within the 65+ age band. Regarding gender, 68.3% were females ($n=41$) and 31.7% were males ($n=19$). In terms of educational attainment, 18.3% of participants ($n=11$) had completed education up to secondary level, while 10% ($n=6$) had attained a post-secondary qualification. Additionally, 33.3% ($n=20$) held an undergraduate degree, and 38.3% ($n=23$) had completed postgraduate studies.

In terms of the participants' Maltese reading ability, assessed using the Maltese Word-Reading Test (Bartolo, 1988), the mean reading age was 9 years and 10 months ($SD=0.30$). Of the 60 participants, the majority (93.3%, $n=56$) demonstrated a reading age of 9 years and 11 months, while 3.3% ($n=2$) had a reading age of 8 years and 8 months, and another 3.3% ($n=2$) had a reading age of 8 years and 5 months. With regard to the participants' vocabulary, assessed using the Vocabulary subtest from the Wechsler Adult Intelligence Scale Fourth Edition (WAIS-IV^{uk}), the majority (63.3%, $n=38$) scored within the average range. Additionally, 21.7% ($n=13$) fell within the below average range, while 15% ($n=9$) scored within the above average range.

Participants were randomly assigned to one of three groups: Maltese-only, English-only, and No Language Restrictions using an online random group generator. Each group consisted of 20 participants, representing 33.3% of the total sample.

Chi-square tests were conducted to examine potential associations between language groups and five categorical variables: vocabulary performance, reading ability, gender, education level, and age group.

The analysis revealed no statistically significant association between language group and vocabulary performance, $\chi^2(4) = 1.34, p = .855$, indicating that vocabulary performance was similarly distributed across the three language groups. Similarly, no significant association was found between language group and reading ability, $\chi^2(4) = 2.04, p = .729$. The association between language group and gender was also non-significant, $\chi^2(2) = 0.62, p = .735$, suggesting a comparable gender distribution across groups. Furthermore, no significant relationship was found between language group and educational level, $\chi^2(6) = 8.38, p = .211$, implying that education levels were consistent across the language groups. Finally, the association between language group and age was not significant, $\chi^2(8) = 12.41, p = .134$, suggesting no meaningful differences in age distribution between groups.

Due to low cell counts (frequencies less than five), Fisher's Exact test was used as a more appropriate statistical alternative. The analysis revealed no significant association between language group and vocabulary performance (Below Average vs. Average or Above), $p = .999$. Similarly, no significant relationship was found between language group and Maltese reading ability (Below/Slightly Below vs. Age-Appropriate), $p = .999$. The association between language group and education level (Lower Education vs. Higher Education) was also non-significant, $p = .211$. Finally, no statistically significant link was observed between language group and the age category (18–34 vs. 35+), $p = .312$. These results suggest that the language groups were comparable in terms of vocabulary skills, reading ability, education level, and age.

Table 4 on the following page presents the demographic information outlined above for each group.

Table 4*Demographic characteristics of participants by language group*

Variable	Descriptor	Maltese-only (<i>n</i> = 20)		English-only (<i>n</i> = 20)		No Language Restrictions (<i>n</i> = 20)		Comparison		
		<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	χ^2	df	<i>p</i>
Gender	Male	7	35%	5	25%	7	35%	.616	2	.735
	Female	13	65 %	15	75%	13	65%			
Age	18-24	8	40%.	4	20%	10	50%.	12.410	8	.134
	25-34	5	25%	10	50%	9	45%			
	35-49.	2	10%	2	10%	1	5%			
	50-64	3	15%	4	20%	0	0%			
	65-89	2	10%	0	0%	0	0%			
Educational Level	Secondary.	4	20%	5	25%	2	10%	8.381	6	.211
	Post-Secondary	0	0%	2	10%	4	20%			
	Undergraduate	10	50%	5	25%	5	25%			
	Postgraduate	6	30%	8	40%	9	45%			
Reading Ability	Below Expected.	1	5%.	0	0%	1	5%	2.036	4	.729
	Slightly Below	1	5%	1	5%	0	0%			
	Age-Appropriate	18	90%.	19	95%	19	95%			
Vocabulary Performance	Below Average	5.	25%.	5	25%	3	15%	1.335	4	.855
	Average	13	65%	12	60%	13	65%			
	Above Average	2	10%	3	15%	4	20%			

Note. The table displays the number (*n*) and percentage (%) of participants in each demographic category by language group. Chi-square analyses were used to assess group differences. All *p*-values greater than .05 suggest that no statistically significant differences were found between groups.

Group Comparisons in Verbal Fluency Performance

The one-way analysis of variance ANOVA test will compare mean verbal fluency scores among participants randomly assigned to one of three groups: Maltese-only, English-only, and No Language Restrictions. The one-way ANOVA is a statistical method used to assess whether the mean scores of two or more independent groups differ significantly from each other (Chatzi & Doody, 2024). It is crucial to note that the one-way ANOVA is an omnibus test, meaning it can indicate whether there is a significant difference among group means. However, it does not specify which groups differ from one another. A post-hoc test must be carried out to identify the specific group differences (Laerd Statistics, 2018).

Before conducting a one-way ANOVA, it is paramount to certify that the data satisfies the test's underlying assumptions. The first assumption requires that the dependent variable is measured at the interval or ratio level (Emerson, 2022). This study's dependent variable, verbal fluency, met this criterion. The second assumption specifies that the independent variable must include two or more categorical groups (Chatzi & Doody, 2024). This study randomly divided participants into Maltese-only, English-only, and No Language Restrictions. Third, observations must be independent. Therefore, there should be no overlaying or relationship between participants across groups. This assumption was satisfied as each participant was randomly assigned to only one group. The fourth assumption concerns the absence of outliers, which was confirmed using boxplots and z-score analysis. The fifth assumption requires the dependent variable to be approximately normally distributed within each group. This was supported by histogram inspections and the results of the Shapiro-Wilk test. Lastly, the sixth assumption is the homogeneity of variance, which was confirmed by Levene's test (Laerd Statistics, 2018). Since all assumptions were met, the one-way ANOVA was deemed an appropriate statistical method for analysing group differences in verbal fluency.

A one-way ANOVA was carried out to assess differences in verbal fluency scores among three language groups: Maltese-only, English-only, and No Language Restrictions. Each group included 20 participants who were randomly assigned. The results presented a statistically significant difference in average verbal fluency scores among the groups, with a p -value less than 0.001. Participants in the No Language Restrictions recorded the highest mean verbal fluency score ($M=53.60$, $SD=9.98$), followed by the English-only group ($M=45.15$, $SD=10.38$), while the Maltese-only group recorded the lowest mean score ($M=40.20$, $SD=7.89$). The partial overlap in the 95% confidence intervals indicates the presence of meaningful differences in performance between groups.

Table 5 presents the findings from the One-way ANOVA.

Table 5

One-Way ANOVA Results for Verbal Fluency Across Three Language Conditions

Language Condition	n	Mean	SD	95% Conf. Interval for Mean	p -value
				Lower Bound – Upper Bound	
English-only	20	45.15	10.38	40.29 – 50.01	<0.001
Maltese-only	20	40.20	7.89	36.51 – 43.89.	<0.001
No Language Restrictions	20	53.60	9.98	48.93 – 58.27	<0.001

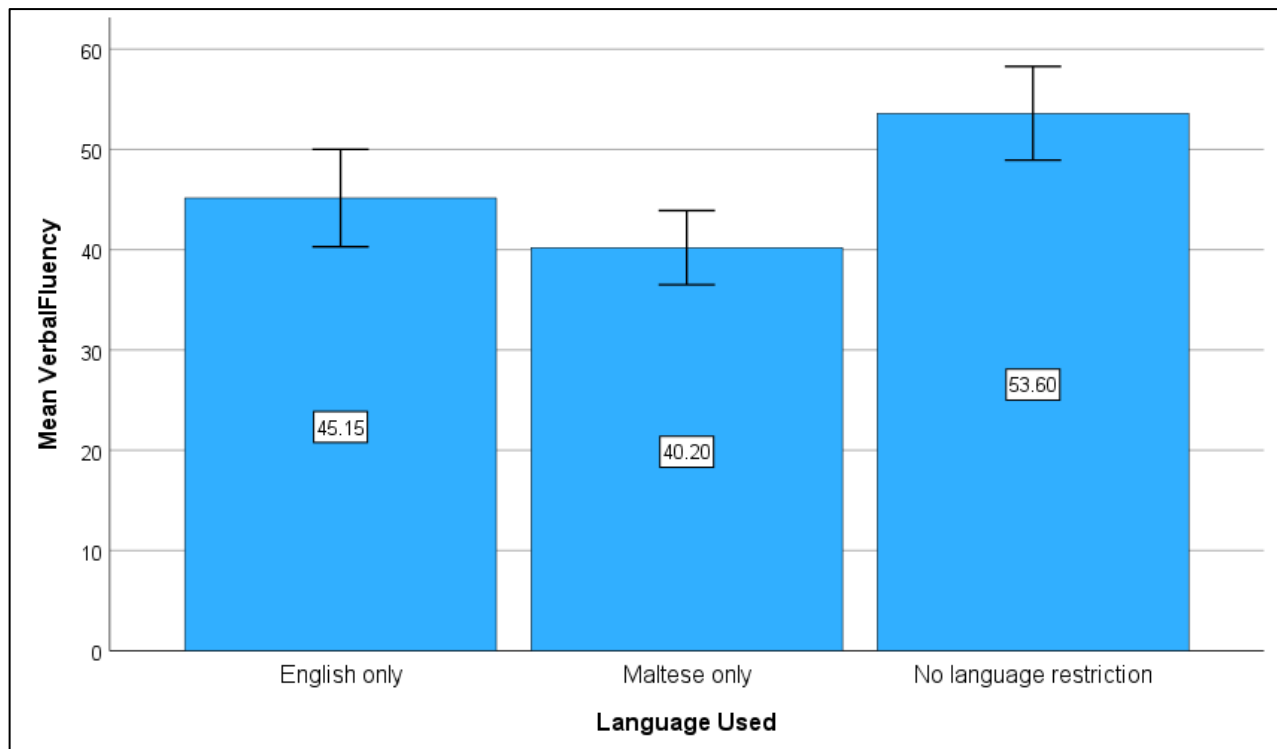
Note. Differences in verbal fluency scores across the three language conditions were assessed using a one-way ANOVA. The analysis revealed a statistically significant effect, as all p -values were less than .001.

The error bar graph illustrates the mean verbal fluency scores for the three language groups, Maltese-only, English-only, and No Language Restrictions, along with their 95% confidence intervals. Among the groups, participants with No Language Restrictions achieved the highest average score ($M=53.60$), followed by those in the English-only group ($M = 45.15$), while the Maltese-only group recorded the lowest ($M = 40.20$). The error bars indicate that the confidence intervals for the No Language Restrictions group do not substantially overlap with those of the other two groups, suggesting a likely significant difference in scores. In contrast, the overlapping intervals between the English-only and Maltese-only groups suggest that their difference in mean verbal fluency scores is not statistically significant.

Figure 4 displays the error bar graph illustrating the mean verbal fluency scores across the different language groups.

Figure 4

Error Bar Graph of Mean Verbal Fluency by Language Group



Post-Hoc Analysis of Group Differences in Verbal Fluency Performance

As previously noted, the one-way ANOVA is an omnibus test. Therefore, a post-hoc analysis is necessary to determine which groups showed significant differences. The Tukey test, also known as Tukey's Honest Significant Difference (HSD) test, is a post-hoc procedure that relies on the studentized range distribution (Tukey, 1984).

A Tukey post-hoc test was conducted to examine further differences in verbal fluency scores among the three language groups: Maltese-only, English-only, and No Language Restrictions. The Tukey post-hoc analysis revealed that the difference in mean scores between the No Language Restrictions group and the Maltese-only and English-only groups was statistically significant. However, the difference between the Maltese-only and English-only groups was not statistically significant.

Table 6 presents the findings from the Tukey post-hoc test.

Table 6

Tukey Post-Hoc Comparison of Verbal Fluency Across Language Conditions

Comparison	Mean Difference	Std. Error	<i>p</i> -value
English-only vs Maltese-only	4.95	2.998	.233
No Language Restriction. vs Maltese-only	13.40	2.998	< .001
No Language Restriction vs English-only	8.45	2.998	.018

Note. Tukey's HSD analysis was used to compare verbal fluency scores across the three language conditions. The results revealed significant differences between the No Language Restriction group and both the Maltese-Only and English-Only groups ($p < .001$ and $p = .018$, respectively).

Conclusion

In summary, participants in the No Language Restrictions group exhibited the highest mean verbal fluency score ($M=53.60$), followed by those in the English-only group ($M=45.15$), with the Maltese-only group recording the lowest mean score ($M=40.20$). Post-hoc analysis revealed statistically significant differences between the No Language Restrictions group and the Maltese-only and English-only groups. However, no significant difference was observed between the Maltese-only and English-only groups. The 95% confidence intervals support the reliability of these differences, suggesting that the pattern would likely persist on a larger scale.

