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BRIDGING THE GAP BETWEEN WORKING MEMORY CAPACITY AND ANAPHORA RESOLUTION: THE PROCESSING OF SUBJECT AND OBJECT PRONOUNS IN L2 BY LOW PROFICIENCY LEARNERS

Florianópolis

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Dissertação submetida ao Programa de Pós-Graduação em Inglês: Estudos Linguísticos e Literários da Universidade Federal de Santa Catarina para a obtenção do grau de Mestre em Inglês: Estudos Linguísticos e Literários. Orientadora: Profa. Dra. Mailce Borges Mota. Coordenador: Dr. Celso Henrique Soufen Tumolo.

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O presente trabalho em nível de mestrado foi avaliado e aprovado por banca examinadora composta pelos seguintes membros:

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Florianópolis, 2021.

To my daughter, Anastácia, who brings light into my life every single day and who makes me feel alive and purposeful.

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Reaching the end of a desirable stage in our lives is always a pleasant achievement. My MA was especially remarkable for two reasons: I was pregnant with my beloved daughter and the study was carried out in the COVID-19 pandemic scenario. Despite the unexpected, I completed my MA studies with great satisfaction and believe that I have become a better person. Throughout this journey, many people contributed to my educational growth and, without them, this achievement would not have been possible.

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Quando o homem compreende a sua realidade, pode levantar hipóteses sobre o desafio dessa realidade, e procurar soluções. Assim pode transformá-la e com seu trabalho pode criar um mundo próprio: seu eu e suas circunstâncias.

FREIRE, 1979

ABSTRACT

Working memory is an important factor in the processing of anaphors. To interpret anaphors, comprehenders need to allocate attention to solve the task of recovering the antecedent of the anaphoric pronoun. The objective of the present study is to investigate the relationship between working memory capacity and anaphora resolution. Eight learners of English as a second language, attending the first year of high school, participated in the study. All participants were native speakers of Brazilian Portuguese. Participants performed an L2 vocabulary test, aimed at assessing participants' vocabulary proficiency, a working memory test in the L1, aimed at assessing their working memory capacity, and an L2 anaphoric resolution task, aimed at assessing participants' processing of subject and object pronouns in sentences. They also answered a biographical and a language experience questionnaire. The results of Spearman's Rank Order Correlations show that there is a positive correlation between WMC and L2 anaphora resolution and between WMC and L2 proficiency. However, the results show that there is no statistically significant correlation between anaphora resolution and L2 proficiency and, no statistically significant correlation between WMC and subject pronoun anaphora resolution only, nor between WMC and object pronoun anaphora resolution only. Together, these results are taken as evidence that participants with a higher working memory capacity are also more prone to interpreting subject and object pronouns in L2 sentences correctly.

Keywords: Working memory capacity. Anaphora resolution. Second language acquisition.

RESUMO

A memória de trabalho é um fator importante no processamento de anáforas. Para interpretar as anáforas, os indivíduos precisam alocar a atenção para resolver a tarefa de recuperar o antecedente do pronome anafórico. O objetivo do presente estudo é investigar a relação entre capacidade de memória de trabalho e resolução de anáfora. Participaram do estudo oito alunos, aprendendo Inglês como segunda língua, do primeiro ano do ensino médio de duas escolas públicas brasileiras. Todos os participantes eram falantes nativos do português brasileiro. Os participantes realizaram um teste de vocabulário em L2, que avaliou a proficiência em vocabulário, um teste de memória de trabalho em L1, com o objetivo de avaliar a capacidade de memória de trabalho e uma tarefa de resolução anafórica em L2, destinada a avaliar o processamento dos participantes em relação aos pronomes sujeito e objeto em contextos sentenciais. Eles também responderam a um questionário biográfico e de experiência linguística. Os resultados da Correlação por Postos de Spearman mostram que há uma correlação positiva entre a capacidade de memória de trabalho e a resolução anafórica em L2 e entre a capacidade de memória de trabalho e a proficiência de vocabulário em L2. No entanto, os resultados mostram que não há correlação estatisticamente significativa entre a resolução anafórica e a proficiência de vocabulário em L2, bem como nenhuma relação estatisticamente significativa foi encontrada entre a capacidade de memória de trabalho e a resolução anafórica apenas do pronome sujeito, nem entre a capacidade de memória de trabalho e a resolução anafórica apenas do pronome objeto. Juntos, esses resultados são considerados evidências de que participantes com maior capacidade de memória operacional também são mais propensos a interpretar os pronomes sujeito e objeto em sentenças em L2 corretamente.

Palavras-chave: Capacidade de memória de trabalho. Resolução anafórica. Aquisição de segunda língua.

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LIST OF ABREVIATION

ART – Anaphoric Resolution Task

BNC – British National Corpus

CE – Central executive

CEPSH-UFSC – Comitê de Ética em Pesquisa com Seres Humanos

ESL – English as second language

LTM – Long term memory

L1 – First language

L2 – Second language

PRI – Perceptual Reasoning Index

PSI – Processing Speed Index

SLA – Second language acquisition

SNL – Sequence of Numbers and Letters

TALE – Termo de Assentimento Livre e Esclarecido

TCLE – Termo de Consentimento Livre e Esclarecido

VCI – Verbal Comprehension Index

VLT – Vocabulary Levels Test

WISC – Wechsler Intelligent Scale for Children

WM – Working memory

WMC – Working memory capacity

WMI – Working Memory Index

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CHAPTER I

INTRODUCTION

1.1 CONTEXT OF INVESTIGATION AND OBJECTIVE OF THE STUDY

Speakers must maintain active what they have just read or heard, few seconds earlier, in order to interpret sentences. This is the case when identifying the proper referent of an anaphor. Depending on the type of communicative situation and its subject matter, this demand is more or less compelling, although still decisive. In order to retrieve and integrate information to accomplish the [1]comprehension task that is being performed, the speaker falls back on the cognitive system termed working memory (COWAN, 2016, p. 2; KARIMI, SWAAB, FERREIRA, 2018, p. 69) which is responsible for storing and processing[2] information simultaneously (COWAN, 2016).

Mota (2015) explains that WM is conceptualized as a cognitive system. This system was first seen as a short-term memory, crucial for the transfer of information to long-term memory (ATKINSON; SHIFFRIN, 1968). Then, Baddeley and Hitch (1974) showed that both short-term and long-term memory can work independently. Mota (2015) states that the multicomponent model proposed by Baddeley and Hitch (1974) is relevant because this model started the development of a line of research on human memory that is very important for understanding the processing of language (p. 210). In Europe, studies on this matter have focused more on the architecture and function of WM, while in the United States, the central executive has received more attention (WEN, 2015, p. 45). Mota (2015, p. 211) claims that there are different models of WM and future studies are promising. Moreover, Mota argues that the relationship between WM and language has been investigated in different areas, such as reading comprehension, listening comprehension, speaking production, writing production,

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[1] According to Steen and Stine-Morrow at the Encyclopedia of Geropsychology (2016) "the comprehension of language in the domains of both written and spoken communication requires the decoding of print or acoustic features of speech to create mental representations of meaning, events, and situations. In spite of the apparent ease with which it accomplished, language comprehension is a complex process requiring the synchronization of a variety of cognitive components (e.g., recognizing letters and words, accessing and integrating word meanings to represent ideas, and using existing knowledge to develop a representation of implied situations). As such, language comprehension is interwoven with core cognitive mechanisms, which show multidirectional patterns of change as a function of both primary aging processes and experience."

[2] Regarding referential processing it "necessarily involves encoding a referential candidate in memory and then reactivating and retrieving that representation when a pronoun (or any other referring expression) is encountered. (FOSSARD, 2006, p. 68)

syntactic processing, lexical processing, reading learning, vocabulary learning, grammar learning and translation, and interpretation.

As described by Miller, Galanter and Pribram (1960), WM can be described as a system for "quick-access" (p. 65) to information, which is used to make plans of actions one decides to accomplish, or as a "place" (p. 65) where one can keep plans in mind while simultaneously implementing them. Cowan (2015, p. 30) states that these plans also refer to language. WM is an important factor in language processing, since linguistic processing requires the capacity to plan ahead at different levels of the comprehension or production processes.

The resolution of anaphora is an important aspect of language comprehension because if the speaker is not able to resolve anaphora, comprehension will be jeopardized. That is, the understanding of the text will not be accurate and there will be a misunderstanding of the meaning the text intends to address (PRETORIUS, 2005, p. 552). Besides, in order to process anaphora, the speaker needs to employ resources from WM, since anaphora resolution requires the maintenance of information online at the same time as anaphora is being processed (KARIMI, SWAAB, FERREIRA, 2018, p. 69). That is, "referential processing necessarily involves reactivating and retrieving the memory representations associated with the referential candidates from memory when a referring expression is encountered" (KARIMI, SWAAB, FERREIRA, 2018, p. 69). According to the Sil[3] Glossary of Linguistic Terms, anaphora is defined as being the "coreference of one expression with its antecedent. The antecedent provides the information necessary for the expression's interpretation" and "this is often understood as an expression 'referring' back to the antecedent" (CRYSTAL, 1980, p. 25–26; LYONS, 1977, p. 659; PEI; GAYNOR, 1954, p. 13; HARTMANN; STORK, 1972, p. 13; MISH, 1991, p. 83). In other words, anaphora is any linguistic expression capable of referring to its antecedent in a given sentence.

Lyons (1977, p. 648) sees two ways in which it is possible to recognize the antecedent through an anaphoric expression: first – by telling where the antecedent is, for example, by locating it for the pronoun *him*; second – by explaining it, that is, by describing it using the pronoun *him*. Crystal (2008) describes anaphora as the interpretation of the referent or expression referring to its antecedent. In other words, first we would have an object being expressed within a sentence and then another linguistic term, or unit that would refer to this object, using not the name of the object itself, but another expression, which is in turn characterized as the anaphoric expression. As an example, the author offers the sentence: "*He*

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[3] Summer Institute of Linguistics. Available at https://glossary.sil.org/. Accessed on 10/11/2020.

did that there," arguing that each element of this sentence has been mentioned previously in a given situation, and that is the reason why these items correspond to an anaphoric word. Crystal (2008, p. 26) explains that "the previous sentence might have been *John painted this picture in Bermuda,* for instance, and each word in the response would be anaphorically related to a corresponding unit in the preceding context".

Concerning how the referent is realized, Gordon, Grosz and Gilliom (1993) conducted a study based on The Centering Theory, which claims that coherence within a sentence, or between sentences, is critical in leading us to the antecedent of an anaphoric expression through linguistic/semantic elements. Coherent elements are considered anaphoric centers in this theory, with (1) forward-looking and (2) backward-looking centers. The first is attached to the next sentence in a discourse, whereas the second is bound to the preceding statement and therefore referential to the forward-looking center of the same discourse. Gordon et al. (1993) showed that, by using a self-paced reading instrument, it was less time-consuming for a reader to process pronouns rather than nouns when referring to an antecedent. The author coined the term "Repeated-Name Penalty" to describe the use of repeated names instead of pronouns, which means that reading sentences with repeated names takes longer (decreases reading time) than reading sentences with pronouns in an anaphoric position.

Parker (2019, p. 2), while investigating cue combinations in memory retrieval for anaphora, emphasizes the relevant function of WM in language operation when the situation is associated with an inaccessible referent, whose demand on the speaker to interpret the more distant referent will be higher. In other words, in contexts where there is a long distance between a referent and its anaphor, the speaker has to deal with concurrent information within WM to process anaphoric resolution. According to Carminati (2002, p. 9), the accessibility of a discourse referent proceeds with the following reasoning: "recent mentions should therefore be more accessible than remote mentions".

Along the same lines, Joseph et al., (2015, p. 626) examined the effects of distance and typicality on anaphoric resolution in children and argued in favor of the influence of WM in the comprehension process. The authors state that as the intellectual depiction of the communicative situation is being represented within the mind, the speaker has to maintain information, or "potential referents", effectively in real time, while dealing with new arrivals of information. This process enables a twofold result: a consistent comprehension of the text, and because the resources are limited, a great allocation of challenge on WM. Likewise, Seigneuric and Megherbi (2008, p. 282) analyzed how children's WMC intervenes in the

comprehension of a pronoun and its antecedent, showing that low-span children had more difficulty in finding a pronoun's referent. In sum, these authors provide evidence for WMC as a potential influencing factor in anaphora resolution. Thus, taking a closer look at the relationship between WMC and anaphora will increase our understanding of how this cognitive system contributes to or hinders the processing of anaphora resolution during language comprehension.

WM and the related concept of WM capacity are two topics that have been consistently investigated over the last decades. As a result, it is possible to find various models, theories, and hypotheses about the structure and function of this cognitive system (MOTA, 2015). Cowan (2017, p. 153) has reviewed the three major types of WM models, such as Atkinson and Shiffrin's (1968) modal model, a basic model which includes sensory memory, short-term storage and long-term memory; Baddeley and Hitch's (1974, 1986, 2000) multicomponent WM model, which proposes that this system consists of a phonological loop, a visuospatial sketch-pad, a central executive and an episodic buffer; and Cowan's (1988) Embedded Process Model of WM, which proposes the central executive processes with a focus of attention. Cowan (2017, p. 153), although acknowledging that WM can be composed of different structures, sees it in a more holistic way, considering its parts as working together, in an overlapping process, since the interference between modules may compel them to work jointly. That is the reason why Cowan calls his model the Embedded-Processing model.