Consequently, the alternative hypothesis that mean verbal fluency scores differ across language groups was supported, as the p-value was below the significance level ($p < 0.05$).

Chapter 5: Discussion

Introduction

This study aimed to examine the impact of bilingualism on verbal fluency within the Maltese context, where individuals frequently and often unconsciously switch between Maltese and English. Malta offers a unique linguistic setting to explore how habitual code-switching influences lexical retrieval and semantic processing. This chapter will present an in-depth discussion of the findings outlined in the previous chapter, examining them in relation to existing research on bilingualism and verbal fluency, with particular emphasis on bilingual cognitive processes. Furthermore, the results will be considered in light of specific features of the Maltese bilingual experience such as early bilingual exposure, educational background, and other sociocultural factors, that may have influenced the outcomes.

Summary of Results

The results showed a statistically significant difference in average verbal fluency scores across the language groups. The highest mean scores were observed in the No Language Restrictions group, followed by the English-only group. In comparison, the Maltese-only group recorded the lowest average verbal fluency scores. Results from the post-hoc test indicated that the mean scores for the No Language Restrictions group were significantly higher compared to the Maltese-only and English-only groups. However, the difference in mean scores between the Maltese-only and English-only groups did not reach statistical significance.

Group Differences in Verbal Fluency Across Three Language Groups

Overview

It was hypothesised that there would be significant differences in mean verbal fluency scores across the three language groups. Specifically, it was hypothesised that participants in the No Language Restrictions group would generate a higher number of words than those in

either the Maltese-only or English-only groups. Additionally, it was hypothesised that participants in the English-only group would outperform those in the Maltese-only group in terms of total word generation.

The following sections will discuss the study's findings within the context of bilingual cognitive processes and the Maltese bilingual setting. These results will be interpreted in relation to existing literature. Where relevant, recommendations for future research will also be proposed.

Cognitive Mechanisms

The findings from this study presented significant differences in semantic verbal fluency performance across the three language groups. The findings align with existing research outlining how bilingual language use and testing conditions can considerably influence verbal fluency results.

According to Patra et al. (2019), bilinguals frequently exhibit diminished verbal fluency in tasks restricted to a single language, particularly those requiring expressive language abilities, such as lexical retrieval. In these situations, bilinguals often experience greater difficulty compared to monolinguals, as reflected in a higher incidence of errors and tip-of-the-tongue states (Zeng et al., 2019). These challenges are attributed to the need to manage two language systems simultaneously, which can lead to slower or reduced efficiency to access words during single-language use. The Bilingual Interactive Activation Plus model supports this interpretation by suggesting that both languages remain active, even when only one is being used (Dijkstra & Van Heuven, 2002). For instance, participants who were randomly assigned to the Maltese-only or English-only groups were instructed to produce words in just one language; however, both language systems likely remained active, creating interference. This cross-linguistic activation imposes an added cognitive load, potentially slowing down lexical retrieval. Consistent with this notion, participants in the

Maltese-only and English-only groups generated fewer words than those in the No Language Restrictions group. The BIA+ model also accounts for the challenges associated with errors and tip-of-the-tongue states by illustrating how cross-linguistic activation occurs across multiple levels, potentially disrupting smooth word retrieval. This was particularly evident in the current study, where participants assigned to the Maltese-only or English-only groups occasionally produced words in the non-target language or experienced tip-of-the-tongue moments, where the word was known but could not be retrieved.

The study's findings can also be interpreted through the lens of the Inhibitory Control Model (Green, 1998), which proposes that lexical items from both languages are activated when a bilingual intends to speak. To produce speech in the target language, it must compete for selection, while the non-target language needs to be actively inhibited. Although crucial for controlling cross-language interference, this process can also lead to slower or less accurate lexical retrieval (Schwieter & Ferreira, 2016). Participants in the Maltese-only and English-only groups were instructed to produce words in a single language, necessitating the active suppression of the non-target language. This extra mental effort likely made the task more challenging, leading to reduced word output. Anderson et al. (2017) and Grundy et al. (2017) support these findings, suggesting that bilinguals are disadvantaged in monolingual verbal fluency tasks, especially when required to inhibit one of their active languages. These models point out that assessment tools such as verbal fluency tasks often assume a single linguistic system, overlooking the cognitive effort of simultaneously managing two active languages (Zhang et al., 2024). Consequently, traditional verbal fluency measures may not accurately capture a bilingual's true language proficiency but instead reveal the difficulties of operating within a more complex bilingual language system.

DeLuca et al. (2020) suggest that bilinguals living in highly integrated language environments may struggle more when asked to operate in an artificially separated language mode. The Adaptive Control Hypothesis suggests that bilingual language control processes adjust in response to the specific interactional contexts in which languages are used (Green & Abutalebi, 2013). In single-language contexts, bilinguals must consistently suppress the non-target language, a process that requires substantial cognitive effort. In dual-language settings, bilinguals frequently switch between languages, which further increases cognitive load due to the constant need to manage and inhibit cross-language interference (Han et al., 2023). In contrast, in dense code-switching environments, bilinguals freely alternate between languages within the same conversation, encouraging more cooperative interaction between language systems and thereby reducing competition (Spinelli & Sulpizio, 2024). This model provides a strong explanation for the findings of the current study. Participants in the Maltese-only and English-only groups were placed in single-language contexts, requiring continuous suppression of the non-target language. This ongoing inhibition likely increased cognitive effort, which in turn may have contributed to the production of fewer words. On the other hand, participants in the No Language Restrictions group operated in a setting similar to a dense code-switching environment, allowing them to freely alternate between Maltese and English. This linguistic flexibility likely reduced cognitive strain, enabling them to produce more words.

Furthermore, the Revised Hierarchical Model (Kroll & Stewart, 1994) sheds light on how bilinguals perform in semantic verbal fluency tasks. This model suggests that even fluent bilinguals may experience slight differences in the ease with which they access words in each language. These asymmetries can interfere with fluency, particularly under standard testing conditions where only one language is permitted (Sperl et al., 2024). In the present study, although participants in the Maltese-only and English-only were fluent in both languages, they

still encountered challenges when required to generate words in only one, highlighting the difficulty of restricting lexical access to a single language system.

Taken together, these models signify that reduced verbal fluency in single-language conditions should not be interpreted as a sign of lower language proficiency. Although some research suggests that monolinguals possess a more extensive vocabulary due to greater exposure to a single language, the patterns observed in this study and supported by theoretical models show that reduced verbal fluency in bilinguals is more accurately attributed to the increased cognitive demands of managing two simultaneously active language systems while being restricted to just one.

Beyond executive control, semantic memory plays a crucial role in verbal fluency tasks, as these require quick and efficient retrieval of stored concepts and lexical items. According to the Spreading Activation model (Collins & Loftus, 1975), the activation of one concept in memory facilitates the retrieval of related concepts. In bilingual individuals, access to both languages may expand the network of activated concepts, enhancing retrieval efficiency. This model help explain why participants in the No Language Restrictions group produced more words, as they were able to access a broader, cross-linguistic semantic network.

To fully interpret the study's findings, it is also important to consider the unique context in which the study was conducted, particularly the impact of code-switching and the bilingual nature of everyday life in Malta.

Influence of Code-Switching and the Maltese Context

Malta's distinctive sociolinguistic context is crucial for understanding the results of the present study. Participants in the No Language Restrictions group, who were allowed to switch freely between Maltese and English, performed better on the verbal fluency task compared to those in the Maltese-only and English-only groups. This finding reflects the natural bilingual communication style in Malta, characterised by a dense code-switching environment where

individuals fluidly and interchangeably draw on both languages in everyday life. As highlighted by Vella (2018), children in Malta are rarely raised monolingually, as they are consistently and simultaneously exposed to both Maltese and English on a daily basis. Camenzuli et al. (2023), supports this concept by explaining that early and sustained bilingual exposure leads to an integrated form of language use, where switching between languages becomes a natural and efficient communicative strategy rather than a sign of linguistic confusion. Additionally, Camilleri Grima (1994) characterises this perspective as a continuum of crosslinguistic influence, in which language use spans from individual word borrowings to more complex forms of code-switching, as well as more profound structural and phonetic integration. Within this continuum, bilinguals fluidly alternate between Maltese and English based on context, communicative goals, and social interaction (Gullifer & Titone, 2021). In this study, restricting participants to a single language may have interfered with their typical patterns of lexical access and expression, placing an artificial constraint on their typical language use. In contrast, the performance of the No Language Restrictions group likely reflects the congruence between the testing conditions and the participants' daily communication practices, shaped by dense code-switching and hybrid forms like Manglish (Panzavecchia, 2023). Overall, these results suggest that verbal fluency tasks limited to a single language may not adequately capture the full range of linguistic and cognitive abilities of bilingual speakers in Malta.

To better understand the group differences observed in verbal fluency performance, it is crucial to consider individual language backgrounds, including early bilingual exposure, educational experiences, and everyday language use across social contexts.

The Role of Early Language Development in Group Differences

Prolonged and early exposure to a bilingual environment is widely recognised for promoting cognitive and linguistic development. Studies highlight the critical role of the

home literacy environment in fostering language and literacy growth in monolingual and bilingual children (Lau & Richards, 2021). Whether children are raised with one or several languages, the quality and frequency of literacy-related activities at home positively impact vocabulary growth, reading comprehension, and overall literacy skills (Li et al., 2023). In bilingual environments, language development generally occurs through one of two main pathways. The first pathway is *simultaneous bilingualism*, in which children are exposed to and acquire two languages simultaneously from an early age. The second pathway is *sequential bilingualism*, which takes place when a child initially becomes proficient in one language before beginning to learn a second. For instance, a child might speak one language at home and then encounter a second language upon entering school (Sultana, 2014). Decisions regarding language exposure in early childhood can be intentional, unintentional, or shaped through everyday social interactions. Ultimately, parents are key in shaping their children's linguistic environment through deliberate planning of bilingual exposure or by responding to social and contextual influences (Mifsud et al., 2021).

Given Malta's distinctive linguistic context, many individuals are exposed to Maltese and English from an early age, either simultaneously at home or sequentially, through schooling and social interaction. This extended exposure helps foster more flexible and integrated language processing skills, particularly in relation to lexical retrieval. In this study, descriptive results from the Maltese Word Reading Test and the Vocabulary subtest suggest that participants across all three groups were likely exposed to both languages from an early age. However, this view cannot be confirmed with certainty, as early language development was not a primary focus of the study. Therefore, future studies should examine more directly how the timing and type of bilingual exposure may affect outcomes on verbal fluency tasks.

Educational Background and Language Dominance

Following the No Language Restrictions group, the English-only group performed better than the Maltese-only group, whose participants appeared to encounter greater difficulty with the task. In Malta's education system, although both Maltese and English serve as languages of instruction in primary and secondary schools, English increasingly takes a dominant role as students advance to higher levels of education (Caruana et al., 2019). In this study, the majority of participants had attained post-secondary, undergraduate, or postgraduate education, which may partly account for the greater word retrieval difficulties observed in the Maltese-only group. Furthermore, the predominant language used for instruction in Maltese schools is partly shaped by the type of school a student attends (Sciriha, 2024). Studies show that state schools, and to a lesser extent, church schools, primarily carry out lessons in Maltese. In contrast, independent schools generally focus more on English as the primary language of instruction (Vassallo & Sciriha, 2020). While this study did not directly explore participants' educational backgrounds or the types of schools they attended, future studies could investigate how these variables may impact verbal fluency performance.

Contextual Language Preferences in Daily Life

Vassallo and Sciriha (2021) found that language use on social media varies depending on the context of communication. Maltese is more frequently used in interpersonal exchanges, particularly among family and friends, where closeness is valued. English tends to dominate when users aim to communicate with a broader audience. This study concluded that although Maltese holds cultural and personal significance, it is often set aside in favour of English when individuals seek to present themselves more globally (Vassallo & Sciriha, 2021). Moreover, a survey conducted by the National Council for Maltese Language in collaboration with the Department of Maltese at the University of Malta in 2021 revealed that 57% of Maltese citizens aged 18 to 80 view Maltese easier to speak and understand than

English. However, only about one-third of respondents felt that Maltese was easier than English in terms of reading and writing. The findings showed that participants preferred using Maltese for informal communication, such as messaging on social media. In contrast, English was favoured for more formal or technical contexts, including ATMs, emails, greeting cards, and books (National Council for the Maltese Language, 2021). Although this study did not specifically examine participants' everyday use of Maltese and English, future research could explore how and why situational language preferences influence verbal fluency performance.

Building on these findings, it becomes clear that assessing bilinguals through a monolingual lens may not capture the realities of their language use, highlighting the need for more ecologically valid approaches to language assessment.