In his discussion of theories of WM, Adams (2018, p. 345-346) points out different scopes of WM, such as modularity, attention, and purpose. The author claims that the most known theories are more or less modular, have a lower or higher focus of attention, and some are grounded in particular processes, while others are based on general principles. All in all, within these theories, there is a consensus that WM is considered limited and WMC is deemed to be the ability one has to carry out cognitive activities.

The primary function of WM is to store and process information concurrently (GARCIA-MADRUGA et al., 2007, p. 374). Nowbakht (2019), in an investigation into the relationship between WM, language proficiency, age, and anaphora resolution, suggests that WM features are closely related to what happens when an individual carries out anaphora resolution processes. Nowbakht (2019) explains that, to interpret anaphora, individuals need to keep previous information on-line in order to find the possible referent and then match it with its anaphoric expression.

Based on the discussion above, the present research aims at exploring further the relationship between working memory capacity and anaphora resolution in a population of Brazilian Portuguese native speakers who are learning English as a second language as part of the school curriculum. Based on my own experiences as a teacher, students struggle to comprehend L2 anaphora, putting great effort in solving L2 anaphora and this leads them to make linguistic mistakes, which, in turn, may contributes to their misunderstanding of the meaning of the text. In my experience as a teacher, I have noticed that anaphoric resolution in English as L2 poses obstacles for learners, especially to those at low levels of proficiency, and is a source of difficulty in L2 processing and learning. It is based on my professional experience in the classroom and on the willingness to help students deal with L2 anaphora that I set out to better understand the cognitive demands involved in anaphoric resolution, taking WM as the point of departure.

In the present study, working memory is defined as the cognitive system responsible for the storage and manipulation of information necessary for the performance of complex cognitive tasks (BADDELEY, 1992, p. 281). Working memory capacity, in turn, is defined here as the ability to store and process information simultaneously, during the performance of complex cognitive tasks. (DANEMAN, 1991). Anaphora is defined as any linguistic expression capable of referring to its antecedent in a given sentence (CRYSTAL, 1980, p. 25–26; LYONS, 1977, p. 659; PEI; GAYNOR, 1954, p. 13; HARTMANN; STORK, 1972, p. 13; MISH, 1991, p. 83), while anaphoric resolution is defined as the ability to determine the antecedent of an anaphoric expression (CRYSTAL, 1980, p. 25).

The main objective of this study is to investigate the relationship between working memory capacity and the processing of anaphoric resolution in L2 English by Brazilian Portuguese speakers who are learning English as a second language as part of the school curriculum.

1.2 SIGNIFICANCE OF THE RESEARCH

The present research focuses on WM as a crucial variable to understand how L2 learners process complex linguistic operations such as anaphoric resolution. According to Nowbakht (2019, p. 359) there are, so far, only few studies investigating how WMC can account for comprehension and processing of anaphoric sentences in L2. By uncovering the relationship underneath WMC and anaphora, the present study will contribute to the understanding of how

L2 learners process anaphora. Also, in terms of pedagogy, the present study will contribute to the teaching and learning of English as L2 by bringing awareness of the complex task one carries out while engaging in learning a second language.

According to Gathercole and Alloway (2008, p. 33) after many years of studies regarding WMC, it can be said that by measuring one's WMC teachers can foresee how learners may develop in school. The authors explain that learners with higher WMC perform better not only in reading skills, but also in other school/academic subjects throughout their lifetime. On the other hand, learners with poor WMC tend to show lower performance in the above subject matters.

Different reasons are given for learners poor achievements concerning the learning of L2 in school, and WMC could be one of them. As stated by Mota (2000, p. 22), in the psychometric correlational approach (which is going to be adopted in the present research), WMC is related to individual differences. The author states that the larger the WMC, the better the performance on complex cognitive tasks. Mota (2000) also offers a compilation of studies showing that "those with a larger working memory span are more efficient at comprehending language. Specifically, those with a larger working memory span are more efficient at selecting linguistic cues that aid in the comprehension of L2 complex sentences" (p. 37). WMC might play a relevant role in bringing to light accounts that may answer why L2 learners are not being successful at a higher level. In addition, since most studies on WMC and L2 learning are carried out with adults in university contexts, the present study will contribute with novel data to research on WM and L2 anaphoric resolution, since the participants are teenagers attending public schools. The study, thus, may provide a broader understanding of not only L2 anaphoric processing but also of the L2 learning process in diverse contexts.

1.3 ORGANIZATION OF THE THESIS

This thesis is organized into 5 chapters. Chapter 1 presented the introduction in which I contextualized the present investigation and gave reasons for the significance of the present study as well as provided the organization of this thesis.

Chapter 2 is divided into seven sections and presents a review of the literature in which I describe the concepts of working memory, the executive control function of working memory, anaphora and anaphora resolution, pronouns, and bilingualism. In this chapter, I also explain

the vocabulary level test as a tool for assessing proficiency and provide empirical evidence on the relationship between working memory capacity and anaphora resolution.

Chapter 3 is divided into eleven sections and presents the method used for carrying out the present investigation. In this chapter I explain my objectives, research questions and hypotheses, as well as describe the participants and present participants' information from the biographic and linguistic background questionnaire. The instruments for data collection are also outlined, first describing the biographic and linguistic background questionnaire, then the vocabulary level test, the number and letter sequence working memory test, and finally the anaphoric resolution task. Next, I explain the data collection procedure, the pilot study and the data analysis procedure.

Chapter 4 is divided into seven sections and presents the results and discussion of the present study, where I provide the descriptive analysis of the vocabulary levels test outcome, the sequence of numbers and letters working memory test outcome, and the anaphoric resolution task outcome. I also describe the inferential analysis and present the discussion, readdressing the research questions and hypotheses.

Finally, chapter 5 is divided into three sections and presents the final remarks and conclusion. Then I mention the limitations of the present study and will contribute with suggestions for further research. I finish the study providing the pedagogical implications.

CHAPTER II
REVIEW OF THE LITERATURE

This chapter presents the theoretical and empirical support for the current study. The chapter presents principles and definitions immediately relevant to the study, as well as empirical evidence on the relationship between working memory capacity and anaphoric resolution. It is divided into seven sections. Section 2.1 presents the concept of working memory and its major models. Section 2.2 provides an overview of the central executive function of working memory. Section 2.3 is dedicated to explaining anaphora and anaphoric resolution. Section 2.4 describes the concept of pronouns and how they are understood in the present study. Section 2.5 discusses bilingualism. Section 2.6 describes how the vocabulary levels test is used as a tool for assessing proficiency. Finally, section 2.7 reviews empirical literature on working memory capacity and anaphora resolution.

2.1 WORKING MEMORY

WM is that part of our cognitive system where information is temporarily stored and where manipulation of information takes place (BADDELEY, 1992; LINCK et al., 2014, p. 862). WM allows the accomplishment of complex cognitive tasks such as reasoning and learning (BADDELEY, 2007, p. 1). As stated by Eriksson et al. (2016, p. 33), WM accounts for the region where information is kept for a short amount of time. In addition, and considering its characteristics, through WM we are able to break the boundaries of "here" and "now" while trying to achieve a goal (ERIKSSON et al., 2016, p. 33).

In the field of cognitive psychology, different perspectives have emerged with regard to the structure and function of WM, how the different components within the system are coordinated, and how these components interact with each other.

Caplan and Waters (1999) show that verbal memory (or verbally mediated tasks) interferes in activities where the reader has to recall previous linguistic expressions, which are involved with post-interpretative tasks. These authors claim that poor WMC, that is, the ability to effectively retain and process a maximum quantity of information at a time (COWAN, 2016, p. 2; DANEMAN, 1991), bears on the process of keeping information active while also processing it in cognitive tasks. They also explain that when the task is connected with post-interpretative procedures, and subjects have to maintain information online, the

accomplishment of such task is more demanding to our working memory (CAPLAN; WATERS, 1999, p. 100).

Baddeley (2012, p. 4) provides crucial insights into the functions of the working memory system. For him, WM is a "combination of storage and manipulation". Baddeley (2012, p. 4-7) proposed a multi-component WM model which includes four subsystems. The first subsystem is the Phonological Loop – accountable for vocal or subvocal rehearsal as well as action control. The Visuo-Spatial Sketchpad is the second subsystem, which is in charge of visual and spatial information. The third subsystem is the Central Executive, responsible for attentional control. Finally, the fourth subsystem is the Episodic Buffer, accountable for binding short-term memory to long-term memory. Figure 1 depicts the Multicomponent Model as presented in Baddeley (2003):

Figure 1
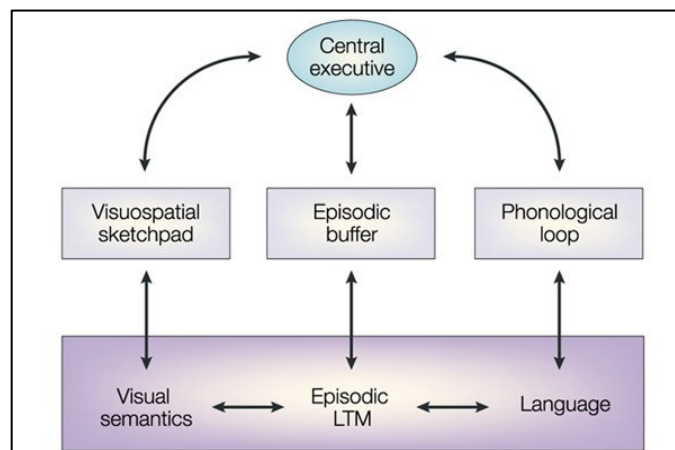
Source: Baddeley (2003)

Within psycholinguistics, the phonological loop, a component of Baddeley's working memory model, has been referred to as the most important component concerning language learning and processing (BADDELEY, 2003, p. 832). Although I do not disregard the relevance of the phonological loop, the present study will focus to a greater extent on another function of WM, that is, the executive and control function, which considers WM functioning in an integrated processing design (COWAN, 2017, p. 153).

2.1.1 Executive Control Function of working memory

In highlighting the possible processes underneath the central executive (CE), Baddeley (2007) claims that in order for the CE to have an important role, and considering what the author has postulated so far about this component, it should function or perform alongside modality, being responsible for engaging in an assortment of tasks. Along with that, Baddeley described which would be the "four candidate processes" in which the CE would hold as capacities to (1) focus attention, (2) divide attention between two concurrent tasks, (3) switch attention from one task to another, and (4) integrate WM and long term memory (LTM) (BADDELEY, 2007, p. 122-124).

According to García-Madruga et al. (2016, p. 3-4), there are four major functions concerning the Executive Function of WM, which are associated with the implementation of a task in real time and with supervision, or monitoring. The first function is related to focus and maintenance of attention, which in turn bypasses distraction; the second, is the shift of attention, which enables for moving flexibly between one piece of information to another; the third, to triggering and updating ideas while monitoring this process; and the fourth, to discarding pointless information and constraining unconscious processes, by choosing some information over another as well as preventing new information to approach.

In an effort to gain a better understanding of language processing, a group of North American cognitive psychologists, such as Meredith Daneman, Patricia Carpenter, Nelson Cowan, Randall Engel, Andrew Conway, Michael Kane, David Kaplan, Gloria Waters, Akira Miyake and Ellen Bialystok have been particularly interested in the executive part of WM, a component which seems to mediate language comprehension (WEN, 2015, p. 45).

According to Wen (2015, p. 47) researchers like Cowan (2013), Gibson (1998), Hartsuiker & Barkhuysen (2006), Miyake and Friedman (1998), among others, have investigated the importance of the executive control function of WM. These researchers advocate that, in terms of language comprehension and production, the executive function of WM seems to be related to a more complex process regarding "post-interpretative" (p. 47) tasks, such as anaphoric and ambiguous resolution.

2.1.2 Anaphora and anaphora resolution

As claimed by Schuster (1988, p. 602), anaphora is conceptualized within the realm of "context-dependent" reference. That is, when we engage in particular forms of communication, like reading or writing, we consider the preceding information in order to relate it to given situations within a sentence. We use certain words to refer or point to those things

acknowledged. The author distinguishes anaphora from anaphor, explaining that the last one is the word used to refer to an antecedent. According to Schuster (1988, p. 602), anaphora is understood as a reference to objects that exist in specific situations and that the discourse may become blurred and lead to misunderstandings if we do not make use of anaphors. In this sense, we gain from the use of anaphoric expressions, since they provide the text with consistency and accuracy while also making the discourse less difficult, lengthy, and slow-moving (p. 602). Bringing the subject to the English language and considering many linguistic situations in which it can occur, Nowbakht (2019, p. 354) states that anaphora can be perceived in expressions where "pronouns, demonstratives, ellipsis, substitution, and lexical anaphors such as proper nouns, definite nouns, and noun phrases" are included. An example of an anaphoric pronoun is "*Fred asked Joe to pass **him** the potatoes*" (NOWBAKHT, 2019, p. 360), where the pronoun *him* is an anaphoric expression referring back to the antecedent *Fred*.