The Need for Ecologically Valid Assessment in Bilingual Contexts

This study emphasises the importance of using assessment tools that accurately capture the complexities of bilingual language processing rather than relying on monolingual standards as the default benchmark. The results of this study show that participants achieved better outcomes when allowed to use both languages freely, suggesting that traditional single-language testing conditions may underestimate the verbal capabilities of bilingual individuals. Consequently, it is paramount to implement ecologically valid testing tools that mirror the way in which bilinguals, particularly in contexts like Malta, use language in their daily lives. Such assessments would offer a more reliable and valid reflection of bilinguals' language abilities and help ensure that the communicative strategies they use are not misinterpreted as deficits.

Conclusion

This chapter provided a detailed discussion of the findings related to language group differences, contextualised within existing research on bilingual cognitive processes and the Maltese bilingual experience.

Chapter 6: Conclusion

Introduction

This study examined the impact of bilingualism on verbal fluency within the Maltese context. It reviewed the relevant literature, focusing on key areas such as bilingualism in general, bilingualism within the Maltese context, verbal fluency as a cognitive measure, and the effects of bilingualism on semantic verbal fluency. A between-group comparison was then presented to test the study's hypotheses. Finally, the findings were discussed in relation to existing literature.

The first section of this chapter will provide a summary of the study's main findings, which were explored in more depth in the Discussion Chapter. The subsequent sections will address the study's strengths and limitations, its broader implications, and recommendations for future research.

Summary of Study Findings

Two main hypotheses related to verbal fluency and bilingualism were tested by examining group differences. Participants in this study were randomly assigned to one of three groups: Maltese-only, English-only, or No Language Restrictions. Each group included 20 participants, resulting in a total sample of 60 participants. The sample consisted of both female ($n=41$) and male ($n=19$) participants, ranging in age from 18 to 73 years.

Data were collected through a demographic questionnaire and three language-related tests, including the Maltese Word Reading Test (Bartolo, 1988), the Vocabulary subtest from the Wechsler Adult Intelligence Scale (WAIS-IV^{uk}; Wechsler, 2008), and the Semantic Verbal Fluency Test. The raw data was analysed through statistical tests. Participants in the No Language Restrictions group exhibited the highest mean verbal fluency score ($M=53.60$), followed by those in the English-only group ($M=45.15$), with the Maltese-only group recording the lowest mean score ($M=40.20$). Post-hoc analysis revealed statistically

significant differences between the No Language Restrictions group and the Maltese-only and English-only groups. However, no significant difference was observed between the Maltese-only and English-only groups. The 95% confidence intervals support the reliability of these differences, indicating that similar patterns would likely emerge in a larger sample. Therefore, the study findings presented support for the developed hypotheses.

Strengths of the Study

This study highlights several important strengths that can help shape and improve future studies. One of its main strengths is the attention it gives to Malta's unique sociolinguistic setting, where most people grow up acquiring both Maltese and English from an early age and naturally code-switch between them in everyday life. This frequent blending of languages has even contributed to the emergence and normalisation of hybrid forms of communication. In contrast to other studies that adopt a rigid first-language versus second-language framework, this study examines verbal fluency within a bilingual population characterised by balanced exposure to both languages. In doing so, it seeks to offer fresh and valuable insights into bilingual language processing. Moreover, to the researcher's knowledge, this is the first study to systematically examine semantic verbal fluency within the specific context of Malta. Therefore, it aims to establish a foundation for future research and contribute to the development of local educational and clinical practices concerning language assessment and cognitive evaluation in bilingual populations.

From a methodological standpoint, using a between-groups experimental design with random allocation to the three language groups helped enable direct and meaningful comparisons, providing a clearer understanding of how the allocated language group influenced verbal fluency. Moreover, random allocation helped strengthen the study's reliability and replicability (Lim & In, 2019), thereby enhancing the credibility of its findings and their value to the broader field of bilingualism research.

In addition, integrating widely recognised international measures, like the WAIS-IV^{uk} Vocabulary subtest, with culturally specific tools, such as the Maltese Word Reading Test, strengthened both the generalisability and cultural relevance of the findings. This study was also founded on a solid theoretical framework, drawing on models like the Inhibitory Control Model, Bilingual Interactive Activation Plus model, Adaptive Control Hypothesis, and Revised Hierarchical Model to guide the interpretation of its findings.

Finally, this study's findings offered meaningful, practical implications, particularly in clinical and educational contexts, emphasising the need for culturally sensitive assessment methods adapted to bilingual environments such as Malta.

Limitations of the Study

Although the study offers valuable contributions, it also has certain limitations that should be acknowledged. A key limitation involves using a standardised assessment, specifically, the WAIS-IV^{uk} Vocabulary subtest which was not standardised for the Maltese population. As a result, the test may not fully capture the cultural and linguistic nuances needed to accurately assess participants' language abilities (Peña, 2013).

Furthermore, the sample size was fairly small ($n=60$), which may have constrained the study's capacity to detect more subtle differences among the three language groups. In addition, relying on convenience and snowball sampling methods may have limited the generalisability of the findings to the wider Maltese bilingual population (Lines et al., 2022).

A further limitation was the absence of a monolingual control group, which restricted the study's ability to directly compare the performance of bilingual individuals with that of monolinguals. Another limitation is the lack of consideration of potential confounding variables that could have influenced performance on the neuropsychological tasks. For instance, factors such as fatigue may negatively affect cognitive functioning during testing.

As a result, these uncontrolled variables may lead to outcomes that do not fully reflect participants' true verbal fluency abilities.

Implications of Findings

Although the study was conducted with a limited sample size, the findings offer valuable insights and raise several important implications, which are outlined below.

Clinical Implications

This study has consistently highlighted that traditional semantic verbal fluency tasks do not offer a valid or complete representation of bilingual language competence. As a matter of fact, semantic verbal fluency tasks that were initially developed for monolingual speakers are still commonly used to assess bilingual individuals. Consequently, this type of assessment tool does not accurately reflect the full scope of bilinguals' language proficiency and places them at a disadvantage. Nevertheless, much of the existing literature still portrays this fluency difference as a bilingual disadvantage, despite numerous studies and theoretical models offering alternative explanations (Dentella et al., 2024).

Consequently, future assessment tools should move beyond surface-level indicators like vocabulary breadth or word count and instead focus on the underlying cognitive processes that influence bilingual verbal fluency (Declerck & Koch, 2023). In addition, future assessment tools should incorporate insights from the theoretical frameworks discussed, account for the developmental and contextual diversity of bilingual experiences, and utilise conceptual scoring alongside ecologically valid task designs (Jevtović et al., 2020). Without these adjustments, the field risks producing inaccurate interpretations of bilingual abilities in clinical contexts, potentially leading to misinterpretations and misdiagnoses.

Research Implications

This study's findings have several noteworthy implications for future research in bilingualism and neuropsychological assessment.

One of this study's key contributions is that it underscores the importance of considering the sociolinguistic context in research. By focusing specifically on Malta, the study was able to interpret its findings more meaningfully within the country's unique bilingual environment. This reinforces the importance of taking into account the specific language practices of a particular country or community when analysing and interpreting study findings. Additionally, relying on standardised assessments not normed for the Maltese population highlights the need for locally developed or adapted instruments to ensure cultural and linguistic validity.

Lastly, this study illustrates the value of using theoretically grounded approaches by drawing on multiple models, including the Inhibitory Control Model, Bilingual Interactive Activation Plus Model, Adaptive Control Hypothesis, and Revised Hierarchical Model. Future research should continue to incorporate such frameworks to promote a deeper and more contextually grounded understanding of bilingual cognition.

The following section presents further directions for future studies in addition to the research implications outlined above.

Further Recommendations

Considering this study's findings and limitations, several valuable directions for future research in bilingualism and neuropsychological assessment exist.

An important step forward would be to develop and validate assessment tools specifically tailored to the Maltese cultural and linguistic context. Many existing instruments are based on international populations, and doing so would enhance the validity of future local studies.

Another suggestion for future research is to include a monolingual control group, as this would enable more accurate comparisons and provide clearer insights into how bilingual individuals perform relative to monolinguals. Ideally, future studies would recruit a more extensive and diverse sample to enable more reliable and applicable insights to the broader population.

Moreover, it would also be worthwhile to explore how various factors, such as educational background, contextual language use, and early bilingual exposure, affect verbal fluency outcomes. This would build on the current study and provide more context-specific insights relevant to the local population. Furthermore, adopting longitudinal research designs could offer meaningful insights into how bilingual language use and associated cognitive abilities develop and shift over time.

In addition, exploring different types of code-switching environments, like those described in the Adaptive Control Hypothesis, could shed light on how various interactional settings affect executive function. Moreover, given the close connection between verbal fluency and cognitive skills such as mental flexibility, inhibition, and working memory, future research should incorporate tasks that directly measure these abilities and compare performance between monolingual and bilingual individuals. Finally, examining results from other bilingual populations, could provide valuable insight into how different sociolinguistic contexts influence cognitive outcomes.

Conclusion

In conclusion, this study has made a meaningful contribution to the field of neuropsychology by exploring the impact of bilingualism on verbal fluency. While the findings are based on a relatively small sample ($n=60$), they offer valuable insights that can inform future research and promote the development of more valid and context-sensitive assessment tools.

References

- Abdelhamid, G. S. M., Bassiouni, M. G. A., & Gómez-Benito, J. (2021). Assessing cognitive abilities using the WAIS-IV: An item response theory approach. *International Journal of Environmental Research and Public Health*, 18(13), 35–68. <https://doi.org/10.3390/ijerph18136835>
- Ahmed, S., & Roberts, L. (2018). Phonological influences in second language acquisition. *Journal of Language Learning*, 15(3), 120-135.
- Akiyama, T., Koeda, M., Okubo, Y., & Kimura, M. (2018). Hypofunction of left dorsolateral prefrontal cortex in depression during verbal fluency task: A multi-channel near-infrared spectroscopy study. *Journal of Affective Disorders*, 231, 83–90. <https://doi.org/10.1016/j.jad.2018.01.010>
- Anderson, J. A. E., Mak, L., Keyvani Chahi, A., & Bialystok, E. (2018). The language and social background questionnaire: Assessing degree of bilingualism in a diverse population. *Behavior Research Methods*, 50(1), 250–263. <https://doi.org/10.3758/s13428-017-0867-9>
- Anderson, J. A. E., Saleemi, S., & Bialystok, E. (2017). Neuropsychological assessments of cognitive aging in monolingual and bilingual older adults. *Journal of Neurolinguistics*, 43, 17–27. <https://doi.org/10.1016/j.jneuroling.2016.08.001>
- Antón, E., Carreiras, M., & Duñabeitia, J. A. (2019). The impact of bilingualism on executive functions and working memory in young adults. *PLOS ONE*, 14(2). <https://doi.org/10.1371/journal.pone.0206770>
- Antonopoulos, C., & Kakisis, J. (2019). Applied statistics in vascular surgery part 1: Choosing between parametric and non-parametric tests. *Hellenic Journal of Vascular and Endovascular Surgery*, 1(1). https://www.heljves.com/wp-content/uploads/2023/01/vol_1_issue_1_2019_8.pdf
- Arce, R. M., Casalietto, K., Tom, S., Pa, J., Harrati, A., Armstrong, N., Rajan, K. B., Manly, J., Mungas, D., & Zahodne, L. (2019). The contributions of active Spanish-English bilingualism

- to cognitive reserve among older Hispanic adults living in California. *Archives of Clinical Neuropsychology*, 34(7), 1235. <https://doi.org/10.1093/arclin/acz029.02>
- Ardila, A. (2019). A cross-linguistic comparison of category verbal fluency test (ANIMALS): A systematic review. *Archives of Clinical Neuropsychology*, 35(2), 213–225. <https://doi.org/10.1093/arclin/acz060>
- Aziez, F., Alkhrisheh, H., Aziez, F., & Mualim, M. (2020). Measuring verbal fluency task performance of Indonesian bilinguals. *Indonesian Research Journal in Education*, 4(2), 306–323. <https://doi.org/10.22437/irje.v4i2.9429>
- Aziz, K. A., Khater, M. S., Emara, T., Tawfik, H. M., Rasheedy, D., Mohammedin, A. S., Tolba, M. F., El-Gabry, D. A., & Qassem, T. (2017). Effects of age, education, and gender on verbal fluency in healthy adult Arabic-speakers in Egypt. *Applied Neuropsychology: Adult*, 24(4), 331–341. <https://doi.org/10.1080/23279095.2016.1185424>
- Barbu, C., Orban, S., Gillet, S., & Poncelet, M. (2018). The impact of language switching frequency on attentional and executive functioning in proficient bilingual adults. *Psychologica Belgica*, 58(1), 115–127. <https://doi.org/10.5334/pb.392>
- Bartolo, P. (1988). *Single Maltese-word reading test*. [Unpublished test]. Malta.
- Bayram, F., Kubota, M., Luque, A., Pascual y Cabo, D., & Rothman, J. (2021). You can't fix what is not broken: Contextualizing the imbalance of perceptions about heritage language bilingualism. *Frontiers in Education*, 6. <https://doi.org/10.3389/feduc.2021.628311>
- Becker, N., Piccolo, L. R., & Salles, J. F. (2019). Verbal fluency development across childhood: Normative data from Brazilian–Portuguese speakers and underlying cognitive processes. *Archives of Clinical Neuropsychology*, 34(7), 1217–1231. <https://doi.org/10.1093/arclin/acz022>

- Benson, N., Hulac, D. M., & Kranzler, J. H. (2010). Independent examination of the Wechsler adult intelligence scale—fourth edition (WAIS-IV): What does the WAIS-IV measure? *Psychological Assessment*, 22(1), 121–130. <https://doi.org/10.1037/a0017767>
- Bialystok, E. (2021). Bilingualism: Pathway to cognitive reserve. *Trends in Cognitive Sciences*, 25(5), 355–364. <https://doi.org/10.1016/j.tics.2021.02.003>
- Bialystok, E., & Craik, F. I. M. (2022). How does bilingualism modify cognitive function? Attention to the mechanism. *Psychonomic Bulletin & Review*, 29(4). <https://doi.org/10.3758/s13423-022-02057-5>
- Birulés, J., Bosch, L., Brieke, R., Pons, F., & Lewkowicz, D. J. (2018). Inside bilingualism: Language background modulates selective attention to a talker’s mouth. *Developmental Science*, 22(3). <https://doi.org/10.1111/desc.12755>
- Bland, M. (2015). *An introduction to medical statistics* (4th ed.). Oxford University Press.
- Bushnell, J., Svaldi, D., Ayers, M. R., Gao, S., Unverzagt, F., Del Gaizo, J., Wadley, V. G., Kennedy, R., Goñi, J., & Clark, D. G. (2022). A comparison of techniques for deriving clustering and switching scores from verbal fluency word lists. *Frontiers in Psychology*, 13. <https://doi.org/10.3389/fpsyg.2022.743557>
- Byers-Heinlein, K., Gonzalez-Barrero, A. M., Schott, E., & Killam, H. (2023). Sometimes larger, sometimes smaller: Measuring vocabulary in monolingual and bilingual infants and toddlers. *First Language*, 44(1). <https://doi.org/10.1177/01427237231204167>
- Calleja, A. (2019). *Il-qlib tal-kodiċi fil-lingwaġġ tax-xandir*. [Unpublished Dissertation]. University of Malta.
- Camenzuli, R., Lundberg, A., & Gauci, P. (2022). Collective teachers’ beliefs about multilingualism in Maltese primary education. *International Journal of Bilingual Education and Bilingualism*, 26(4), 1–16. <https://doi.org/10.1080/13670050.2022.2114787>

- Camilleri Grima, A. (1994). Language contact between Maltese and English: Codeswitching and crosslinguistic influence. In D. Caubet & M. Vanhove (Eds.), *Actes des premieres journees internationales de dialectologie arabe de Paris* (pp. 431-449). INALCO.
- Camilleri Grima, A. (2013). Challenging code-switching in Malta. *Revue Française de Linguistique Appliquée*, 18(2), 45-61. <https://doi.org/10.3917/rfla.182.0045>
- Camilleri Grima A. (2015). Malta: Bilingual education for self-preservation and global fitness. In Mehisto P., Genesee F. (Eds.), *Building bilingual education systems: Forces, mechanisms and counterweights* (pp. 215–224). Cambridge University Press.
- Camilleri Grima, A. (2016). Young children living bilingually in Malta. *Lingwistyka Stosowana*, 17(2), 1–13. <https://doi.org/10.32612/uw.20804814.2016.2.pp.1-13>
- Camilleri Grima, A. (2018). Globalization and education: What future for the Maltese-speaking child? *Éducation et Sociétés Plurilingues*, 44, 31–43. <https://doi.org/10.4000/esp.2259>
- Carpenter, E., Peñaloza, C., Rao, L., & Kiran, S. (2021). Clustering and switching in verbal fluency across varying degrees of cognitive control demands: Evidence from healthy bilinguals and bilingual patients with aphasia. *Neurobiology of Language*, 2(4), 1–26. https://doi.org/10.1162/nol_a_00053
- Caruana, M. (2002). *Attitudes towards code switching in Malta: A sociolinguistic study*. [Unpublished Dissertation]. University of Malta.
- Caruana, S., Vassallo Gauci, P., & Scaglione, S. (2019). Multilingualism and the inclusion of migrant learners in Maltese schools. In C. Bezzina & S. Caruana (Eds.), *Teacher Education Matters: transforming lives ... transforming schools* (pp. 330-343). University of Malta.
- Chatzi, A., & Doody, O. (2023). The one-way ANOVA test explained. *The One-Way ANOVA Test Explained*, 31(3). <https://doi.org/10.7748/nr.2023.e1885>
- Collins, A. M., & Loftus, E. F. (1975). A spreading-activation theory of semantic processing. *Psychological Review*, 82(6), 407–428. <https://doi.org/10.1037/0033-295X.82.6.407>

- Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). SAGE Publications.
- Cui, M., Zhang, W. G., & Sun, T. (2018). Linguistic distance, language learners' mother tongue, and Chinese acquisition: An empirical study from the perspective of language economics. *Chinese Teaching in the World*, 32(2), 280–288
- Dash, Ch. S. K., Behera, A. K., Dehuri, S., & Ghosh, A. (2023). An outliers detection and elimination framework in classification task of data mining. *Decision Analytics Journal*, 6, 100-164.
<https://www.sciencedirect.com/science/article/pii/S2772662223000048>
- Dash, T., Berroir, P., Ghazi-Saidi, L., Adrover-Roig, D., & Ansaldo, A. I. (2019). A new look at the question of the bilingual advantage. *Linguistic Approaches to Bilingualism*, 11(4), 520–550.
<https://doi.org/10.1075/lab.18036.das>
- Declerck, M., & Koch, I. (2023). The concept of inhibition in bilingual control. *Psychological Review*, 130(4). <https://doi.org/10.1037/rev0000367>
- De Houwer, A. (1996). Bilingual language acquisition. In P. Fletcher & B. MacWhinney (Eds.), *The Handbook of Child Language* (pp.219–250). Blackwell Publishing Ltd.
- Delis, D. C., Kaplan, E., & Kramer, J. H. (2001). *Delis-Kaplan executive function system*. Pearson.
<https://www.pearsonassessments.com/en-us/Store/Professional-Assessments/Cognition-%26-Neuro/Delis-Kaplan-Executive-Function%20System/p/100000618?srsId=AfmBOoeY7utBDcejSXMdD59uXO2ZQcZJBtJURm1k5XhkN2nlrYGG405>
- DeLuca, V., Rothman, J., Bialystok, E., & Pliatsikas, C. (2020). Duration and extent of bilingual experience modulate neurocognitive outcomes. *NeuroImage*, 204, 116-222.
<https://doi.org/10.1016/j.neuroimage.2019.116222>

- Demir, S. (2022). Comparison of normality tests in terms of sample sizes under different skewness and kurtosis coefficients. *International Journal of Assessment Tools in Education*, 9(2), 397–409. <https://doi.org/10.21449/ijate.1101295>
- Dentella, V., Masullo, C., & Leivada, E. (2024). Bilingual disadvantages are systematically compensated by bilingual advantages across tasks and populations. *Scientific Reports*, 14(1). <https://doi.org/10.1038/s41598-024-52417-5>
- Dijkstra, T., & Van Heuven, W. J. B. (2002). The architecture of the bilingual word recognition system: From identification to decision. *Bilingualism: Language and Cognition*, 5(3), 175–197. <https://doi.org/10.1017/S1366728902003012>
- Dubé, D. (2019). *Estimating vocabulary size with verbal fluency scores* [Master's Thesis, McGill University].
- Dubé, D., & Thordardottir, E. (2024). Using semantic verbal fluency to estimate the relative and absolute vocabulary size of bilinguals: An exploratory study of children and adolescents. *Journal of Communication Disorders*, 111, 106-450. <https://doi.org/10.1016/j.jcomdis.2024.106450>
- Ellajosyula, R., Narayanan, J., & Patterson, K. (2020). Striking loss of second language in bilingual patients with semantic dementia. *Journal of Neurology*, 267(2), 551–560. <https://doi.org/10.1007/s00415-019-09616-2>
- Emerson, R. W. (2022). ANOVA assumptions. *Journal of Visual Impairment & Blindness*, 116(4), 585–586. <https://doi.org/10.1177/0145482x221124187>
- Farzanfar, D., Statucka, M., & Cohn, M. (2018). Automated indices of clustering and switching of semantic verbal fluency in Parkinson's disease. *Journal of the International Neuropsychological Society*, 24(10), 1047–1056. <https://doi.org/10.1017/s1355617718000759>

- Filippi, R., Ceccolini, A., & Bright, P. (2021). Trajectories of verbal fluency and executive functions in multilingual and monolingual children and adults: A cross-sectional study. *Quarterly Journal of Experimental Psychology*, 75(1). <https://doi.org/10.1177/17470218211026792>
- Fishman, J. A. (1967). Bilingualism with and without diglossia: Diglossia with and without bilingualism. *Journal of Social Issues*, 23(2), 29–38. <https://doi.org/10.1111/j.1540-4560.1967.tb00573.x>
- Frankenberg, C., Weiner, J., Knebel, M., Abulimiti, A., Toro, P., Herold, C. J., Schultz, T., & Schröder, J. (2021). Verbal fluency in normal aging and cognitive decline: Results of a longitudinal study. *Computer Speech & Language*, 68, 101–195. <https://doi.org/10.1016/j.csl.2021.101195>
- Friesen, D. C., Edwards, K., & Lamoureux, C. (2021). Predictors of verbal fluency performance in monolingual and bilingual children: The interactive role of English receptive vocabulary and fluid intelligence. *Journal of Communication Disorders*, 89. <https://doi.org/10.1016/j.jcomdis.2020.106074>
- Gallo, F., DeLuca, V., Prystauka, Y., Voits, T., Rothman, J., & Abutalebi, J. (2022). Bilingualism and aging: Implications for (delaying) neurocognitive decline. *Frontiers in Human Neuroscience*, 16. <https://doi.org/10.3389/fnhum.2022.819105>
- Gatt, B. (2012). *A validation of the “Naqra u Nifhem” reading comprehension test (TL1)*. [Dissertation, University of Malta].
- Giovannoli, J., Martella, D., & Casagrande, M. (2023). Executive functioning during verbal fluency tasks in bilinguals: A systematic review. *International Journal of Language & Communication Disorders*, 58(4). <https://doi.org/10.1111/1460-6984.12855>
- Giovannoli, J., Martella, D., Federico, F., Pirchio, S., & Casagrande, M. (2020). The impact of bilingualism on executive functions in children and adolescents: A systematic review based on the PRISMA method. *Frontiers in Psychology*, 11(11). <https://doi.org/10.3389/fpsyg.2020.574789>

- Godefroy, O., Martinaud, O., Narme, P., Joseph, P. A., Mosca, C., Lhommée, E., Meulemans, T., Czernecki, V., Bertola, C., Labauge, P., Verny, M., Bellmann, A., Azouvi, P., Bindschaedler, C., Bretault, E., Boutoleau-Bretonniere, C., Robert, P., Lenoir, H., Krier, M., & Roussel, M. (2018). Dysexecutive disorders and their diagnosis: A position paper. *Cortex*, 109, 322–335. <https://doi.org/10.1016/j.cortex.2018.09.026>
- Goodenough, F. L. (1926). Racial differences in the intelligence of school children. *Journal of Experimental Psychology*, 9(5), 388–397. <https://doi.org/10.1037/h0073325>
- Golzar, J., Tajik, O., & Noor, S. (2022). Convenience sampling. *International Journal of Education and Language Studies*, 1(2), 72–77. <https://doi.org/10.22034/ijels.2022.162981>
- Gonzalez-Recober, C., Nevler, N., Shellikeri, S., Cousins, K. A. Q., Rhodes, E., Liberman, M., Grossman, M., Irwin, D. J., & Cho, S. (2023). Comparison of category and letter fluency tasks through automated analysis. *Frontiers in Psychology*, 14. <https://doi.org/10.3389/fpsyg.2023.1212793>
- Grech, S. (2023). Sociolinguistics in Malta. In M. J. Ball, R. Mesthrie, & C. Meluzzi (Eds.), *The Routledge handbook of sociolinguistics around the world* (pp. 569-575). London: Routledge.
- Green, D. W. (1998). Mental control of the bilingual lexico-semantic system. *Bilingualism: Language and Cognition*, 1(2), 67–81. <https://doi.org/10.1017/S1366728998000133>
- Green, D. W., & Abutalebi, J. (2013). Language control in bilinguals: The adaptive control hypothesis. *Journal of Cognitive Psychology*, 25(5), 515–530. <https://doi.org/10.1080/20445911.2013.796377>
- Gregersen, T., & Mercer, S. (2021). *The Routledge handbook of the psychology of language learning and teaching*. Routledge.
- Grosjean, F. (1989). Neurolinguists, beware! The bilingual is not two monolinguals in one person. *Brain and Language*, 36(1), 3–15. [https://doi.org/10.1016/0093-934X\(89\)90048-5](https://doi.org/10.1016/0093-934X(89)90048-5)