Particularly with respect to anaphora resolution, according to García-Madruga et al., (2007, p. 375), this has much to do with the ability to cope with unnecessary information in a given context, that is, the capacity to discard information which is not helpful in determining the antecedent of an anaphoric expression. García-Madruga et al., (2007) states that the capacity to discard unnecessary information seems to be one of the duties of the central executive, allowing for the control of attention and attention-drive scheme, which allows one to focus primarily on the task-relevant information, apart from its immediate connection to long-term memory (GARCÍA-MADRUGA et al., 2007, p. 375).

The complexity of resolving particular anaphoric expressions, or finding faster and more accurately the referent in order to strike meaning, resides in the fact that anaphoric resolution could be embedded into implicit and explicit spaces. Thus when explicitly mentioned the referent is easier to be pointed to. However, implicit referents can only be found under context guidance (NOWBAKHT, 2019, p. 354). This could be a challenge to L2 learner because they need to deal with the second language linguistic context, which is not as accessible (i.e. familiar and frequent) as it is in the learner's first language frame reference. Nowbakht (2019) (**i**) (**ii**) provides a better illustration of this issue by distinguishing between sentences that have an explicit reference and those that contain an implicit referent (NOWBAKHT, 2019, p. 355):

(**i**) John bought himself a bicycle.

(**ii**) Hercules rode at a furious pace toward Thebes. *The horse* was exhausted on arrival.

As explained by the author, in the first sentence there is an explicit referent, *John*. In sentence **i**, *John* is the person who performed the action of bringing the bicycle. In sentence **ii**, the referent for *The horse* can only be determined by exploring the context, and looking for cohesiveness within the sentence. In **ii** we do not have an explicit referent but we can find it by identify linking items within the sentence.

According to Keating, Jegerski and Vanpatten (2016), the subject of anaphora resolution has been consistently investigated. Apart from the keen enthusiasm concerning this subject, anaphora resolution has also been, as mentioned by Keating, Jegerski and Vanpatten (2016), "a fertile testing ground for examining cross-linguistic influence during language development" (p. 38, 39) within language comprehension. Keating, Jegerski and Vanpatten (2016, p. 36) examined online processing of subject pronouns in monolingual and heritage bilingual speakers of Mexican Spanish using the position of antecedent strategy. The results suggest that when associating an antecedent with a null subject, there may be influence from different contexts, but when this is applied to the interpretation of an overt pronoun, the chance of this context variation is higher in terms of amount and type of exposure to the target language (KEATING; JEGERSKI; VANPATTEN, 2016, p. 45-48). The findings also show that monolinguals and bilinguals have little in common when it comes to pronominal interpretation during online sentence processing, implying no cross-linguistic influence on pronominal resolution.

Sorace and Filiaci (2006, p. 339) investigated how anaphora was interpreted by a group of near-native and native Italian speakers. Subjects were presented with main and subordinate clauses consisting of either an overt or a null subject pronoun. The two groups had similar results regarding the null subject pronoun, but when it came to the overt subject pronoun, the non-native Italians had a preference for the main clause subject as a possible referent. The results also demonstrate that non-native Italian speakers have a consistent understanding of the syntactic rules of pronominal subjects in the Italian language.

Serratrice (2007, p. 225) conducted a study on intra-sentential [4]anaphora and cataphora in English–Italian bilingual children, Italian monolingual children and Italian monolingual adults. Serratrice's (2007) findings show that there was no significant difference between the three groups when they had to decide an antecedent for a null anaphoric pronoun. That is,

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[4] Anaphora is "where a pronoun follows one or more potential antecedents", and cataphora is "where a pronoun precedes its antecedent. Both anaphora and cataphora require the establishment of an unambiguous relationship between a pronoun and its antecedent" (SERRATRICE, 2007, p. 227, 228)

monolinguals and bilinguals made comparable decisions. English-Italian bilinguals, on the other hand, assumed the coreference with the antecedent more often in relation to the overt subject pronoun. According to Serratrice (2007), her findings provide evidence of a "cross-linguistic influence at the level of processing" (p. 235).

In the case of solving a pronominal anaphor, Frederiksen (1982, p. 12) proposes that speakers use rules to assign pronominal referents. Frederiksen (1982, p. 1-2) sought to investigate the degree of difficulty in interpreting some textual cohesiveness components in a specific textual structure of anaphoric reference, namely pronominal anaphoric reference. Participants were required to decide which of many antecedents referred to the pronoun that appeared in the sentences while reading a text, as shown below:

(**iii**) **The judge** passes up the letter to the defendant's **lawyer**, who studies it.

(**iv**) **He** is finally ready, it now becomes clear, to address the court and pass sentence upon William Crawford.

(**v**) **He** says: "William Crawford, you have made a proper mess of your life, and I have no choice except to send you to prison.

His findings (FREDERIKSEN, 1982, p. 1-2) revealed that when presented with a pronoun in a sentence (**iv** and **v**), we consider some priority rules, such as gender or number, which are used to determine the correct referent, and that the potential referents that occur before the pronoun (**iii** – The judge/Lawyer) in a sentence are activated in working memory.

Gernsbacher (1989) suggests two mechanisms that would improve referential access: suppression and enhancement. It is believed that by using these mechanisms it is possible to investigate whether an anaphoric reference consisted of an overt or a tacit pronoun.

Arnold et al. (2000, p. 13) investigated pronoun interpretation by monitoring participants' eye movements to discover how accessibility and gender information can interfere with this process. While listening to the descriptions of pictures containing two characters already viewed by the participants, they had to identify whether the given pronoun referred to the more accessible character or not, as shown below.

(**vi**) Donald is bringing some mail to {Mickey/Minnie}
while a violent storm is beginning.
He's/She's carrying an umbrella,
and it looks like they're both going to need it.

Arnold et al. (2000, p. 25) findings showed that a wide range of information is used in assisting referential processing, but that both gender and accessibility are probable elements employed in aiding pronominal resolution shortly after participants are faced with a pronoun.

The findings of the aforementioned studies show that by investigating referential access using different cognitive mechanisms we can better understand how linguistic systems work. It seems that several sources of information are necessary in order to lead us to the pronominal resolution. Therefore, we can find many cues in diverse discourse conditions. There is an uninterrupted flow of information being presented to us, while others are being omitted and this is how the referent is chosen, by prioritizing some rules.

The present study will contribute to the research on L2 anaphora resolution by investigating the relationship between anaphora resolution and WM when it involves subject and object pronouns in L2.

2.1.3   Pronouns

As for the linguistic object of this study, I have chosen the category of pronouns, more specifically, the subject and object pronouns, given that they are frequent items in the materials that the participants of the present study have access to in English classes at school. In the present study, the subject and object pronouns are considered anaphoric expressions referring to an antecedent in the sentence. Their linguistic nature is also important since the sentences in the anaphoric processing test (see Chapter 3, section 3.3.4) will take into account the characteristics of these pronouns.

In trying to characterize pronouns, Bhat (2004) states that it is difficult to accept the general definition of pronouns as words that *stand for nouns* and emphasizes that pronouns do not always refer to *nouns* but also to *noun phrases*. Although this traditional definition is the most commonly accepted, Bhat (2004, p. 1) claims it is still difficult to define pronouns in this way because there is no consensus among grammarians and because many questions are left unanswered about the inconsistencies of the traditional definition of pronouns as words that stand for nouns and noun phrases. Besides, Bhat (2004) claims that first and second personal pronouns (I - You) are quite different from the rest of the other pronouns, such as demonstratives, interrogatives, indefinites, relatives, correlatives, etc. The former have the primary function of indicating "the speech roles of "being the speaker and being the addressee,

respectively", while the latter are employed in a broader sense since they are tasked with performing different functions (BHAT, 2004, p. 2-6).

Bhat (2004) argues that placing the lexical class of what is currently called pronouns in a single category is not the best way to comprehend this group of vocabulary, as there are many differences between them that need to be highlighted in order to understand their functions more clearly. This is the reason why Bhat separates the so-called pronouns into two groups: (1) the pronouns (meaning first and second personal pronouns, i.e. I - You) and (2) the proforms (meaning the personal other pronouns, such as he, she, it, and also demonstratives, interrogatives, indefinites, relatives, correlatives). Bhat (2004) made this separation to distinguish the different functions that exist between these two groups. The former (1) is related with speech roles and the latter (2) seem to have the function of performing distinctive roles such as "identifying the participants of an event by locating them with reference to the spatio-temporal location of the speech act participants" and "referring back (or forward) to other expressions that occur in the utterance or in previous utterances" (p. 7). Proforms provide information that can be associated, or linked, with their referent, unlike pronouns (I – You), which must be dissociated from characteristics like gender or number in order to function as shifters (BHAT, 2004, p. 9). Although there is this distinction, it is not the case of having two very different groups but rather, according to Bhat (2004), a "gradation" (p. 13) or a modification of characteristics from first and second personal pronouns to the proforms. Figure 2 presents an overview of the characteristics of these two groups, according to Bath (2004), first providing the conventional definition of all pronouns into one category, then splitting them into two categories, where it is explained that the first and second (I – You) personal pronouns have no identifiable referents. Next, it shows that the distinction between the two groups is not as limited as it seems, because both groups might share comparable features at times, which is why there is a gradation of characteristics from one group to the other. Finally, it typifies the proforms as having the potential to be linked with referent information, demonstrating their relevance for the present study.

Figure 2 – Summary of pronouns characteristics according to Bhat (2004).

Traditional definition of pronouns	Standing for nouns	Standing for noun phrases
Two groups	Personal pronouns (1st and 2nd)	Profoms
Personal pronouns	No reference to identity	Primary function is being shifters
Gradation	Modifying characteristics	
Profoms	Associate referents information in order to locate them	
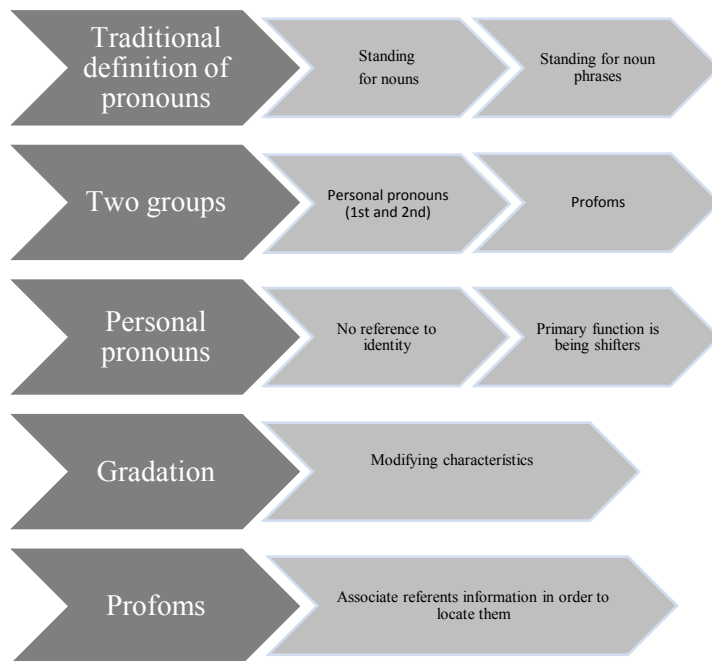
Source: the author (2020)

What is substantial here is that, in order to provide a consistent definition of a lexical group it is essential to describe or distinguish the functions that different pronouns perform. Otherwise, there will not be an adequate interpretation of them. In the present research, we will follow Bhat's (2004) proposal and will use Proforms, which are associated with referent information, as stimuli of the anaphoric resolution task

2.1.4 Bilingualism

In the present study, we adopt Grosjean's (2007) view of bilingualism. According to Grosjean (2007), bilingualism is characterized "as the alternate use of two or more languages by the same individual" (p. 22). For Grosjean (2007), language is, in general terms, "a systematic combination of smaller units - phonemes, lexical items and sentences into larger units to create meaning" (p. 6). Language is considered by Grosjean (2007) as being essentially social because of the peculiarities of people who speak it at a particular time and place. As people live in different ways in different places, as well as having different characteristics such as gender and age, the manifestations of the language they speak also vary (p.7). Having this in mind, Grosjean (2007) claims that bilingualism is a relative concept, which implicates different aspects of language. That is, a speaker may choose to use one of their languages when it is convenient or necessary for them. Grosjean (2007) states that it is important to consider that in

order to define bilinguals it is paramount to contemplate the psychological, linguistic, and social aspects of the languages being used and its interrelationships. Also, that a person varies the use of one of the languages in its degree, function, alternation and interference, and that "It is in terms of these four inherent characteristics that bilingualism may be" (p. 23). In other words, being bilingual means using a language in various degrees at the time that suits the user. We conclude from this that bilinguals alternate between using their languages depending on the settings in which they find themselves, or when the situation requires them to use one or the other language. As the purpose of language is to create meanings and as language is essentially social, as stated by Grosjean (2007), bilinguals' decision to use one or another language will be based on their need to better express themselves in the world, in the language that for them best represents what they want to express.