- Grundy, J. G., Chung-Fat-Yim, A., Friesen, D. C., Mak, L., & Bialystok, E. (2017). Sequential congruency effects reveal differences in disengagement of attention for monolingual and bilingual young adults. *Cognition*, 163, 42–55. <https://doi.org/10.1016/j.cognition.2017.02.010>
- Gullifer, J. W., & Titone, D. (2021). Engaging proactive control: Influences of diverse language experiences using insights from machine learning. *Journal of Experimental Psychology: General*, 150(3), 414–430. <https://doi.org/10.1037/xge0000933>
- Gunnerud, H. L., Foldnes, N., & Melby-Lervåg, M. (2022). Levels of skills and predictive patterns of reading comprehension in bilingual children with an early age of acquisition. *Reading and Writing*, 35, 2365–2387. <https://doi.org/10.1007/s11145-022-10286-2>
- Han, X., Wei, L., & Filippi, R. (2022). Modulating effects of interactional contexts on bilinguals' cognitive control: Evidence for the adaptive control hypothesis. *International Journal of Bilingualism*, 27(5). <https://doi.org/10.1177/13670069221102011>
- Hirnstein, M., Stuebs, J., Moè, A., & Hausmann, M. (2023). Sex/gender differences in verbal fluency and verbal-episodic memory: A meta-analysis. *Perspectives on Psychological Science*, 18(1). <https://doi.org/10.1177/17456916221082116>
- Hossan, D., Dato' Mansor, Z., & Siah Jaharuddin, N. (2023). Research population and sampling in quantitative study. *International Journal of Business and Technopreneurship*, 13(3), 209–222.
- Jacobsen, G. M., Joannette, Y., Kristensen, C. H., & Fonseca, R. P. (2017). Executive processing in children on verbal fluency tasks: The predictive role of child age and parental education. *Psychology & Neuroscience*, 10(3), 273–280. <https://doi.org/10.1037/pne0000097>
- Jebahi, F., Abou Jaoude, R., Daaboul, H., El Achkar, R., & Jacobs, M. M. (2021). Preliminary normative data for 12 categories using semantic verbal fluency: The role of animacy. *Applied Neuropsychology: Adult*, 680–685. <https://doi.org/10.1080/23279095.2021.1971981>
- Jevtović, M., Duñabeitia, J. A., & de Bruin, A. (2019). How do bilinguals switch between languages in different interactional contexts? A comparison between voluntary and mandatory language

switching. *Bilingualism: Language and Cognition*, 23(2), 1–13.
<https://doi.org/10.1017/s1366728919000191>

Jiang, J. (2021). Nonparametric statistics. In *Large sample techniques for statistics* (pp. 379–415). Springer.

Jochimsen, M. (2022). Living in two languages: Regimes of language and identity constructions of Maltese-English bilinguals: *Journal of Mediterranean Studies*, 31(2), 199–219.
<https://doi.org/10.1353/jms.2022.a912070>

Kang, C., & Lust, B. (2019). Code-switching does not predict executive function performance in proficient bilingual children: Bilingualism does. *Bilingualism: Language and Cognition*, 22(2), 366–382. <https://doi.org/10.1017/S1366728918000299>

Kassir, R., Roussel, M., Abboud, H., & Olivier Godefroy. (2023). Verbal fluency in bilingual Lebanese adults: Is the prominent language advantage due to executive processes, language processes, or both? *Applied Neuropsychology Adult*, 1–13.
<https://doi.org/10.1080/23279095.2023.2234536>

Kazdin, A. E. (2021). *Research design in clinical psychology* (5th ed.). Cambridge University Press.

Kempler, D., Teng, E. L., Dick, M., Taussig, I. M., & Davis, D. S. (1998). The effects of age, education, and ethnicity on verbal fluency. *Journal of the International Neuropsychological Society*, 4(6), 531–538. <https://doi.org/10.1017/S1355617798466013>

Knief, U., & Forstmeier, W. (2021). Violating the normality assumption may be the lesser of two evils. *Behavior Research Methods*, 53(6). <https://doi.org/10.3758/s13428-021-01587-5>

Korkman, M., Kirk, U., & Kemp, S. (2007). *NEPSY: Second edition*. Pearson.
https://www.pearsonassessments.com/en-us/Store/Professional-Assessments/Academic-Learning/NEPSY-%7C-Second-Edition/p/100000584?srsId=AfmBOorEn01pM0uZMBKviEvOdrfHX8ksDf_jXZFiiH9TH7rJWVt1GSQA

- Kremin, L. V., & Byers-Heinlein, K. (2021). Why not both? Rethinking categorical and continuous approaches to bilingualism. *International Journal of Bilingualism*, 25(6), 1560–1575. <https://doi.org/10.1177/13670069211031986>
- 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. <https://doi.org/10.1006/jmla.1994.1008>
- Kwak, S. K., & Kim, J. H. (2017). Statistical data preparation: Management of missing values and outliers. *Korean Journal of Anesthesiology*, 70(4), 407–411. <https://doi.org/10.4097/kjae.2017.70.4.407>
- Language education policy profile: Malta*. (2015). Ministry for Education and Employment. <https://rm.coe.int/language-education-policy-profile-malta/16807b3c39>
- Laerd Statistics. (2018). *One-way ANOVA in SPSS statistics: Step-by-step procedure including testing of assumptions*. Laerd. <https://statistics.laerd.com/spss-tutorials/one-way-anova-using-spss-statistics.php>
- Lau, C., & Richards, B. (2021). Home literacy environment and children's English language and literacy skills in Hong Kong. *Frontiers in Psychology*, 11. <https://doi.org/10.3389/fpsyg.2020.569581>
- Leach, L., Kaplan, E., Rewilak, D., Richards, B., & Proulx, G. B. (2000). *Kaplan Baycrest neurocognitive assessment*. Pearson. https://www.pearsonassessments.com/en-us/Store/Professional-Assessments/Cognition-%26-Neuro/Kaplan-Baycrest-Neurocognitive-Assessment/p/100000199?srsId=AfmBOopc0eG5eo3hx-oN5NaFK3NMpyvIMC-8juzi_mBOu9-FPMwQfbyT
- Lehtonen, M., Fyndanis, V., & Jylkkä, J. (2023). The relationship between bilingual language use and executive functions. *Nature Reviews Psychology*, 2, 360–373. <https://doi.org/10.1038/s44159-023-00178-9>

- Levene, H. (1960). Robust tests for equality of variances. In I. Olkin, L. J. Gleser, M. D. Perlman, S. J. Press, & A. R. Sampson (Eds.), *Contributions to probability and statistics* (pp. 278–292). Springer.
- Lezak, M. D., Howieson, D. B., Bigler, E. D., & Tranel, D. (2012). *Neuropsychological assessment* (5th ed.). Oxford University Press.
- Li, G., Zhen, F., Lin, Z., & Gunderson, L. (2023). Bilingual home literacy experiences and early biliteracy development among Chinese–Canadian first graders. *Education Sciences*, 13(8), 808–808. <https://doi.org/10.3390/educsci13080808>
- Li, S., Botezatu, M. R., Zhang, M., & Guo, T. (2021). Different inhibitory control components predict different levels of language control in bilinguals. *Memory & Cognition*, 49(4), 758–770. <https://doi.org/10.3758/s13421-020-01131-4>
- Lim, C. Y., & In, J. (2019). Randomization in clinical studies. *Korean Journal of Anesthesiology*, 72(3), 221–232. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6547231/>
- Lines, T., Burdick, C., Dewez, X., Aldridge, E., Neal-Williams, T., Walker, K., Akhlaghi, H., Paul, B., & Taylor, D. M. (2021). Nature and extent of selection bias resulting from convenience sampling in the emergency department. *Emergency Medicine Journal*, 39(4), 325–330. <https://doi.org/10.1136/emmermed-2021-211390>
- Liu, H., & Wu, L. (2021). Lifelong bilingualism functions as an alternative intervention for cognitive reserve against Alzheimer’s disease. *Frontiers in Psychiatry*, 12. <https://doi.org/10.3389/fpsy.2021.696015>
- Lohndal, T., Rothman, J., Kupisch, T., & Westergaard, M. (2019). Heritage language acquisition: What it reveals and why it is important for formal linguistic theories. *Language and Linguistics Compass*, 13(12). <https://doi.org/10.1111/lnc3.12357>

- López, B. G., Luque, A., & Piña-Watson, B. (2021). Context, intersectionality, and resilience: Moving toward a more holistic study of bilingualism in cognitive science. *Cultural Diversity and Ethnic Minority Psychology, 29*(1), 24–33. <https://doi.org/10.1037/cdp0000472>
- Lubrin, G., Periañez, J. A., Laseca-Zaballa, G., Bernabéu-Brotons, E., & Ríos-Lago, M. (2021). Verbal fluency tasks: Influence of age, gender, and education and normative data for the Spanish native adult population. *Archives of Clinical Neuropsychology, 37*(2), 365–375. <https://doi.org/10.1093/arclin/acab056>
- Mack, L. (2010). The philosophical underpinnings of educational research. *Polyglossia, 19*, 5-11. http://www.apu.ac.jp/rcaps/uploads/fckeditor/publications/polyglossia/Polyglossia_V19_Lindsay.pdf
- Marian, V., & Hayakawa, S. (2020). Measuring bilingualism: The quest for a “bilingualism quotient.” *Applied Psycholinguistics, 42*(2), 1–22. <https://doi.org/10.1017/s0142716420000533>
- Marques, P. do N., Oliveira, R. M., & Correa, J. (2022). Contributions of executive functions and linguistic skills to verbal fluency in children. *Child Neuropsychology, 28*(8), 1031–1051. <https://doi.org/10.1080/09297049.2022.2042502>
- Marra, C., Piccininni, C., Masone Iacobucci, G., Caprara, A., Gainotti, G., Costantini, E. M., Callea, A., Venneri, A., & Quaranta, D. (2021). Semantic memory as an early cognitive marker of Alzheimer’s disease: Role of category and phonological verbal fluency tasks. *Journal of Alzheimer’s Disease, 81*(2), 619–627. <https://doi.org/10.3233/jad-201452>
- McGlinchey, S. (2022). *Foundations of international relations*. Bloomsbury Academic.
- Merriam-Webster. (2018). *Definition of bilingualism*. Merriam-Webster. <https://www.merriam-webster.com/dictionary/bilingualism>
- Merza, E. O., & Al-Anber, N. J. (2021). Fast ways to detect outliers. *Journal of Techniques, 3*(1), 66–73. <https://doi.org/10.51173/jt.v3i1.287>

- Meuter, R. F. I., & Allport, A. (1999). Bilingual language switching in naming: Asymmetrical costs of language selection. *Journal of Memory and Language*, 40(1), 25–40. <https://doi.org/10.1006/jmla.1998.2602>
- Mifsud, C. L., Georgieva, R., & Kucirkova, N. (2021). Parent-child joint reading of digital books in bilingual families in Malta. *International Journal of Educational Research*, 109, 101–844. <https://doi.org/10.1016/j.ijer.2021.101844>
- Ministry for Education. (2012). *A national curriculum framework for all: 2012*. <https://curriculum.gov.mt/wp-content/uploads/2024/07/NCF.pdf>
- Ministry of Education. (1999). *Creating the future together*. National Minimum Curriculum .
- Mishra, P., Pandey, C. M., Singh, U., Sahu, C., Keshri, A., & Gupta, A. (2019). Descriptive statistics and normality tests for statistical data. *Annals of Cardiac Anaesthesia*, 22(1), 67–72. https://doi.org/10.4103/aca.ACA_157_18
- Mohammed, A., & Aljabr, F. S. (2023). Linguistic relativity: A study of the role of L1 in L2 vocabulary acquisition in an EFL setting. *Theory and Practice in Language Studies*, 13(12), 3232–3239. <https://doi.org/10.17507/tpls.1312.21>
- Moñivas, J. R., Benton, T., & Craib, I. (2005). Philosophy of social science. The philosophical foundations of social thought. *Reis*, 1(112), 270. <https://doi.org/10.2307/40184720>
- Montrul, S. (2023). Heritage languages: Language acquired, language lost, language regained. *Annual Review of Linguistics*, 9(1), 399–418. <https://doi.org/10.1146/annurev-linguistics-030521-050236>
- Moreno Thobo-Carlsen, G. D. (2019). *Malta: A functional bilingual society: An analysis of societal and individual bilingualism* [Thesis, Malmö University].
- Muscat, L., & Grech, H. (2024). The home literacy environment of individuals with down syndrome. A comparative study within a bilingual context. *International Journal of Bilingual Education and Bilingualism*, 1–16, 479–494. <https://doi.org/10.1080/13670050.2024.2439277>