2.1.5 Vocabulary Levels Test as a tool for assessing proficiency

In the present study, participants' proficiency in English will be assessed by means of the Vocabulary Levels Test (VLT) (WEBB, S.; SASAO, Y.; BALANCE, O., 2017). The control for proficiency aims to select participants competent enough to read the sentences presented in the anaphoric resolution task. As pointed out by Souza and Soares-Silva (2015), the VLT allows for the assessment of L2 learner's lexical and grammatical knowledge (p. 187), thus being a useful and practical tool to control for proficiency for the purposes of the present study.

The VLT is intended to measure the amount of words an English learner is acquainted with when carrying out tasks such as reading (KREMMEL, SCHMITT, 2018). As argued by Kremmel and Schmitt (2018), the VLT "is a tool to measure the written receptive vocabulary knowledge, that is mainly the word knowledge required for reading" (p. 1). This means that the objective of the test is to find out what the participant can understand while being presented with a set of word families, not what she/he can produce with it. These authors also say that this test is designed to prevent the participants from guessing the meaning of the words (p. 3). That is, according to Kremmel and Schimitt (2018), in the VLT, the participants have to give their best answer intuitively. This is relevant because reducing the possibility of guessing would bring more reliability to the test (KREMMEL; SCHIMITT, 2018). Another important aspect of the VLT is that it can provide L2 learner's knowledge profile. In a study carried out to investigate the measurement of vocabulary size to differentiate Brazilian Portuguese-English bilinguals' access to grammatical knowledge in the L2, Souza and Soares-Silva (2015) found

that by measuring participant's vocabulary size it is possible to access L2 learner's lexical and grammatical knowledge (p. 187).

There are different versions of the VLT available for professionals and researchers, although all of them are very similar to each other. In the Schmitt, Schmitt and Clapham's (2001) version, the VLT is conceptualized as a test which provides a prediction of vocabulary knowledge that an L2 learner has, both general and academic English vocabulary knowledge. This is because a person's vocabulary knowledge can predict the ability to use the English language in different ways (p. 55). The result obtained with the VLT can be used by researchers, as well as by teachers, to establish whether a learner has the necessary L2 vocabulary resources to deal with certain language tasks (SCHMITT; SCHMITT; CLAPHAM, 2001, p. 56).

The VLT is widely recognized in studies on vocabulary, both for pedagogical assessment and research. The design of the test, as well as its name, is based on the idea that each level of proficiency evaluates the knowledge of a set of words. That is, instead of specifying a total number of words a learner knows, it provides the vocabulary profile that a learner has per level of proficiency (SCHMITT; SCHMITT; CLAPHAM, 2001, p.58), also "providing an indication of whether examinees have an initial knowledge of the most frequent meaning sense of each word in the test" (p. 62).

Originally, the test was designed with the five most frequent word levels: 2000, 3000, 5000, 10000 (each set of number refers to a level and each level refers to the most frequent word families) and the fifth being the academic level, in Nation's version (1983, 1990), which contain eighteen questions to be answered at each level, so the maximum score for each level would be 18. Schmitt, Schmitt and Clapham's (2001) version, which improved and gave more reliability to the previous test (NATION, 1983, 1990), has the same number of levels but an increased number of items/questions (phrases and not words). That is, Schmitt, Schmitt and Clapham's (2001) version has thirty items for each level, with a maximum score of 30. For the present study, I adopted an updated version of the VLT, developed by Webb, Sasao and Balance (2017), who adapted it from Nation (1983, 1990) and Schmitt, Schmitt and Clapham's (2001) versions. The version used in this research contains 30 questions/items per level, as in Schmitt, Schmitt and Clapham's (2001) version. In their version, Webb, Sasao and Balance (2017) modified the number of levels. Their updated version is composed of the 1000, 2000, 3000, 4000 and 5000 word families level. Therefore, as will be detailed in Chapter three (section 3.3.2), the version adopted in the present study (WEBB, S.; SASAO, Y.; BALANCE, O., 2017)

consists of thirty questions for each most frequent word levels, which are: 1000, 2000, 3000, 4000 and 5000 word families levels.

According to Schmitt and Schmitt (2014), the 1000 word families[5] correspond to the most used words in the English language, according to the BNC – British National Corpus – corpora (NATION, 2006) and are considered to be of high frequency, that is, the 1000 most used word families in English language. From the next 1000 words on, the frequency is smaller but still substantial, and it is only after the level of 4000 word families that the frequency drops dramatically (p. 488). Therefore, Schmitt and Schmitt (2014), while investigating a useful parameter of high frequency vocabulary (that is, words that appear most frequently in the English language) in its own rights, attested that the most frequent vocabulary level is up to 3000 thousand words. This level would give the participants the necessary vocabulary to understand the English language (p. 490). Besides that, trained and classified readers for ESL finish their grades at the level of 3000 words, which reinforces 3000 word families is a significant figure for L2 learners (p. 491). All in all, between 2000 and 3000 word families is the level considered adequate to use English effectively, considering novice learners. A vocabulary level more extensive than that would allow the learner to communicate in a wider number of contexts. However, for more basic situations, up to 3000 word families would be enough. Therefore, Schmitt and Schmitt (2014) argue that high-frequency vocabulary in English occurs between 2000 and 3000 words, beyond that the focus is more on academic contexts (p. 494). In addition, the words within the set of high-frequency vocabulary are used for more pedagogical purposes (p, 498).

Webb, Sasao and Balance (2017) state that Schmitt, Schmitt and Clapham (2001) has two main limitations. The first is about the words used in the test, which are derived from very old texts, and the second is because their version does not take into account the 1000 most frequent word families as constituting a level. Especially with regard to the second limitation, according to Webb, Sasao and Balance (2017), the first most frequent 1000 words are the most important words because they account for about 80% of English (p. 34). From that number on, that is, from 1000 to 2000 words, it would correspond to approximately 4 to 10% of English. For this reason, Webb, Sasao and Balance (2017) emphasize that "the most valuable word frequency level to measure is the most frequent 1000 word families because of its importance

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[5] The word **family** here corresponds to a set of words considering its root, inflection and derivation (SCHMITT; SCHMITT, 2014)

to understanding English" (p. 34). Likewise, as stated by these authors, having good knowledge of the family class of 1000 words together with interjections and proper names, would correspond to the understanding of

> [...] 86.52% of movies (Webb & Rodgers, 2009a), 85.11% of television programs (Webb & Rodgers, 2009b), 83.25% of text written for children (Webb & Macalister, 2013), 91.06 of graded readers (Webb & Macalister, 2013), 87.54% of academic spoken English (Dang & Webb, 2014), and from 64.74–88.00% of English proficiency test passages (Webb & Paribakht, 2015) Thus, because the most frequent 1000 word families account for by far the largest proportion of English vocabulary, measuring this word frequency level on its own has great value. (WEBB, S.; SASAO, Y.; BALANCE, O., 2017, p.54)

In light of the above remarks, I have embraced Webb, Sasao and Balance (2017) standpoint about the most adequate vocabulary knowledge level to assess participants' knowledge of the English language, that is the 1000 word families level. This decision was taken especially because, for the purpose of the present study, the participants do not have to master the English language in all skills, but rather be able to read simple sentences to perform the anaphoric resolution task.

2.2 EMPIRICAL REVIEW OF THE LITERATURE ON WMC AND ANAPHORA RESOLUTION

In the complex process of language comprehension, under a psycholinguistic perspective, the topic of anaphora is intimately related to WMC because the latter could predict how one is capable of finding a given referent more easily or not. Since WM is considered to hold both mechanisms of storage information at the immediately accessible level together with the processing of new information (COWAN, 2017, p. 147), it turns up to be paramount for the investigation of anaphora resolution, which has to deal with the ability to refer to the antecedent previously mentioned in the text, that is, the ability to hold and process linguistic information simultaneously.

One important complex aspect underneath comprehension processing is to consider the combination of the new information coming to the speaker and the speaker's background knowledge, which in turn will provide them with support to process anaphora resolution (NOWBAKHT, 2019, p. 354).

Some researchers have seen anaphora resolution as a means of inference processing, proposing circumstances under which it can be inhibited by WMC and/or provided with

additional support in acknowledging the referent, using tests like "reading time, response time or reaction time, as well as eye-tracking measures"(NOWBAKHT, 2019, p. 3). These tests provide evidence that different variables are believed to lead to anaphoric resolution, such as "antecedent identifiability" – that is, how easily a person can find the antecedent –, "topic continuity" – repeated anaphora is more complex than reduced anaphora for skilled readers –, and the "distance between the anaphor and the antecedent" – anaphora is first identified with the closest antecedent (PRETORIUS, 2005, p. 524). In the present study, these variables will be under control.

Even though most studies regarding anaphoric resolution are related to L1 processing, more recently some researchers have addressed this issue in L2. Nowbakht (2019, p. 356) agrees that L2 learners do not understand language the same way L1 speakers do, they may use L1 strategies to comprehend L2 sentences and this could inhibit proper understanding. Besides, L1 learners lack the inherent dynamicity of L2 language comprehension, which is paramount for language processing.

In a study conducted by Cunnings, Fotiadou and Tsimpli (2017, p. 42), in which they investigated anaphoric resolution and reanalysis during L2 sentence processing, the results showed that L1 and L2 English speakers use gender cues in order to come across pronoun resolution. L2 English speakers were able to process and interpret ambiguous pronouns in English in a largely nativelike way, in spite of the fact that L2 learners, unlike L1 speakers, tend to support the initial interpretation of the pronoun as a subject longer. Their findings also indicate that L2 learners were more limited in reviewing a first interpretation ascribed to an ambiguous pronoun than native speakers. Overall, this study provided evidence supporting the similarity in which L1 and L2 speakers interpret pronoun resolution.

By the same token and aiming at providing evidence of how important WMC could be to sort out anaphora resolution, Nowbakht (2019, p. 353), conducted a study intended to examine L2 English learners' working memory, language proficiency, and age in the processing and comprehension of English anaphoric sentences. Nowbakht (2019) is a relevant study for my own research, and my design is partially influenced by his work. In this regard, I provide a more thorough description of the experiment he conducted. In addition to WMC, two other variables were also considered in Nowbakht (2019): language proficiency and age, neither of which proved to be significant predictors of the ability to solve anaphora in terms of processing or comprehension. In his experiment, Nowbakht (2019) adopted three instruments in order to collect the data, the first being an Operation Span Task (OSPAN), aiming at assessing

participants' WMC, the second, a Quick Placement Test (QPT), aiming at assessing participants' English proficiency and finally, an anaphoric resolution test (ART), aimed at tapping into participants' processing and comprehension of anaphoric expression. In order to perform the three aforementioned tests (OSPAN, QPT, ART) participants were given a self-paced reading test containing 19 items, four of which were distractors, without anaphora. Nowbakht (2019) selected forty participants, EFL learners, with distinct proficiency levels. Based on several multiple regression analyses, Nowbackt (2019) showed that participants' WMC anticipated changes concerning the comprehension and processing of anaphoric expression. In other words, according to his results, WMC can predict one's ability to solve anaphora expression in the L2.

In a state-of-the-art review conducted, Jackson (2020) seeks to bridge a gap between complex dynamic systems theory and WM in L2 research, given that, like language, WM is conceived as dynamic and complex. The author outlines what has been discovered, also the main trends, about how, through investigation, different WM models can shed some light on the complex processes of L2 learning and teaching. Jackson (2020) suggests that the research on WM and L2 can be organized in the following main themes: **1** – Aptitude theory (MIYAKE; FRIEDMAN, 1998; ROBINSON, 2007; SKEHAN, 2016; WEN et al., 2017; LI, 2016). **2** – Instructed SLA (MACKEY et al., 2002; VATZ et al., 2013; LINCK; WEISS, 2011; WEN, 2018; LI; FU, 2018; ZALBIDEA, 2017). **3** – Comprehension and production (LINCK et al., 2014; SAGARRA, 2017). **4** – Novel SLA (KEMPE; BROOKS, 2016; JACKSON, 2013, 2016; DOUGHTY, 2001; MCDONOUGH; TROFIMOVICH, 2016). **5** – Psycholinguistic approaches to bilingualism (MIYAKE et al., 2000; BIALYSTOK, 2018; SCHWIETER, 2016; GRUNDY; TIMMER, 2017), and **6** – Transfer of training (TSAI et al., 2016; CHRISTINER; REITERER, 2016).

In his article, Jackson (2020) discusses whether WM is a predictor of L2 learning and/or production or the other way around, that is, if a person has a constant practice on learning an L2 could enhance his/her WMC? The author points out that this interrelation between WM and L2 performance and learning must be analyzed carefully and within a specific context (p. 96). This is because different views are presented, they are compelling and have evidence-based methods. According to Jackson (2020), "In addition to the robustness of this evidence, it is also clear that there are wide-ranging differences between individuals in each age group, and that different WM tests yield different results at any given age" (p. 97). That is, the relationship between WM and L2 outcomes seems to be dependent on circumstances like time of exposure to L2 language, age, context, among other factors. In this sense, WM and L2 outcomes are

dynamic, they do not present stable features (JACKSON, 2020, p.101). Another important aspect to be considered, discussed by Jackson (2020) is that studies concerning WM and L2 outcomes need "longitudinal design, measured repeatedly". He believes this type of studies would bring to light stronger evidence on the relationship between WM and L2 (p. 101).

The relationship between WMC and L2 learning and processing has been a longstanding topic at the LabLing (Language and Cognitive Processes Laboratory), going all the way back to Mota (1995) and (Mota) Fortkamp (2000), who investigated the role of WM in L2 speech production. The relationship between WM and L2 speaking was later explored by Weissheimer (2007), Bergsleithner (2007), Finardi (2009), Prebianca (2004, 2009), Tavares (2008) and Xhafaj (2006). In the context of LabLing, other aspects of L2 learning and processing, such as vocabulary and the effects of bilingualism, and their relationship with WM have also been explored (MENDONÇA, 2003; KRAMER, 2011; SOUZA; 2015). The present study will contribute to this line of research at LabLing by exploring the role of WM in the processing of a specific aspect of English grammar – the interpretation of anaphora within the realm of object and subject pronouns – by beginning bilinguals whose learning of English as an L2 is taking place in the public school context.

CHAPTER III
METHOD

The present study was submitted to the Ethics Committee of the Federal University of Santa Catarina CEPSH/UFSC in February, 2020, and was approved in March, 2020 (CAAE 29433320.1.0000.0121). With the outbreak of the COVID-19 pandemic, it was necessary to submit an amendment to the Ethics Committee requesting changes in the way the current study would be conducted, as well as to reshape the consent and assent terms, in order to match the criteria for remotely carrying out the tests. The amendment was also approved (29433320.1.0000.0121) in March, 2021.

This chapter is organized into eleven sections and presents the method of the present study. Section 3.1 presents the objective and the research questions together with the hypotheses. Section 3.2 outlines participants' profile. Section 3.2.1 presents participants' biographical and linguistic background questionnaire information. Section 3.3 details the instruments for data collection, describing the biographical and linguistic background questionnaire in section 3.3.1, the Vocabulary Levels Test in section 3.3.2, the Number and Letter Sequence Working Memory Test (WISC-IV) in section 3.3.3 and the Anaphoric Resolution Task in section 3.3.4. Section 3.4 displays the data collection procedures. Section 3.5 informs about the pilot study, which was conducted before the instruments were applied to the participants. Finally, in section 3.6, the data analysis is outlined.

3.1 OBJECTIVE, RESEARCH QUESTIONS AND HYPOTHESES

The current study aims at investigating the relationship between working memory and the processing of anaphoric resolution in L2 English by Brazilian Portuguese speakers who are learning English as a second language as part of the school curriculum. More specifically, the study aims to examine whether participants' working memory capacity correlates with the interpretation of subject and object pronouns in sentences in English as L2. Based on these objectives, this study addresses the following research questions.

Research question 1– Is there a relationship between working memory capacity and the processing of subject and object pronoun anaphoric resolution in English as L2?

Hypothesis 1 – There is a positive correlation between working memory capacity and the processing of anaphoric resolution in English as L2. Participants with a higher working

memory capacity will be better able to relate the anaphoric subject pronoun as well as the anaphoric object pronoun to their respective antecedents.

Hypothesis **1** is based on studies which show that WMC plays an important role in the processing of anaphoric resolution. In the current research, WM is viewed as an important language operation when the circumstance is associated with an inaccessible referent, placing a greater demand on the speaker to interpret the more distant reference (PARKER, 2019, p. 2). Therefore, the relationship between WM and anaphora resolution finds its place in the ability to simultaneously hold and process linguistic information (COWAN, 2007, p. 147). According to the psychometric correlational approach to WM, the larger the WMC, the better the performance on complex cognitive tasks (MOTA, 2000, p. 22). Evidence shows that activities requiring the reader to retain prior language terms, such as post-interpretative tasks, are hampered by verbal memory (CAPLAN, WATERS, 1999). In addition, low-span children seem to have a harder time identifying a pronoun's referent (SEIGNEURIC, MEGHERBI, 2008, p. 282).

Research question 2– Is there a relationship between working memory capacity and the comprehension of subject and object pronoun anaphoric sentences in English as L2?

Hypothesis 2 – There is a positive correlation between working memory capacity and the comprehension of subject and object pronoun anaphoric sentences in English as L2. Participants with higher WMC are more capable of interpreting L2 subject and object pronouns in sentences.

Hypothesis **2** is based on studies that provide evidence that comprehension of anaphora is better achieved depending on how good WMC is. In other words, there is evidence that WMC could be a potential influencing factor in anaphora resolution. In order to understand anaphora, people must have previous knowledge on hand in order to find a plausible referent and then match it to its anaphoric expression (NOWBAKHT, 2019). Evidence was shown in support of the role of WM in the comprehension process when children were investigated for the effects of distance and typicality on anaphoric resolution (JOSEPH et al, 2015, p. 626). Anaphora resolution is also important when investigating cross-linguistic effects on language comprehension (KEATING et al., 2016). Likewise, studies have provided supported to the idea that L1 and L2 speakers understand pronoun resolution similarly (CUNNINGS et al., 2017, p. 42), and that certain pronouns are closely connected with referent information (BHA, 2004). Additionally, learners with higher WMC have a better lifetime performance, not only in reading

skills, but also in other school/academic subjects. Learners with poor WMC, on the other hand, tend to do worse in this area (GATHERCOLE, ALLOWAY, 2008, p. 33).

3.2 PARTICIPANTS

The participants of the present study were students regularly attending one of two schools in the public state network in Florianópolis, Santa Catarina, Brazil. The first one was the EEB (Escola Estadual Básica – Basic State School) Júlio da Costa Neves, located in the neighborhood of Costeira do Pirajubaé, and the second was the EEB (Escola Estadual Básica – Basic State School) Vereador Oscar Manoel da Conceição, in the neighborhood of Rio Tavares. Both neighborhoods are located on the island of Santa Catarina, Florianópolis.

Due to the Covid-19 pandemic, which made it difficult for me to invite students in person, there was only a small number of them who agreed to take part in this study. Participants were invited either through my participation in their English online classes or through a visit to their schools. Ten students volunteered to participate in the study, but two of them were attending the 2nd year of high school and, therefore, could not be included in the study. In total, data was collected from 8 participants (6 female; $M = 15$, $SD = 0$), all attending the 1st year of high school. All the participants were native speakers of Brazilian Portuguese, learning English as a second language as part of the school curriculum.

Participants' legal caretakers gave their formal written consent (Appendix A) allowing their children to be invited to the study and all participants gave their formal consent (Appendix B) agreeing to participate in the study. Data was collected online, individually with each participant in one session, through the platform Google Meet. The procedures for data collection are fully described in session 3.4.

3.2.1 Biographical and linguistic background questionnaire

According to the responses given in the biographical and linguistic information questionnaire, participants' mean age is $M = 15$. The school year, and consequently the age of the participants, were chosen for the purpose of testing learners who could read short phrases in the English language. According to the questionnaire, all participants were attending the expected school year for their age and two of them had been studying English as L2 since the first year of elementary school. Furthermore, as shown in tables 1 and 2, the majority of

participants (75%) have studied English as part of the school curriculum only, while 25% have also studied English in language schools.

Table 1 – Information on the participant's overall biographical and linguistic background.

Participant	Gender	Age	Expected School Year/Age	Year in which participant started to learn English at school	Years studying English Means = 6,5 SD = 1,936492
1	M	15	Yes	1st year of elementary school	9 years
2	F	15	Yes	5th year of elementary school	5 years
3	F	15	Yes	2nd year of elementary school	8 years
4	F	15	Yes	3rd year of elementary school	7 years
5	F	15	Yes	6th year of elementary school	4 years
6	F	15	Yes	4th year of elementary school	6 years
7	M	15	Yes	6th year of elementary school	4 years
8	F	15	Yes	1st year of elementary school	9 years

Source: the author (2021).

Table 2 – Information on whether or not participants learned English outside of school.
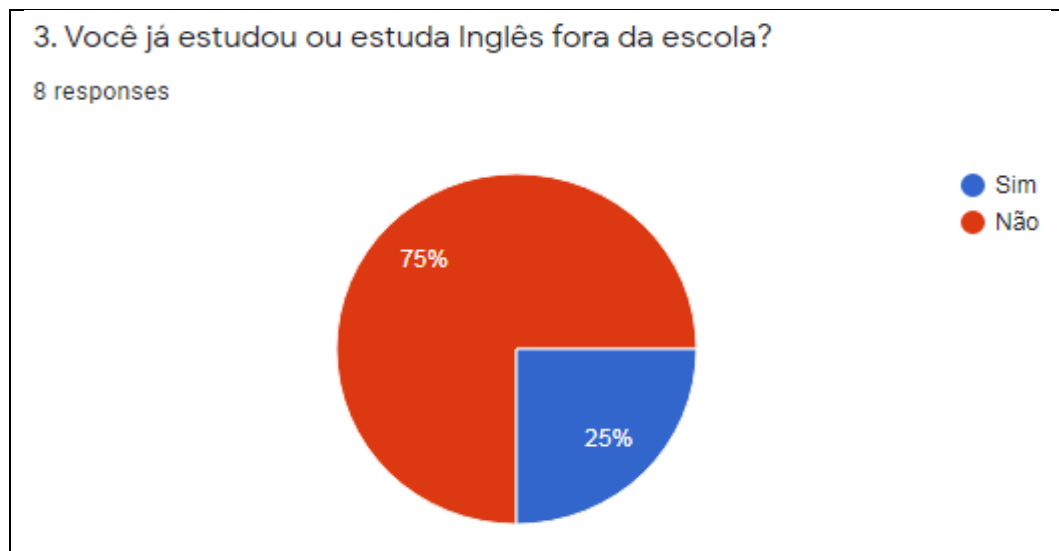
Source: the author (2021)

3.3 INSTRUMENTS FOR THE DATA COLLECTION

In order to obtain the data, four instruments were adopted in the present research. The first one is a biographical and linguistic background questionnaire, aiming at gathering

participants' information concerning language learning. The second instrument is the Vocabulary Levels Test, which assessed vocabulary proficiency. The third instrument, aiming at assessing working memory capacity, is the Number and Letter Sequence working memory test, taken from the Wechsler Intelligence Scale for Children (WISC-IV). The fourth instrument is an anaphoric resolution task, aimed at assessing participants' online processing of subject and object pronouns in sentential contexts. The application of the four instruments was carried out remotely due to the COVID-19 pandemic. Each of these instruments will be fully described next.

3.3.1   The biographical and linguistic background questionnaire

The biographical and linguistic background questionnaire was designed to gather participants' personal information such as age and gender, as well as linguistic information like English language experience. The questionnaire consisted of five personal questions and eight linguistic background questions, all of which were in Brazilian Portuguese. The questionnaire was originally designed to be filled out on a printed sheet of paper by the participants, but due to the pandemic scenario, it was adapted to a virtual form, through Google Forms. Through a WattsApp message, the researcher provided the participants with a link to the questionnaire form to be answered by them. As each participant completed the questionnaire, the researcher had access to all of the information via the Google form platform, and only the researcher and the supervisor had access to this information.

3.3.2   Vocabulary Levels Test

The present study adopted Webb, Sasao and Balance's (2017) updated version of the VLT, which is freely available in paper-based and electronic formats at Stuart Webb's homepage http://www.edu.uwo.ca/faculty-profiles/stuart-webb.html. The criterion included in the experiment chosen was the same used by Schmitt, Schmitt and Clapham (2001, p. 67), which determines that participants have to score or master 26 out of 30 questions. This criterion was adopted in the 1000 word families' level test to tap into participants' vocabulary knowledge in English in order to make sure they would be able to complete the anaphoric resolution task. In the present study, the VLT consisted of ten blocks, each block containing three attempts, in which they had to match items/phrases with a word. Items/phrases were placed vertically,

whereas words were placed horizontally, as shown in table 3. The maximum score for this test was thirty.

Table 3 – Vocabulary 1000 Word Level Test Sample.

1,000 Word Level						
	boy	rent	report	size	station	thing
how big or small something is						
place buses and trains go to						
young man						

Source: Example from the Vocabulary Levels Test (VLT) (WEBB, S.; SASAO, Y.; BALANCE, O., 2017)

The updated version of the VLT adopted in the present research, that is, Webb, Sasao and Balance's version (2017), was presented to the participants in PowerPoint slides during the online session of data collection through Google Meet.

In the VLT, participants were instructed to read the words/phrases, in English, in the left column and relate them to the right columns. There were ten blocks with three attempts each (maximum score: 30), as well as letters (A, B, C) in the left column and numbers (1,2,3,4,5,6) in the right columns that could be used by each participant to present the answers to the researcher (See Appendix E, adapted by the researcher). After reading each block, participants said the number corresponding to each letter they considered to be correct. Once participants chose the options they considered correct, they told the researcher, who wrote down the answers on an answer sheet specific for the VLT.

Participants had up to 10 minutes to complete the test and this is because they did not have to deal with the five levels, but only one (the 1000 word families' level). According to Schmitt, Schmitt and Clapham (2001, p. 72), 31 minutes is enough to answer the five levels, so I considered that 10 minutes would be appropriate to answer just one level.

Prior to the actual test, there was a training session to make sure participants understood how to perform the test.