- Naderifar, M., Goli, H., & Ghaljaie, F. (2017). Snowball sampling: A purposeful method of sampling in qualitative research. *Strides in Development of Medical Education*, 14(3). <https://doi.org/10.5812/sdme.67670>
- Nasreddine, Z. S., Phillips, N. A., Bedirian, V., Charbonneau, S., Whitehead, V., Collin, I., Cummings, J. L., & Chertkow, H. (2005). The Montreal cognitive assessment, MoCA: A brief screening tool for mild cognitive impairment. *Journal of the American Geriatrics Society*, 53(4), 695–699. <https://doi.org/10.1111/j.1532-5415.2005.53221>
- National Council for the Maltese. (2021). *Survey on the use of Maltese and English in different social situations*. University of Malta. <https://www.um.edu.mt/newspoint/news/2021/06/maltese-language-population>
- Ng, G., & Yang, H. (2021). Code-switching patterns differentially shape cognitive control: Testing the predictions of the adaptive control hypothesis. *Bilingualism: Language and Cognition*, 1–15. <https://doi.org/10.1017/s1366728921000754>
- Nogueira, D. S., Azevedo Reis, E., & Vieira, A. (2016). Verbal fluency tasks: Effects of age, gender, and education. *Folia Phoniatrica et Logopaedica*, 68(3), 124–133. <https://doi.org/10.1159/000450640>
- Nussbaum, E. M. (2024). *Categorical and nonparametric data analysis: Choosing the best statistical technique* (2nd ed.). Routledge.
- Okoye, K., & Hosseini, S. (2024). Choosing between parametric and non-parametric tests in statistical data analysis . *In R programming: Statistical data analysis in research* . Springer.
- Olabarrieta-Landa, L., Rivera, D., Xia, B., Moreno, O., Ramos Usuga, D., Morel Valdés, G. M., Lopez, E., Rodriguez, M. J., Carrión, C. I., Lequerica, A. H., Drago, C. I., García, P., Rivera, P. M., Perrin, P. B., & Arango-Lasprilla, J. C. (2024). Normative data for verbal fluency and naming tests in Spanish-speaking adults in the United States. *NeuroRehabilitation*, 55(2), 195–208. <https://doi.org/10.3233/nre-240087>

- Paap, K. R., Myuz, H. A., Anders, R. T., Bockelman, M. F., Mikulinsky, R., & Sawi, O. M. (2017). No compelling evidence for a bilingual advantage in switching or that frequent language switching reduces switch cost. *Journal of Cognitive Psychology*, 29(2), 89–112. <https://doi.org/10.1080/20445911.2016.1248436>
- Panchenko, O., & Bilous, K. (2023). The concept of bilingualism . *Polonia University Scientific Journal*, 57(2), 74–80. <https://doi.org/10.23856/5709>
- Panzavecchia, M. (2023). “Issa open your books għax ser nibdew il-lesson tal-English...”: The impact of Maltese primary school teachers’ language backgrounds on linguistic identities, language use, and pedagogical practices. *Malta Journal of Education*, 4(2), 117–143. <https://doi.org/10.62695/eftc9137>
- Panzavecchia, M. (2024). Diverse voices, dynamic classrooms: Exploring changing demographics, pedagogical shifts, and training perspectives in Maltese multilingual primary classrooms. *EuroAmerican Journal of Applied Linguistics and Languages*, 11(2), 1–26. <https://doi.org/10.21283/2376905x.1.11.2.3078>
- Patra, A., Bose, A., & Marinis, T. (2019). Performance difference in verbal fluency in bilingual and monolingual speakers. *Bilingualism: Language and Cognition*, 23(1), 1–15. <https://doi.org/10.1017/s1366728918001098>
- Patra, A., Bose, A., & Marinis, T. (2020). Lexical and cognitive underpinnings of verbal fluency: Evidence from Bengali-English bilingual aphasia. *Behavioral Sciences*, 10(10), 155. <https://doi.org/10.3390/bs10100155>
- Pekkala, S., Goral, M., Hyun, J. M., Obler, L. K., Erkinjuntti, T., & Albert, M. L. (2009). Semantic verbal fluency in two contrasting languages. *Clinical Linguistics and Phonetics*, 23(6), 431–445. <https://doi.org/10.1080/02699200902839800>

- Peña, E. D. (2013). Dynamic Assessment and Intervention: A Critical Study on Evaluating Language Abilities in Bilingual Children. *Journal of Speech, Language, and Hearing Research*, 56(3), 1-15.
- Pereira, A. H., Gonçalves, A. B., Holz, M., Gonçalves, H. A., Kochhann, R., Joannette, Y., Zimmermann, N., & Fonseca, R. P. (2018). Influence of age and education on the processing of clustering and switching in verbal fluency tasks. *Dementia e Neuropsychologia*, 12(4), 360–367. <https://doi.org/10.1590/1980-57642018dn12-040004>
- Pereira Soares, S. M., Prystauka, Y., DeLuca, V., & Rothman, J. (2022). Type of bilingualism conditions individual differences in the oscillatory dynamics of inhibitory control. *Frontiers in Human Neuroscience*, 16. <https://doi.org/10.3389/fnhum.2022.910910>
- Pernecky, R., Kempermann, G., Korczyn, A. D., Matthews, F. E., Ikram, M. A., Scarmeas, N., Chetelat, G., Stern, Y., & Ewers, M. (2019). Translational research on reserve against neurodegenerative disease: Consensus report of the international conference on cognitive reserve in the dementias and the Alzheimer's association reserve, resilience and protective factors professional interest area working groups. *BMC Medicine*, 17(1). <https://doi.org/10.1186/s12916-019-1283-z>
- Pfenninger, S. E., Festman, J., & Singleton, D. (2023). *Second language acquisition and lifelong learning*. Taylor & Francis.
- Plack, M. (2015). Human nature and research paradigms: Theory meets physical therapy practice. *The Qualitative Report*, 10(2), 223-245. <https://doi.org/10.46743/2160-3715/2005.1847>
- Polinsky, M., & Scontras, G. (2020). A roadmap for heritage language research. *Bilingualism: Language and Cognition*, 23(1), 50–55. <https://doi.org/10.1017/s1366728919000555>
- Quiñones, I., Gisbert-Muñoz, S., Amoruso, L., Manso-Ortega, L., Mori, U., Bermudez, G., Robles, S. G., Pomposo, I., & Carreiras, M. (2024). Unveiling the neuroplastic capacity of the bilingual

brain: insights from healthy and pathological individuals. *Brain Structure and Function*, 229(9), 2187–2205. <https://doi.org/10.1007/s00429-024-02846-9>

Randolph, C. (1998). *Repeatable battery for the assessment of neuropsychological status update*. Pearson. <https://www.pearsonclinical.co.uk/en-gb/Store/Professional-Assessments/Cognition-%26-Neuro/Repeatable-Battery-for-the-Assessment-of-Neuropsychological-Status-Update/p/P100009272>

Rayo, W., Barrita, A. M., Cabrera Martinez, L., & Carbajal, I. (2024). The complexity in bilingual code-switching research: A systematic review. *Languages*, 9(6), 217–217. <https://doi.org/10.3390/languages9060217>

Ritchie, S. J., Hill, W. D., Marioni, R. E., Davies, G., Hagenaars, S. P., Harris, S. E., Cox, S. R., Taylor, A. M., Corley, J., Pattie, A., Redmond, P., Starr, J. M., & Deary, I. J. (2020). Polygenic predictors of age-related decline in cognitive ability. *Molecular Psychiatry*, 25, 2584–2598. <https://doi.org/10.1038/s41380-019-0372-x>

Rivera, D., Olabarrieta-Landa, L., Van der Elst, W., Gonzalez, I., Rodríguez-Agudelo, Y., Aguayo Arelis, A., Rodriguez-Irizarry, W., García de la Cadena, C., & Arango-Lasprilla, J. C. (2019). Normative data for verbal fluency in healthy Latin American adults: Letter M, and fruits and occupations categories. *Neuropsychology*, 33(3), 287–300. <https://doi.org/10.1037/neu0000518>

Rosselli, M., Ardila, A., Lalwani, L. N., & Velez-Urbe, I. (2015). The effect of language proficiency on executive functions in balanced and unbalanced Spanish–English bilinguals. *Bilingualism: Language and Cognition*, 19(3), 489–503. <https://doi.org/10.1017/s1366728915000309>

Rothman, J., Bayram, F., DeLuca, V., Di Pisa, G., Duñabeitia, J. A., Gharibi, K., Hao, J., Kolb, N., Kubota, M., Kupisch, T., Laméris, T., Luque, A., van Osch, B., Pereira Soares, S. M., Prystauka, Y., Tat, D., Tomić, A., Voits, T., & Wulff, S. (2022). Monolingual comparative

- normativity in bilingualism research is out of “control”: Arguments and alternatives. *Applied Psycholinguistics*, 44, 1–14. <https://doi.org/10.1017/s0142716422000315>
- Sale, J. E. M., Lohfeld, L. H., & Brazil, K. (2002). Revisiting the quantitative-qualitative debate: Implications for mixed-methods research. *Quality and Quantity*, 36(1), 43–53. <https://doi.org/10.1023/a:1014301607592>
- Schmidt, C. S. M., Schumacher, L. V., Römer, P., Leonhart, R., Beume, L., Martin, M., Dressing, A., Weiller, C., & Kaller, C. P. (2017). Are semantic and phonological fluency based on the same or distinct sets of cognitive processes? Insights from factor analyses in healthy adults and stroke patients. *Neuropsychologia*, 99, 148–155. <https://doi.org/10.1016/j.neuropsychologia.2017.02.019>
- Schwartz, A. I. (2021). *Bilingualism across the lifespan* (1st ed.). Routledge.
- Schwieter, J. W., & Festman, J. (2023). *The cognitive neuroscience of bilingualism*. Cambridge University Press.
- Schwieter, J. W., & Ferreira, A. (2016). Effects of cognitive control, lexical robustness, and frequency of codeswitching on language switching. In J.W. Fletcher (Ed.), *Cognitive Control and Consequences of Multilingualism*. John Benjamins.
- Sciriha, L. (2021). Language proficiency, use and attitudes among university students in bilingual Malta. *International Journal of Englishes English*, 1(1), 101–108.
- Sciriha, L. (2024). *The Maltese language in education in Malta* (2nd ed.). Mercator.
- Shuttleworth-Edwards, A. B. (2016). Generally representative is representative of none: commentary on the pitfalls of IQ test standardization in multicultural settings. *The Clinical Neuropsychologist*, 30(7), 975–998. <https://doi.org/10.1080/13854046.2016.1204011>
- Smeeton, N., Spencer, N., & Sprent, P. (2025). *Applied nonparametric statistical methods* (5th ed.). CRC Press.

- Soetewey, A. (2020, August 11). *Outliers detection in R*. Stats and R. <https://statsandr.com/blog/outliers-detection-in-r/>
- Soltani, M., Moradi, N., Rezaei, H., Hosseini, M., & Jasemi, E. (2021). Comparison of verbal fluency in monolingual and bilingual elderly in Iran. *Applied Neuropsychology: Adult*, 28(1), 80–87. <https://doi.org/10.1080/23279095.2019.1594234>
- Sperl, L., Schroeger, A., Kaufmann, J. M., & Kreysa, H. (2024). Mental representation of words and concepts in late multilingualism. *The Mental Lexicon*, 1–42. <https://doi.org/10.1075/ml.23018.spe>
- Spinelli, G., & Sulpizio, S. (2024). Is adaptation involved in bilingual language production? A fresh look at the assumptions motivating potential bilingual-monolingual differences in adaptive control. *Psychonomic Bulletin & Review*, 31, 2681–2691. <https://doi.org/10.3758/s13423-024-02503-6>
- Spinelli, G., & Sulpizio, S. (2025). No evidence that selection is resource-demanding in conflict and bilingual language production tasks: Implications for theories of adaptive control and language-control associations. *Psychonomic Bulletin & Review*. <https://doi.org/10.3758/s13423-025-02672-y>
- Stojanović, M., Andjelković - Apostolović, M., Milošević, Z., & Ignjatović, A. (2018). Parametric versus nonparametric tests in biomedical research . *Acta Medica Medianae*, 57(2), 75–80. <https://doi.org/10.5633/amm.2018.0212>
- Strauss, E., Sherman, E. M. S., & Spreen, O. (2006). *A compendium of neuropsychological tests: Administration, norms, and commentary* (3rd ed.). Oxford University Press.
- Sukamolson, S. (2007). Fundamentals of quantitative research. *Language Institute Chulalongkorn University*, 1(3), 1-20.