3.3.3 Number and Letter Sequence working memory test (WISC-IV)

To assess participants' working memory capacity, the Number and Letter Sequence working memory test of the Wechsler Intelligence Scale for Children (WISC-IV) was employed. WISC is a test battery aimed at neuropsychological assessment. The scale is

comprised of four major tests to measure cognitive competence and overall intelligence of children age ranging from 6-0 years and to 16 years and 11 months old. These tests are called Indexes. WISC-IV has been used in some studies at LabLing, such as Moraes (2014), Mascarello (2016), and Kuerten (2017).

According to Wechsler (2013), the verbal Comprehension Index (VCI) measures participants' verbal skills, such as comprehension, reasoning, and conceptualization. The Perceptual Reasoning Index (PRI) measures participants' ability to understand their surroundings and to get organized. The Working Memory Index (WMI) gives an overall measure of working memory and attentional resources. Finally, the Processing Speed Index (PSI) measures participant mental process agility. To pursue the objectives of the present research, the Sequence of Number and Letter test (SNL) of the WM index was carried out in Brazilian Portuguese.

The screen was not shared with the participants during the working memory test (SNL – WISC), although they could see the researcher's face while reading the numbers and letters. In the Sequence of Numbers and Letters WM Test (SNL – WMT), the researcher read a sequence of numbers and letters and the participant had to repeat the numbers in ascending order and the letters in alphabetical order (WECHSLER, 2013). The SNL – WMT consisted of ten blocks. In each block there were three items (total items = 30). The participant had one attempt at each item and she/he achieved one point for each item correctly repeated back to the researcher, saying, first, the number in ascending order, and then the letters in alphabetical order. The test was interrupted when the participant failed to recall at least one item correctly at any of the 10 blocks. After seeing and listening to the researcher read the sequence of numbers and letters, the participants provided orally what they considered to be the correct answer, and the researcher wrote the responses on a specific answer sheet for this test. The maximum score on this test was thirty.

Prior to the actual test, there was a training session to assure participants understood how to complete the test.

3.3.4   The Anaphoric Resolution Task

Finally, for the anaphoric processing assessment, a sentence reading task was applied. This task was designed by the researcher herself and underwent various adaptations during the planning stage of the study, in order to improve the stimuli. The anaphoric resolution task contained one hundred and twenty sentences (120) in English, thirty of which carried anaphoric

expressions (15 sentences containing subject pronouns, and 15 containing object pronouns), thirty being baseline sentences, and the remaining sixty sentences being distractors/fillers without anaphora. All thirty experimental sentences (15 with anaphoric subject pronouns and 15 with anaphoric object pronouns) comprised nine words and started with a proper name. In addition to the experimental sentences (15 with anaphoric subject pronouns and 15 with anaphoric object pronouns), there were 30 baseline sentences and 60 filler sentences. The baseline sentences consisted of the same 30 experimental sentences, but had a proper name in the position of either the subject or the object pronouns, thus consisting of sentences without anaphora. The baselines had the purpose of not conditioning the participants to a linguistic structure pattern. For example, we did not want the participant to realize that the experimental sentences of the ART were organized following the pattern of constantly having the subject in an initial position of the sentence, in the first clause, and the anaphoric expression, whether it was a subject or an object pronoun, in the second clause of the sentence. The filler sentences consisted of nine words, randomized sentences without anaphora and had the purpose of preventing the participants from guessing the target structure. Finally, the anaphoric processing task also included thirty comprehension questions. Each comprehension question consisted of a question, in Brazilian Portuguese, about the experimental sentences, containing three potential response items, intended to be addressed to the participant right after s/he read the experimental sentence. The comprehension questions aimed at verifying whether participants were able to interpret and solve the anaphora. That is, the comprehension questions were designed to determine whether or not the participants had attained anaphoric resolution.

All one hundred sentences (30 experimental, 30 baseline and 60 fillers) were grouped into fifteen blocks. Each block contained eight sentences (1 experimental sentence with a subject pronoun, 1 experimental sentence with an object pronoun, 2 baseline sentences related to each experimental sentence, and 4 fillers) and two comprehension questions, one for each experimental sentence. Only the third person singular pronouns of the feminine and masculine genders (he and she) were inserted. The stimuli were, therefore, created to fulfill the regular pattern criterion, allowing participants to focus their efforts solely on the resolution of the anaphora during the task. The task's rationale was then to provide the participant with a proper name in the first clause so that she/he could retrieve it in the following clause with the subject or object pronoun, hence recovering the anaphoric expression, or antecedent. The thirty experimental sentences were randomized, to which the researcher used the Latin Square principle, including them into four different lists with 60 filler sentences, 30 baseline sentences

and a comprehension question for each experimental stimulus according to the organization shown in the table 4 below.

Table 4 – Example of the stimuli in a block.

			Subject				Subject pronoun				
1	One Subj.	Experimental **Subject** Pronoun Sentence	Karina	got	a	job.	She	is	feeling	very	happy.
2	First	Filler	Arthur	said	he	is	going	to	have	the	money.
			Subject								Object pronoun
3	One Obj.	Experimental **Object** Pronoun Sentence	Sean	reads	very	slowly.	Some	training	should	help	him.
4	Second	Filler	I	am	going	to	need	a	hand	with	this.
5	One	**Subject** Pronoun Baseline	Karina	got	a	job.	Lara	is	feeling	very	happy.
6	Third	Filler	They	were	told	to	get	off	the	bus	soon.
7	One	**Object** Pronoun Baseline	Sean	reads	very	slowly.	Some	training	should	help	Robert.
8	Fourth	Filler	There	is	a	lot	of	water	in	the	ocean.

Source: the author (2020).

This task was aimed at assessing participants' L2 anaphoric processing in identifying the antecedent of a subject or an object pronoun. This task yielded two sets of data: sentence processing and accuracy of interpretation. Throughout the test, the sentences were randomly presented. There were four lists designed according to the Latin Square. These lists were switched between participants. Participants 2 and 5 read list **1**, participants 1 and 6 read list **2**, participants 3 and 7 read list **3**, and participants 4 and 8 read list **4**. In summary, each list was read by two participants. It was used the Latin Square to randomize the sentences for the Anaphoric Resolution Task. In the set Latin Square, all the experimental sentences as well as the baselines appear in each list, however in different positions. There were four lists in total. Each list was comprised of one hundred and twenty sentences and divided into fifteen blocks. Each block consisted of eight sentences ((two of which were experimental sentences (one with

a subject pronoun and one with an object pronoun), two baselines and four fillers (one filler for each sentence)) and the two comprehension questions (one related to the subject pronoun and one related to the object pronoun sentence). Summing up, there were four lists, one hundred and twenty sentences, fifteen blocks, thirty experimental sentences, thirty baselines, sixty fillers and thirty comprehension questions within each list (See Appendix G). Table 5 is an example of the conditions.

Table 5 – Latin Square Sample – first block – list 1.

BLOCK 1	LIST 1
A	Karina got a job. She is feeling very happy.
QUESTION	Quem está feliz?
FILLER	Arthur said he is going to have the money.
B	Sean reads very slowly. Some training should help him.
QUESTION	Quem seria ajudado pelo treino?
FILLER	I am going to need a hand with this.
C	Karina got a job. Lara is feeling very happy.
FILLER	They were told to get off the bus soon.
D	Sean reads very slowly. Some training should help Robert.
FILLER	There is a lot of water in the ocean.

Source: the author (2021).

Each sentence appeared on a computer screen, using PowerPoint software, one sentence per slide, in English. Among them, randomly, there were comprehension questions, which were in Brazilian Portuguese. The task required participants to read the sentences and inform the researcher when they had finished reading each sentence to proceed to the next slide. When the comprehension question appeared, the researcher read the question as well as the three possible answers also shown on the screen, and the participant had to choose the alternative that best suited the anaphora resolution. Participants' answers were noted on a specific answer sheet for that task. Table 6 illustrates how the sentences appeared to the participants at the time of the application of the ART.

Table 6 – Example of the first block of the first list, containing eight sentences and two comprehension questions, shown to the participants, using the PowerPoint software.

Karina got a job. She is feeling very happy.

1 - Subject pronoun experimental sentence

Quem está feliz?

- Mary
- Karina
- John

1st – Comprehension question

Arthur said he is going to have the money.

1st – Filler

Sean reads very slowly. Some training should help him.

1 – Object pronoun experimental sentence

Quem seria ajudado pelo treino?

- Sean

- Him

- Sandra

2nd – Comprehension question

I am going to need a hand with this.

2nd – Filler

Karina got a job. Lara is feeling very happy.

1st – Baseline

They were told to get off the bus soon.

3rd – Filler
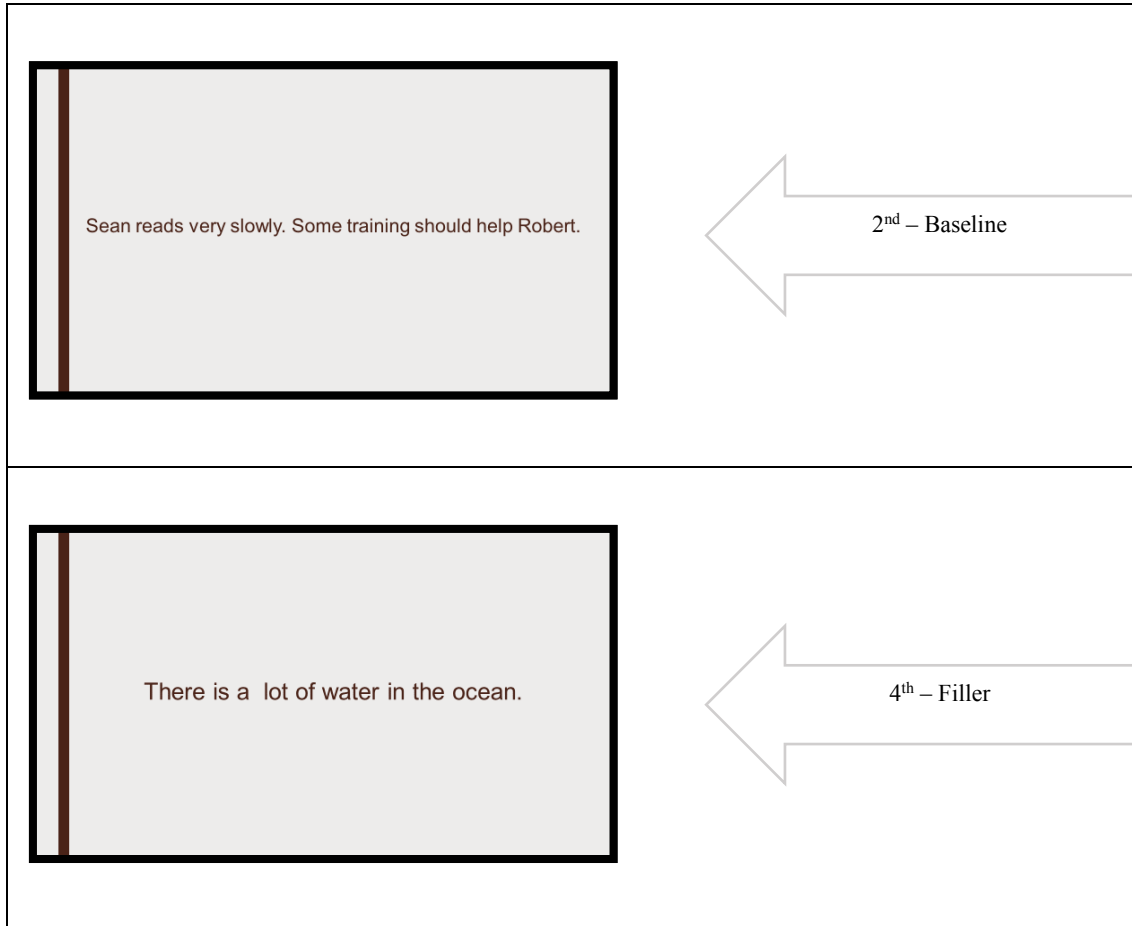
Source: the author (2021).

All 120 sentences went through an acceptability test by a native speaker of English. The acceptability test was based on the Likert Scale and aimed at indicating whether individual sentences sounded acceptable or not in English. The procedure was to use the following scale to register the answers:

1   Totally unacceptable. No one would say that;

2   Slightly unacceptable. There are better ways to say that;

3   Slightly acceptable. The sentence is acceptable, but there are better ways to say that;

4   Acceptable. This sentence sounds natural;

5   Perfectly acceptable. Everybody would say that.

A native speaker of English was invited to assess the acceptability of the 120 sentences on the scale above, indicating which number better represented her opinion concerning each sentence. The result of the acceptability test showed that most sentences were acceptable in the English language, ($M = 4.85$; $SD = 0.5$), as can be seen in Figure 3. In addition, for those

sentences that were deemed (almost or totally) unsuitable, the native speaker provided the researcher with suggestions for modification, which were accepted and implemented.

Figure 3 – The result of the acceptability test.
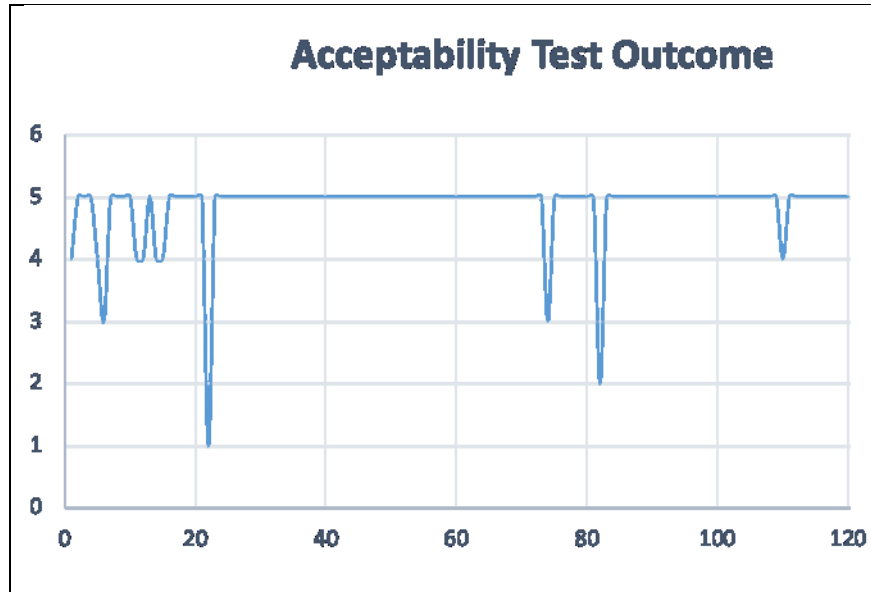
Source: the author (2021)

3.4 DATA COLLECTION PROCEDURES

All instruments and procedures were tested prior to data collection in a pilot study. The entire study was conducted remotely, using the Google Meet platform. Initially, the researcher contacted the English teachers of the two schools (EEB Júlio da Costa Neves and EEB Vereador Oscar Manoel da Conceição) and scheduled a video conference with them to explain the study and the invitation procedure. Students were invited to participate in the study as volunteers in either online or face-to-face meetings. There were five online meetings arranged with their English teacher by means of visits to the schools during their English classes after the teachers agreed to let the researcher use some of their English classes to invite participants to take part in the study. Upon invitation, learners were asked to provide the researcher with their WhatsApp or e-mail contacts. The first contact with the participants, mostly via WhatsApp, was to ask them for their legal representative's contact, which was then used to request their approval via an online form that included a consent form (Appendix A). After receiving the legal representative's permission, participants were also asked for permission to participate in the study as volunteers. After the assent (Appendix B) for participation was given, learners filled in the language experience questionnaire (Appendix D), via WhatsApp. Next, participants were

given, via remote meeting with the researcher, the vocabulary proficiency test, the working memory test and the anaphoric resolution task. The biographical and linguistic experience questionnaire, the Vocabulary Levels Test, the Sequence of Numbers and Letters test and the Anaphoric Resolution Task were applied individually. The application of the three tests (VLT, SNL, ART) only took place after all the consent and assent forms, as well as the questionnaire, were answered and sent back to the researcher. The phases of the data collection procedure are illustrated in Figure 4.

Figure 4 – Flow chart of data collection procedures.
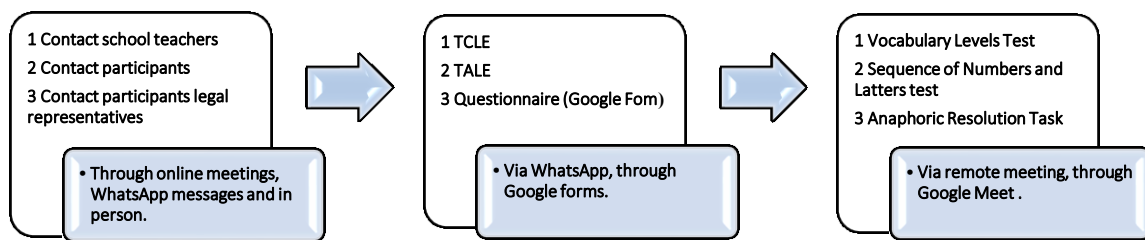
Source: the author (2021).

Each participant was assigned a specific day and time for the application of the tests (See table 7). The tests were presented to the participants through screen sharing on the Google Meet Platform using the PowerPoint software. Before taking the test, participants were given a training session for each of the three tests.

At the beginning of the three tests application, participants were informed that if they felt tired, they could quit at any time. In addition, in the intervals between tests, the researcher asked if the participants wished to take a break or drink water. Table 7 shows the data collection information summary.

Table 7 – Data Collection Information Summary.

Part.*	VLT** MS****** = 30	SNL*** MS = 30	ART**** MS = 30	TTCT*****	Date / Time	Valid
1	28 / 08 min.	21 / 11 min.	30 / 26 min.	45 min.	01.05.21 at 10h 03 min.	Ok
0	20 / 08 min.	17 / 07 min.	26 / 17 min.	32 min.	04.05.21 at 13h 34 min.	Excluded
0	21 / 09 min.	19 / 07 min.	29 / 22 min.	38 min.	04.05.21 at 18h 33 min.	Excluded
2	21 / 11 min.	17 / 06 min.	22 / 20 min.	37 min.	05.05.21 at 09h 04 min.	Ok
3	15 / 16 min.	17 / 08 min.	29 / 27 min.	51 min.	12.05.21 at 10h	Ok
4	08 / 07 min.	13 / 04 min.	26 / 16 min.	27 min.	12.05.21 at 13h	Ok
5	16 / 15 min.	18 / 08 min.	28 / 30 min.	53 min.	12.05.21 at 15h	Ok
6	26 / 05 min.	18 / 06 min.	27 / 20 min.	31 min.	12.05.21 at 17h	Ok
7	07 / 11 min.	17 / 07 min.	20 / 27 min.	45 min.	14.05.21 at 14h 03 min.	Ok
8	24 / 17 min.	19 / 06 min.	30 / 1h 12 min.	1h 35 min.	18.05.21 at 15h 59 min.	Ok

Source: the author (2021).
*Participant
**Vocabulary Levels Test
***Sequence of Numbers and Letters
****Anaphoric Resolution Task
*****Total Tasks Completion Time
******Maximum Score

The vocabulary proficiency test (VLT) took an average of 11 minutes and 25 seconds to be completed (SD = 4.1). The memory test (SNL) took an average of 7 minutes (SD = 1.9). For the anaphoric resolution task (ART), participants spent an average of 21 minutes and 29 seconds (SD = 8.6) to finish this test. Overall, participants took an average of 36 minutes and 29 seconds (SD = 15.7) to complete the three tasks.

3.5 PILOT STUDY

The pilot study took place right after all stimuli were organized and passed the acceptability test, as well as having had the amendment requesting to carry out the research remotely approved by the Ethics Committee, in March, 2021. The pilot study was conducted with two participants, both first-year high school students of public schools, native speakers of Brazilian Portuguese, learning English as a second language. The entire protocol for the data collection was followed. First, the consent and the assent documents were approved. Second, the questionnaire was filled out. Then, the three tests were applied (1st VLT, 2nd SNL, 3rd ART). The pilot study aimed at testing all the instruments for the data collection procedure and tackled some organizational aspects of the three tests, which were adjusted for the collection itself.

As evidenced by the instruments' application in the pilot study, it was noticed that certain changes were required in order for the tests to be applied effectively. First, each section of the ten vocabulary test were labeled as a block, so that both the participant and the researcher could identify which of the blocks were being answered. It was also determined that two mobile devices were needed, in which case the researcher utilized two laptops, one to deliver the tests and the other to hold the participant's answer sheets for each test, on which the researcher recorded the participants' responses. Another aspect that was noticed was the time spent for the vocabulary proficiency test. As described in the VLT section, the participant should be allowed to take the test for up to ten minutes, but both participants in the pilot study surpassed this time limit and it was anticipated that a longer time would be needed for the test to be answered. See table 8.

Table 8 – Pilot general framework

	PILOT			
	GENERAL FRAMEWORK **Online Experiment**			
	VLT**	**SNL***	**ART****	**TTCT*****
Part.*	**MS=30********	**MS=30**	**MS=30**	
1	**21** / **14 min**	**19** / **9 min**	**30** / **29 min**	**52 min.**
2	**17** / **16 min**	**18** / **5 min**	**27**/ **34 min**	**55 min.**

Source: the author (2021).

*Participant
**Vocabulary Levels Test
***Sequence of Numbers and Letters
****Anaphoric Resolution Task
*****Total Tasks Completion Time
******Maximum Score

In the memory test it was noticed that it was more convenient to read the answer sheet, instead of the slides, which contained the test itself, to apply the test, as the screen was not shared with the participant in that part of the experiment. Regarding the Anaphoric Resolution Task, it was noticed that the pilot participants answered the task very easily, but due to the lack of time to reformulate it, it had to be implemented as it was. The Discussion chapter will go over the VLT time limit to complete the test and the above ART issue in further detail.

3.6 DATA ANALISYS PROCEDURE

The present study established two variables, the dependent one is the score of the working memory capacity test and the independent one is the anaphoric items. Three tests were applied, the first test was a vocabulary proficiency test (VLT), which assessed participants' lexical knowledge. The second test assessed participants' working memory capacity (SNL-WMT) and was carried out in Brazilian Portuguese. The last test aimed at assessing participants' anaphoric processing and comprehension (ART).

Following the organizational procedure indicated in Figure 4, the data was entered into a Microsoft Excel Program spreadsheet as soon as all tests were completed. A tab for each instrument (1. The Biographical and Linguistic Questionnaire, 2. The Vocabulary Levels Test, 3. The Sequence of Numbers and Letters Test, 4. The Anaphoric Resolution Task) was created in order to compile the scores of each participant. The findings of the participants' biographical

and linguistic experience questionnaires are summarized in Tab 1. Tab 2 includes the results of the vocabulary test. The memory test results were reported in tab 3, whereas tab 4 has the results of the anaphoric resolution task. A tab was also set aside for compiling data information from pilot participants. Finally, another tab was reserved to report the scores together of the eight participants regarding all three tests, allowing us to see the outcomes of the final scores.

The test scores were statistically analyzed in the present study adopting R Software, a programming language for statistical computing and graphics, using RStudio, the Integrated Development Environment (IDE) for the mentioned software, version 1.2.5001, with the alpha level set at 0.05 ($p < 0.05$). Aiming at assessing the variables, the Spearman's rank correlation coefficient (Spearman's p) was employed. This is a non-parametric method of measuring variables with the objective of determining the relationship between variables. The Spearman's p provides the equivalence between the dependent variable Y and the independent variable X by displaying the rank value for the correlation between the two variables. The results of the measurements, as well as the standard deviations of the three tests, were described by means of a descriptive analysis. The vocabulary (VLT), memory (SNL) and anaphoric (ART) tests' means and medians were first described. The Spearman's p correlation was then applied, first between ART and SNL, then between VLT and SNL, then between ART and VLT, and finally, taking the results of the correlation between ART and SNL and correlating them separately with, first, the subject pronouns and then with the object pronouns scores. The next chapter will present the results and discussion.

CHAPTER IV
RESULTS AND DISCUSSION

This chapter presents and discusses the results of the current study, attempting to demonstrate whether WMC correlates with anaphora resolution in L2 English learners, native speakers of Brazilian Portuguese, attending the first year of public high schools in Florianópolis. The chapter is divided into four sections. Section 4.1 presents the descriptive analysis of participants' results on the Vocabulary Levels Test (4.1.1), the Sequence of Numbers and Letters working memory test (4.1.2) and the anaphoric resolution test (4.1.3). Section 4.2 presents the inferential analyses related to the correlation between WMC and anaphora resolution, as well as between L2 proficiency and WMC and between L2 proficiency and L2 anaphora resolution. Section 4.3 presents the discussion of results. Finally, section 4.4 readdresses the research questions.

4.1 DESCRIPTIVE ANALYSIS

Table 9 provides an overview of the descriptive data related to the Vocabulary Levelst Test (VLT), the Sequence of Numbers and Letters Test (SNL), and the Anaphoric Resolution Task (ART). The table also informs the list that each participant was exposed to in the ART.

Table 9 – Overview of the results on the Vocabulary Levels Test, the Sequence of Numbers and Letters WM test and the Anaphoric Resolution Task.

LIST	PART*	VLT**	SNL***	ART****	S.P.S (ART)*****	O.P.S (ART)******
2	1	28	21	30	15	15
1	2	21	17	22	10	11
3	3	15	17	29	15	14
4	4	8	13	26	12	14
1	5	16	18	28	15	13
2	6	26	18	27	12	15
3	7	7	17	20	12	8
4	8	24	19	30	15	14
Total= 4	M******* SD********	M = 18.12 SD = 7,954109	M = 17.50 SD = 2,267787	M = 26.50 SD = 3,70328	M = 13,25 SD = 1.85405	M = 13 SD = 2.236068
	MS*********	30	30	30	15	15

Source: the author (2021).

*Participant
**Vocabulary Levels Test
*** Sequence of Numbers and Letters
**** Anaphoric Resolution Task

***** Subject Pronoun Scores (in relation to the Anaphoric Resolution Task)
****** Object Pronoun Scores (in relation to the Anaphoric Resolution Task)
*******Means
******** Standard Deviation
********* Maximum Score

These results will be addressed next.