- Sullivan, J. H., Warkentin, M., & Wallace, L. (2021). So many ways for assessing outliers: What really works and does it matter? *Journal of Business Research*, 132(1), 530–543. <https://doi.org/10.1016/j.jbusres.2021.03.066>
- Sultana, M. (2014). *Bilingual exposure at home and at school in early childhood* [Thesis, University of Malta].
- Thompson, R., & Martinez, L. (2017). Lexical skills development in EFL learning. *Applied Linguistics Quarterly*, 23(1), 45-5.
- Thurstone, L.L. (1938). *Primary mental abilities*. University of Chicago Press: Chicago.
- Tukey, J. W. (1984). *The Collected Works of John W. Tukey*. Taylor & Francis.
- Vassallo, M., & Sciriha, L. (2020). *The meltdown of Maltese: A language perspective* [Thesis, University of Malta].
- Vassallo, M., & Sciriha, L. (2021). English or Maltese? Language use among university students on social media platforms. *Journal of English Linguistics*, 13, 101-118
- Vella, A. (2013). Languages and language varieties in Malta. *International Journal of Bilingual Education and Bilingualism*, 16(5), 532–552. <https://doi.org/10.1080/13670050.2012.716812>
- Vella, L. A., Mifsud, C. L., & Muscat, D. (2018). *Language use in early childhood education classrooms in Malta* (pp. 1–84). Ministry for Education and Employment.
- Vella, L. A., Mifsud, C. L., & Muscat, D. (2022). *A language policy for the junior years: In Malta and Gozo*. Government of Malta: Ministry for education, sport, youth, research and innovation. <https://nla.gov.mt/wp-content/uploads/2023/12/A-Language-Policy-for-the-Junior-Years.pdf>
- Villalobos, D., Torres-Simón, L., Pacios, J., Paúl, N., & del Río, D. (2023). A systematic review of normative data for verbal fluency test in different languages. *Neuropsychology Review*, 33, 733–764. <https://doi.org/10.1007/s11065-022-09549-0>

- Wagner, D., Bialystok, E., & Grundy, J. G. (2022). What is a language? Who is bilingual? Perceptions underlying self-assessment in studies of bilingualism. *Frontiers in Psychology*, 13. <https://doi.org/10.3389/fpsyg.2022.863991>
- Wang, J., Zhang, J., & Cui, Z. (2020). L2 verbal fluency and cognitive mechanism in bilinguals: Evidence from Tibetan–Chinese bilinguals. *Journal of Psycholinguistic Research*, 50, 355–374. <https://doi.org/10.1007/s10936-020-09730-7>
- Wechsler, D. (2008). *WAIS–IV - Wechsler adult intelligence scale - Fourth edition*. Pearson. <https://www.pearsonassessments.com/en-us/Store/Professional-Assessments/Cognition-%26-Neuro/Wechsler-Adult-Intelligence-Scale-%7C-Fourth-Edition/p/100000392?srsId=AfmBOor2Q4uZP-YLljxxucp5VWmYIJUI0jJv8YSbGk-100CL7PHGuOzm>
- Wechsler, D. (2008b). *Wechsler Adult Intelligence Scale - Fourth Edition: Technical and interpretive manual*. Pearson.
- Wechsler, D. (2024). *WAIS-5 - Wechsler adult intelligence scale - Fifth edition*. Pearson. https://www.pearsonassessments.com/en-us/Store/Professional-Assessments/Cognition-%26-Neuro/Wechsler-Adult-Intelligence-Scale-%7C-Fifth-Edition/p/P100071002?srsId=AfmBOoqTKHJRE5dekEA_kMayOvFl1JzdGGmrZZtDewjsUky15zHe6NLb
- Williams, C., & Naganuma, N. (2024). Young learner L2 vocabulary acquisition: Does the revised hierarchical model apply to child learners? *JALT Journal*, 46(1), 35–54. <https://doi.org/10.37546/jaltj46.1-2>
- Wilson, R. S., Yu, L., Lamar, M., Schneider, J. A., Boyle, P. A., & Bennett, D. A. (2019). Education and cognitive reserve in old age. *Neurology*, 92(10), 1041–1050. <https://doi.org/10.1212/wnl.00000000000007036>

- Wright, L., De Marco, M., & Venneri, A. (2023). Current understanding of verbal fluency in Alzheimer's disease: Evidence to date. *Psychology Research and Behavior Management*, 16, 1691–1705. <https://doi.org/10.2147/prbm.s284645>
- Yang, S., & Berdine, G. (2021). Normality tests. *The Southwest Respiratory and Critical Care Chronicles*, 9(37), 87–90. <https://doi.org/10.12746/swrccc.v9i37.805>
- Żammit, J. (2025). Does multilingualism hold the golden key to acquiring the Maltese language? *International Journal of Multilingualism*, 1–26. <https://doi.org/10.1080/14790718.2025.2475395>
- Zeng, Z., Kalashnikova, M., & Antoniou, M. (2019). Integrating bilingualism, verbal fluency, and executive functioning across the lifespan. *Journal of Cognition and Development*, 656-679. <https://doi.org/10.1080/15248372.2019.1648267>
- Zhang, J., Fan, L., & Liu, J. (2024). Exploring the role of executive functions in Chinese-English bilinguals' emotional word comprehension during language switching. *International Journal of Bilingual Education and Bilingualism*, 27(7), 946–962. <https://doi.org/10.1080/13670050.2024.2315979>
- Zigiotto, L., Vavassori, L., Annicchiarico, L., Corsini, F., Avesani, P., Rozzanigo, U., Sarubbo, S., & Papagno, C. (2022). Segregated circuits for phonemic and semantic fluency: A novel patient-tailored disconnection study. *NeuroImage : Clinical*, 36. <https://doi.org/10.1016/j.nicl.2022.103149>

Appendices

Appendix A: Social Media Blurb (English and Maltese Version)

Titkellem ħafna sew kemm bil-
Malti kif ukoll bl-**Ingliz** u
interessat/a li tipparteċipa fi
studju dwar l-effetti tal-
bilingwimu fuq il-felicità Verballi?

Għar-riċerka tal-Master tiegħi, qed infittex adulti (18+) li jafu sew il-Malti kif ukoll l-Ingliz biex jipparteċipaw fi studju li jeżamina l-impatt tal-bilingwizmu fuq il-felicità verbali.

Dan l-istudju (madwar 15-il minuta) jinvolve:

- Ġenerazzjoni ta' kliem minn kategoriji partikolari bbażati fuq lingwa assenjata b'mod random: Malti biss, Ingliz biss, jew kemm Malti kif ukoll Ingliz.

Tixtieq tipparteċipa?

Jekk jogħġbok ikkuntattja lil Aurora Micallef fuq aurora.micallef.19@um.edu.mt għal aktar informazzjoni.

Grazzi ħafna!

Are you proficient in both
Maltese and **English** and
interested in participating in a
study on the effects of
bilingualism on verbal fluency?

For my Master's research, I am looking for adults (18+) who are fluent in both Maltese and English to participate in a study examining the impact of bilingualism on verbal fluency.

This study (about 15 mins) involves:

- Generating words from given categories based on a randomly assigned language: Maltese-only, English-only, or both Maltese and English.

Would you like to participate?

Please contact Aurora Micallef at aurora.micallef.19@um.edu.mt for more information.

Thank you very much!

Appendix B: Participant Demographic Information Sheet

Participant Number: _____

Age: _____

Gender: _____

Highest level of education you have completed: _____

Formula ta' Informazzjoni Demografika tal-Parteċipanti

Numru tal- Parteċipant: _____

Età: _____

Ġeneru: _____

L-ogħla livell ta' edukazzjoni li lestejt: _____

Appendix C: Proof of Ethical Clearance

The status of your REDP form (SWB-2024-00521) has been updated to Acknowledged



Inbox x



form.urec@um.edu.mt

to me ▾

Wed, 22 May 2024, 07:21



Dear Aurora Micallef,

Please note that the status of your REDP form (SWB-2024-00521) has been set to *Acknowledged*.

This status change was accompanied by the following explanation/justification: *Dear Aurora Micallef, Your research **ethics** application has been received. As indicated in the Research **Ethics** Review Procedures, REDP forms which have no self-assessment issues are kept for record and audit purposes only. Hence, research may commence. Kindly note that FREC will not issue any form of approval as the responsibility for the self-assessment part lies exclusively with the researcher. Regards, SWB FREC*

You can keep track of your applications by visiting: <https://www.um.edu.mt/research/ethics/redp-form/frontEnd/>.

****This email has been automatically generated by URECA. Please do not reply. If you wish to communicate with your F/REC please use the respective email address.****

Reply

Forward

Appendix D: Information Sheet

Dear participant,

My name is Aurora Micallef and I am student at the University of Malta, presently reading for a Master of Psychology in Neuropsychology. I am presently conducting a research study for my dissertation titled “Examining the Impact of Bilingualism on Verbal Fluency”; that is being supervised by Dr Kristina Bettenzana and Dr Fiona Ambery. This letter is an invitation to participate in this study. Below, you will find information about the study and about what your involvement would entail, should you decide to take part.

The aim of my study is to investigate the impact of bilingualism on verbal fluency in the Maltese context. Your participation in this study would help contribute to a better understanding of whether the findings from international studies on monolinguals and bilinguals are similar or different when compared to the Maltese population, who seamlessly transition between Maltese and English. Any data collected from this research will be used solely for purposes of this study.

Should you choose to participate, you will be randomly assigned to one of three groups: one generating words only in English, another one only in Maltese, and a third with no language restrictions, using both languages. In your assigned group, the Maltese Word-Reading Test (Bartolo, 1988) and the “Vocabulary” subtest from the Weschler Adult Intelligence Scale Fourth Edition (WAIS-IV) will be administered. The Semantic Verbal Fluency test will then be administered, where you will be asked to generate as many words as possible from three categories: animals, fruits, and vegetables. You will have 60 seconds to complete each category, and this process will be repeated for all three categories, with a short break in between.

Data collected from the tests will be noted down on paper, and you are not required to disclose any personal information except when filling out the consent form, which will be securely stored in a locked drawer. Only my research supervisors and I will have access to the data. The research supervisors and dissertation examiners have the right to access data for verification purposes. However, to ensure anonymity, your name will not be used in the study, and the information will only be used for my dissertation.

Participation in this study is entirely voluntary; in other words, you are free to accept or refuse to participate, without needing to give a reason. You are also free to withdraw from the study at any time, without needing to provide any explanation and without any negative repercussions for you. Should you choose to withdraw, any data collected will be erased as long as this is technically possible (for example, before it is published), unless erasure of data would render impossible or seriously impair achievement of the research objectives, in which case it shall be retained in an anonymised form.

If you choose to participate, please note that there are no direct benefits to you. Your participation does not entail any known or anticipated risks.

This study might be published in the future and a copy of the dissertation will be available at the University of Malta Library and can therefore be accessed by staff, students, and members of the public.

Please note also that, as a participant, you have the right under the General Data Protection Regulation (GDPR) and national legislation to access, rectify, and where applicable ask for the data concerning you to be erased. All data collected will be erased following the publication of results in July 2025.

A copy of this information sheet is being provided for you to keep and for future reference.

Thank you for your time and consideration. Your contribution to this study would be highly appreciated. If you decide to participate in this study, kindly fill in the consent form attached and send it to me through an email on aurora.micallef.19@um.edu.mt

Should you have any questions or concerns, please do not hesitate to contact me by e-mail on the address above or you can contact my supervisors via email kristina.vella@um.edu.mt or fiona.ambery@gmail.com. If you would like to know the outcome of the study you are participating in, please let me know, and I will provide you with a summary of the dissertation results. However, personal results will not be given. Thank you in advance.

Yours Sincerely,

Aurora Micallef

Neuropsychology Trainee

Supervised by: Dr Kristina Bettanzana (Vella) and Dr Fiona Ambery

Information Sheet (Maltese Version)

Nota ta' Informazzjoni

Għażiż/a parteċipant/a,

Jiena Aurora Micallef, studenta fl-Università ta' Malta, u bhalissa qed insegwi Master tal-Psikoloġija fin-Newropsikoloġija. Fil-preżent qedgħa nagħmel ir-riċerka għad-dissertazzjoni tiegħi jisimha "L-Eżaminazzjoni tal-Impatt tal-Bilingwiżmu fuq il-Feliċità Verbali"; taħt is-superviżjoni ta Dr Kristina Bettenzana u Dr Fiona Ambery. B'din l-ittra nixtieq nistiednek tipparteċipa fir-riċerka. Hawn taħt issib aktar informazzjoni fuq l-istudju li qed nagħmel u fuq xi jkun l-involvement tiegħek jekk tiddeċiedi li tiegħu sehem.

L-għan tal-istudju hu li jinvestiga l-impatt tal- bilingwiżmu fuq il-feliċità verbali fil-kuntest Malti. Sehemek jgħin biex ikun hawn iżjed għarfien dwar jekk is-sejbiet minn studji internazzjonali dwar il-monolingwi u l-bilingwi humiex simili jew differenti meta mqabbla mal-popolazzjoni Maltija li taqleb bejn il-Malti u l-Ingliż b'mod normali. L-informazzjoni kollha li tingabar fir-riċerka tintuża biss għall-fini ta' dan l-istudju.

Jekk taqbel li tipparteċipa, inti se tiġi assenjat/a b'mod random għal wieħed minn tliet gruppi: wieħed jiġġenera kliem biss bl-Ingliż, ieħor bil-Malti biss, u terz mingħajr restrizzjonijiet tal-lingwa, bl-użu taż-żewġ lingwi. Fil-grupp assenjat/a tiegħek, se jiġu amministrati t-Test tal-Qari bil-Malti (Bartolo, 1988), u t-test tal-"Vokabularju" mir-Raba Edizzjoni Weshler Adult Intelligence Scale (WAIS-IV). Wara se jiġi amministrat it- test tal- Feliċità Verbali Semantika, fejn tintalab tiġġenera kemm tista kliem minn tliet kategoriji: animalali, frott u ħaxix. Inti se jkollok sittin sekonda għal kull kategorija, u dan il-proċess jiġi ripetut għat-tliet darbiet, b'waqfa qasira bejniethom.

L-informazzjoni miġbura minn dawn it-testijiet se jiġu nnotata fuq karta u inti mintiex meħtieġ/a tiżvela l-ebda informazzjoni personali hlief meta timla l-formola tal-kunsens, li se tinħażen b'mod sigur għewwa kexxun msakkar. Is-superviżuri tar-riċerka tiegħi u jien biss se jkollna aċċess għad-dejta. Is-superviżuri tar-riċerka u l-eżaminaturi tad-dissertazzjoni għandhom id-dritt li jkollhom aċċess għad-dejta għal skopijiet ta' verifika. Pero biex tkun

zgurata l-anonimità, ismek mhux se jintuża fl-istudju, u l-informazzjoni se tintuża biss għad-dissertazzjoni tiegħi.

Il-partecipazzjoni tiegħek f'dan l-istudju tkun għalkollox volontarja; fi kliem ieħor, inti liberu/a li taċċetta jew tirrifjuta li tiegħu sehem, mingħajr ma tagħti raġuni. Inti wkoll liberu/a li twaqqaf il-partecipazzjoni tiegħek fl-istudju meta tixtieq, mingħajr ma jkollok bżonn tagħti spjegazzjoni u mingħajr ebda riperkussjoni. Jekk tagħzel li tirtira mir-riċerka, l-informazzjoni li tkun laħqet ittiehdet tithassar dment li dan ikun teknikament possibbli (ngħidu aħna, qabel ippubblikata), u sakemm l-għanijiet tar-riċerka jkunu jistgħu jintlaħqu u ma jintlaqtux serjament. F'dak il-każ, l-informazzjoni tiegħek tintuża u tinżamm anonima.

Jekk tagħzel li tipparteċipa, jekk jogħġbok innota li m'hemm l-ebda benefiċċju dirett għalik. Il-partecipazzjoni tiegħek ma fiha l-ebda riskju magħruf jew mistenni.

Dan l-istudju jista jigi ppubblikat fil-futur u kopja tad-dissertazzjoni tkun disponibbli fil-librerija ta' l- Università ta' Malta u għalekk tista' tkun aċċessata minn staff, studenti u membri tal-pubbliku.

Bħala partecipant/a, għandek id-dritt, skont ir-Regolament Ġenerali dwar il-Protezzjoni tad-Data (GDPR) u l-leġiżlazzjoni nazzjonali, li taċċessa, tikkoreġi u fejn hu applikabbli, titlob li l-informazzjoni li tikkonċernak tithassar. L-informazzjoni kollha li tingabar fl-istudju se tithassar wara l-pubblikazzjoni tar-riżultati f'Lulju 2025.

Qed ngħaddilek kopja ta' din l-ittra biex iżżommha bħala referenza għal-futur.

Grazzi tal-ħin u l-kunsiderazzjoni tiegħek. Il-kontribut tiegħek għal dan l-istudju hu apprezzat ħafna. Jekk tiddeċiedi li tipparteċipa f'dan l-istudju, ġentilment imla l-formola tal-kunsens meħmuża u ibgħatha lili permezz ta' email fuq aurora.micallef.19@um.edu.mt

Jekk ikollok xi mistoqsija jew tħassib, jekk jogħġbok, toqgħodx lura milli tikkuntattjani bl-email fuq l-indirizz ta' hawn fuq jew tista' tikkuntattja lis-superviżuri tiegħi permezz tal-imejls kristina.vella@um.edu.mt jew fiona.ambery@gmail.com. Jekk tixtieq tkun taf ir-riżultat tal-istudju li qed tipparteċipa fih, jekk jogħġbok għarrafni, u ngħaddilek summary tar-riżultati tad-dissertazzjoni. Madankollu, riżultati personali mhux se jingħataw. Grazzi bil-quddiem.

Tislijiet,

Aurora Micallef

Trainee tan-Newropsikologija

Taht is- supervizjoni ta: Dr Kristina Bettenzana u Dr Fiona Ambery.

Appendix E: Participant's Consent Form

"Examining the Impact of Bilingualism on Verbal Fluency"

I, the undersigned, give my consent to take part in the study conducted by Aurora Micallef. This consent form specifies the terms of my participation in this research study.

1. I have been given written and/or verbal information about the purpose of the study; I have had the opportunity to ask questions and any questions that I had were answered fully and to my satisfaction.
2. I also understand that I am free to accept to participate, or to refuse or stop participation at any time without giving any reason and without any penalty. Should I choose to participate, I may choose to decline to answer any questions asked. In the event that I choose to withdraw from the study, any data collected from me will be erased as long as this is technically possible (for example, before it is published), unless erasure of data would render impossible or seriously impair achievement of the research objectives, in which case it shall be retained in an anonymised form.
3. I understand that I have been invited to participate in a group comparison design in which the researcher will randomly assign me to one of three groups: one generating words solely in English, another one only in Maltese, and a third with no language restrictions, using both languages to investigate the impact of bilingualism on verbal fluency in the Maltese context. I am aware that the group comparison design will take approximately 30 minutes. I understand that the group comparison design is to be conducted in a place and at a time that is convenient for me.
4. I understand that my participation does not entail any known or anticipated risks.
5. I am informed that the completed dissertation will be available at the University of Malta Library and hence will be available for students, staff, and public.
6. I have been informed that this study might be published in the future.
7. I understand that there are no direct benefits to me from participating in this study. I also understand that this research may benefit others by exploring whether the findings from international studies on monolinguals and bilinguals are similar or different when compared to the Maltese population, who seamlessly transition between Maltese and English.

8. I am aware that I will not be required to disclose any personal information, that my scores will be destroyed after the study is over and that I have the right to receive a summary of results of the study upon request.
9. I understand that my information will be treated confidential and that my identity will remain anonymous.
10. I am aware that the research supervisor and dissertation examiners have the right to access data for verification purposes.
11. I understand that, under the General Data Protection Regulation (GDPR) and national legislation, I have the right to access, rectify, and where applicable, ask for the data concerning me to be erased.
12. I understand that all data collected will be erased following the publication of results in July 2025.
13. I have been provided with a copy of the information letter and understand that I will also be given a copy of this consent form.

I have read and understood the above statements and agree to participate in this study.

Name of participant: _____

Signature: _____

Date: _____

Please tick this box if you would like a copy of the dissertation once it is finished by e-mail and provide your email address below:

☐

Ms Aurora Micallef
aurora.micallef.19@um.edu.mt

Dr Kristina Bettenezana (Vella)
kristina.vella@um.edu.mt

Dr Fiona Ambery
fiona.ambery@gmail.com

Formola tal-Kunsens tal- Parteċipant/a

"L-Eżaminazzjoni tal-Impatt tal-Bilingwiżmu fuq il-Feliċità Verbali"

Jiena, hawn taht iffirmit/a, nagħti l-kunsens tiegħi li niehu sehem fl-istudju ta' Aurora Micallef. Din il-formola tal-kunsens tispjega t-termini tas-sehem tiegħi f' din ir-riċerka.

1. Inghatajt l-informazzjoni bil-miktub u/jew bil-fomm dwar l-iskop tar-riċerka; kelli l-opportunità nagħmel il-mistoqsijiet, u kull mistoqsija ngħatajt twegiba għaliha b' mod shih u sodisfaċenti.
2. Nifhem ukoll li jiena liberu/a li naċċetta li niehu sehem, jew li nirrifjuta, jew li nwaqqaf il-parteċipazzjoni tiegħi meta nixtieq mingħajr ma nagħti spjegazzjoni jew mingħajr ma niġi penalizzat/a. Jekk nagħzel li nipparteċipa, jaf niddeċiedi li ma nwegibx kull mistoqsija li ssirli. F'każ li nagħzel li ma nkomplix niehu sehem fl-istudju, l-informazzjoni li tkun lahqet ingabret mingħandi tithassar dment li jkun teknikament possibbli (ngħidu aħna, qabel ma tiġi ippubblikata), u sakemm l-għanijiet tar-riċerka jkunu jistgħu jintlaħqu u ma jintlaqtux serjament. F'dak il-każ, l-informazzjoni tiegħi tintuża u tinzamm anonima.
3. Nifhem li ġejt mistieden/mistiedna nipparteċipa f' *group comparison design* u l-persuna li qed tagħmel ir-riċerka se jassenjani/tassenjani b' mod random għal wiehed minn tliet gruppi: wiehed jiġġenera kliem biss bl-Ingliż, ieħor bil-Malti biss, u ieħor mingħajr restrizzjonijiet lingwistiċi, allura jintużaw iż-żewġ lingwi biex tkun tista tinvestiga l-impatt tal- bilingwiżmu fuq il-feliċità verbali fil-kuntest Malti. Jiena konxju/a li l-*group comparison design* se jiehu madwar tletin minuta. Nifhem li l-*group comparison design* se jsir/ssir f' post u f' hin li huma komdi għaliha.
4. Nifhem li l-parteċipazzjoni tiegħi ma fiha l-ebda riskju magħruf jew mistenni.
5. Jien infurmat/infurmata li d-dissertazzjoni se tkun fil-Librerija tal-Università ta' Malta u għalhekk se tkun disponnibli għall-istudenti, l-istaff u l-pubbliku.
6. Jien infurmat/infurmata li d-dissertazzjoni jista jiġi ppublikat fil-futur.
7. Nifhem li bil-parteċipazzjoni tiegħi f' dan l-istudju, m'hemm l-ebda benefiċċju dirett għaliha. Nifhem ukoll li din ir-riċerka jaf tkun ta' benefiċċju għall-oħrajn għax se tkun qed tesplora jekk is-sejbiet minn studji internazzjonali dwar il-monolingwi u l-bilingwi humiex simili jew differenti meta mqabbla mal-popolazzjoni Maltija, li taqleb bejn il-Malti u l-Ingliż b' mod normali.

8. Nifhem li mhux se nkun mitlub/a niżvela xi informazzjoni personali, li r-riżultat tiegħi se jinqered wara li jintemm l-istudju u li għandi d-dritt li nirċievi *summary* tar-riżultat tal-istudju fuq talba.
9. Nifhem li l-informazzjoni tiegħi se tiġi ttrattata kunfidenzjali u li l-identità tiegħi tibqa' anonima.
10. Jien konxju/konxja li s-superviżur tar-riċerka u l-eżaminaturi tad-dissertazzjoni għandhom id-dritt li jkollhom aċċess għad-dejta għal skopijiet ta' verifika.
11. Nifhem li, skont ir-Regolament Ġenerali dwar il-Protezzjoni tad-Data (GDPR) u l-leġislazzjoni nazzjonali, għandi dritt naċċessa, nikkoreġi u, fejn hu applikabbli, nitlob li l-informazzjoni li tikkonċernani tithassar.
12. Nifhem li l-informazzjoni kollha miġbura se tithassar meta joħorġu r-riżultati f'Lulju 2025.
13. Inghatajt kopja tal-ittra ta' tagħrif biex inżommha u nifhem li se ninghata wkoll kopja ta' din il-formola tal-kunsens.

Qrajt u fhimt l-istqarrijiet t'hawn fuq, u naqbel li nipparteċipa f'dan l-istudju.

Isem il-partecipant/a: _____

Firma: _____

Data: _____

Jekk jogħġbok immarka l-kaxxa jekk tixtieq kopja taz-teżi meta titlesta permezz ta' imejl u iprovdi l-indirizz elettroniku tiegħek hawn taht:

☐

Ms Aurora Micallef
aurora.micallef.19@um.edu.mt

Dr Kristina Bettenezana (Vella)
kristina.vella@um.edu.mt

Dr Fiona Ambery
fiona.amberry@gmail.com