4.1.1 Vocabulary Levels Test (VLT) Outcome

The one thousand words family of the VLT was applied in the present research, with the maximum possible score of 30. Eight participants took the test and the results are presented in figure 5.

Figure 5 – The VLT outcome.
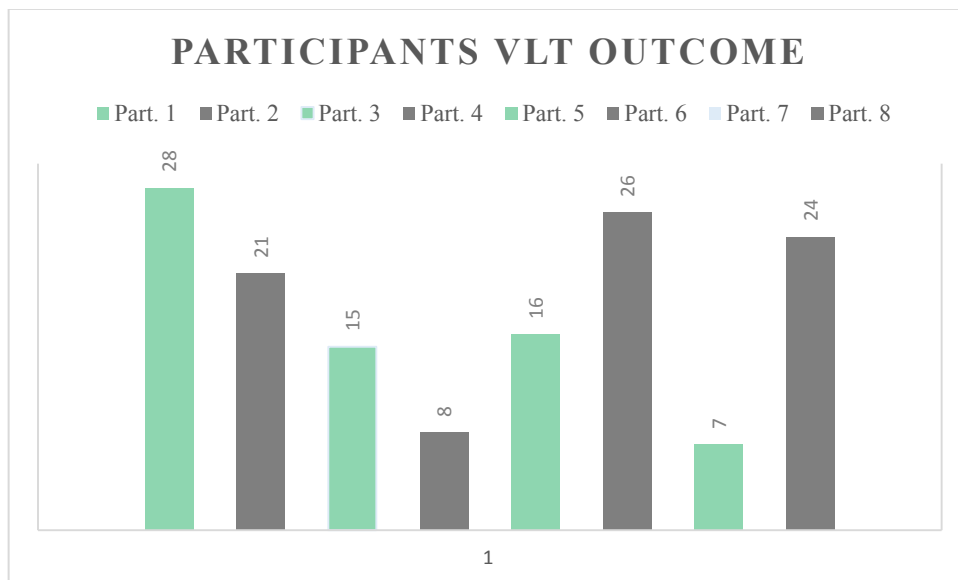
Source: the author (2021).

Figure 5 shows that none of the eight individuals achieved the highest possible score. Participant 1 reached the 28-hit mark, participant 2 reached the 21-hit mark, participant 3 reached the 15-hit mark, participant 4 reached the 8-hit mark, participant 5 reached the 16-hit mark, participant 6 reached the 26-hit mark, participant 7 reached the very slow 7-hit mark, and participant 8 reached the 24-hit mark. The maximum score achieved in this pool of participants was 28, and the lowest possible score was 7 (M = 18.12; SD = 7.954109). Appendix I shows the summary of the VLT results.

As indicated in the VLT section (chapter III, section 3.3.2), participants of the present study were predicted to take up to ten minutes to complete this test level (most frequent 1000

words families). This estimated time limit was determined based on Schmitt, Schmitt, and Clapham (2001, p. 72), who claim that 31 minutes was enough to answer the five levels. As mentioned in the pilot study section (3.6), for high school students, taking the first level required more than ten minutes, but because it was a preliminary estimate, and the extra time was not excessive, I made the decision to keep 10 minutes as an estimate in the main data collection. Results from the main data showed that the 8 participants took a little longer than 10 minutes to complete the VLT (M = 11,25; SD = 4.145781). Since participants took more time to complete the VLT than was anticipated, we infer that they benefitted from this extra time, which might have led to better performance on the VLT.

In addition, the minimum score required in this test to be regarded suitable for the participants to further perform the anaphoric task was between 26 and 30 points (SCHMITT, SCHMITT, CLAPHAM, 2001, p. 67). However, only participants 1 (28) and 6 (26) met this criterion. Therefore, the majority of the participants of the present study were below the proficiency level expected to allow for the resolution of subject and object pronoun anaphora in English as L2.

4.1.2 The Sequence of Numbers and Letters (SNL) Working Memory Test

The working memory test used in the present study was taken from the Wechsler Intelligence Scale for Children (WISC-IV). The Sequence of Numbers and Letters Test, a subtest of the Working Memory Index of WISC-IV, has a maximum possible score of 30, broken into 10 blocks of three items each. For the recall component of the WM measure, one point was awarded for each successfully recalled item at its correct serial location within a set, and no point was given for an incorrectly recalled item. As a result, the higher an individual's WMC, the closer his or her scores are to 30. Figure 6 presents the results of the SNL working memory test for each participant.

Figure 6 – The SNL-WMT outcome.

PARTICIPANTS SNL WORKING MEMORY
TEST OUTCOME
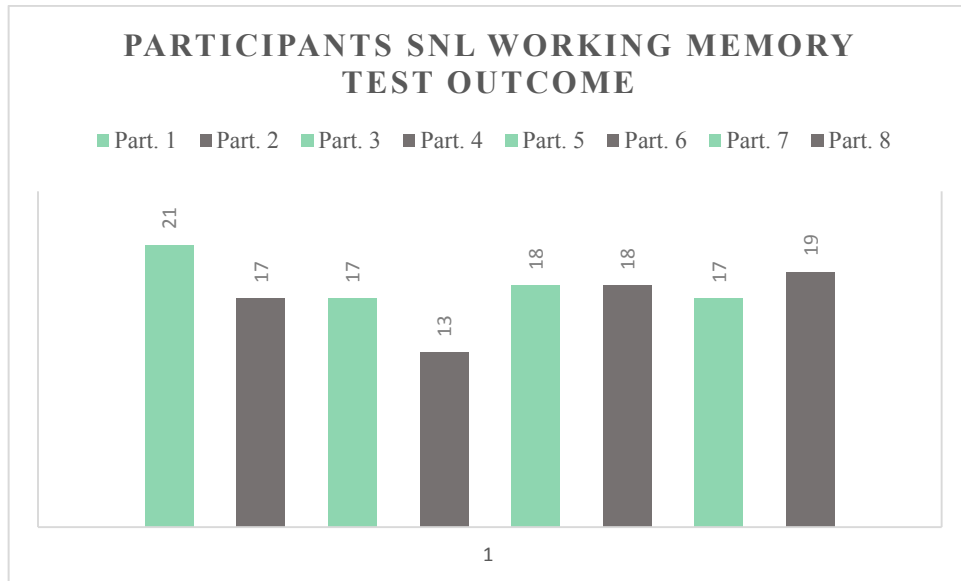
Source: the author (2021).

As shown in Figure 6, participants' scores on the SNL-WM test ranged from 13 to 21 ($M = 17.50$, $SD = 2.267787$). Participant 1 scored 21 points, participants 2, 3 and 7 scored 17 points each, participant 4 scored 13 points, participants 5 and 6 scored 18 points each, and finally, participant 8 scored 19 points. All participants failed to progress to block 8 (8 out of 10). Appendix J shows a summary of the results of the SNL test.

4.1.3 The Anaphoric Resolution Task (ART)

The ART was designed with the objective of allowing the participant to focus on the resolution of the anaphora with as little distraction as possible. The maximum score on this task is 30. The ART results are shown in figure 7.

Figure 7 – The ART outcome.

PARTICIPANTS ANAPHORIC RESOLUTION TASK OUTCOME
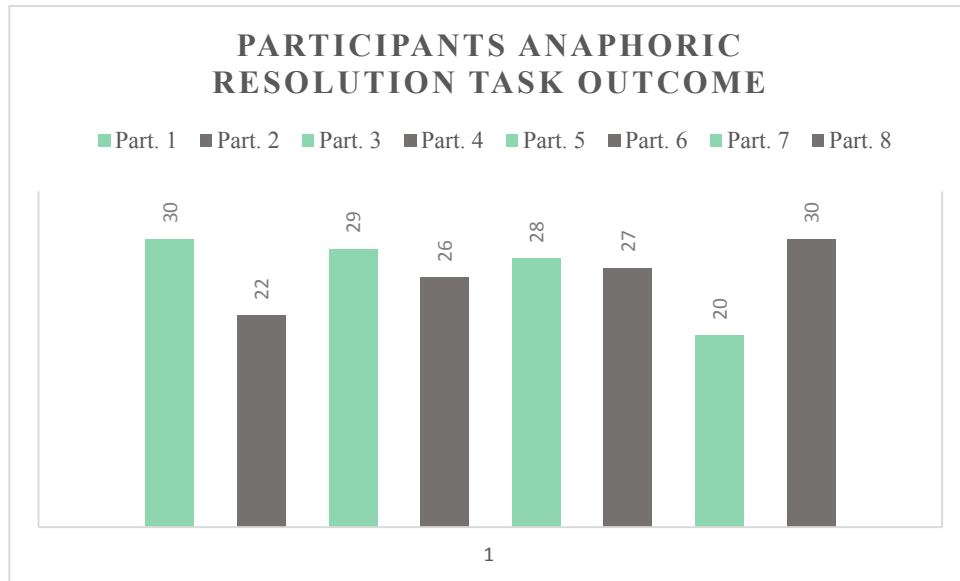
Source: the author (2021).

As indicated in Figure 7, and in contrast to the previous VLT and SNL-WM tests, the maximum attainable score was achieved in this task. Participants 1 and 8 scored 30 points, whereas participants 2 scored 22 points, participant 3 scored 29 points, participant 4 scored 26 points, participant 5 scored 28 points, and participant 6 scored 27 points. The mean and standard deviation values were: $M = 26.50$, $SD = 3.70328$. Appendix K shows the summary of results of the applied test.

Figure 8 presents the subject and object pronouns sentence scores per participant separately.

Figure 8
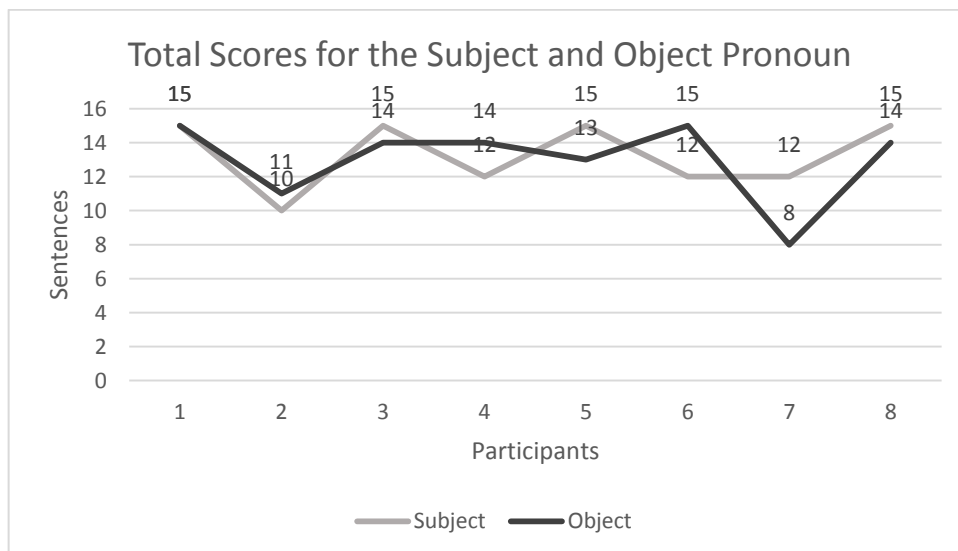
Source: the author (2021).

As can be seen in Figure 8, in processing the resolution of subject pronouns, participants 1, 3, 5, and 8 reached a score of 15, participants 4, 6, and 7 reached a score of 12, and participant 2 reached a score of 10 (M = 13,25; SD = 1.85405). In the processing of anaphora with object pronouns, participants 1 and 6 scored 15 points, participants 3, 4, and 8 scored 14 points, participant 5 reached 13 points, participant 8, 11 points, and participant 7, 8 points (M = 13; SD = 2.236068).

Figure 8 also shows that participants' performance on the resolution of L2 anaphora with subject and object pronouns is approximately the same, with participants doing slightly better on the subject pronoun sentences. With an eight-point score, participant 8 was the only one who scored lower than the other participants in the object pronoun sentences.

4.2 INFERENTIAL ANALYSIS

A Kolmogorov-Smirnov test was run for each test: proficiency (VLT), working memory (SNL-WMT) and anaphora resolution (ART). The results showed all Ds=1 and all $ps1$ < 0.001, indicating that all three variables are not normally distributed. Given the number of participants of the present study (N = 8), and the fact that the data was not normally distributed, which violates the assumptions of Pearson's correlation, the Spearman's Rank Order Coefficient Correlation, a nonparametric test, was adopted to analyze the data and determine if there is a correlation between working memory capacity and anaphora resolution, between vocabulary proficiency and working memory capacity, between anaphora resolution and vocabulary proficiency, and finally, between participants' performance on the working memory capacity test with their subject and object pronoun output separately.

First, it was determined whether there was a correlation between WMC (SNL-WM test) and anaphora resolution (ART). The results show a statistically significant correlation between WMC and L2 anaphora resolution (r_s=0.7409666, p=0.03545). These results can be interpreted as an indication that participants with a higher working memory capacity are also better able to interpret subject and object pronouns in sentences in the L2 correctly. Figure 9 illustrates the association between working memory and anaphora resolution.

Figure 9
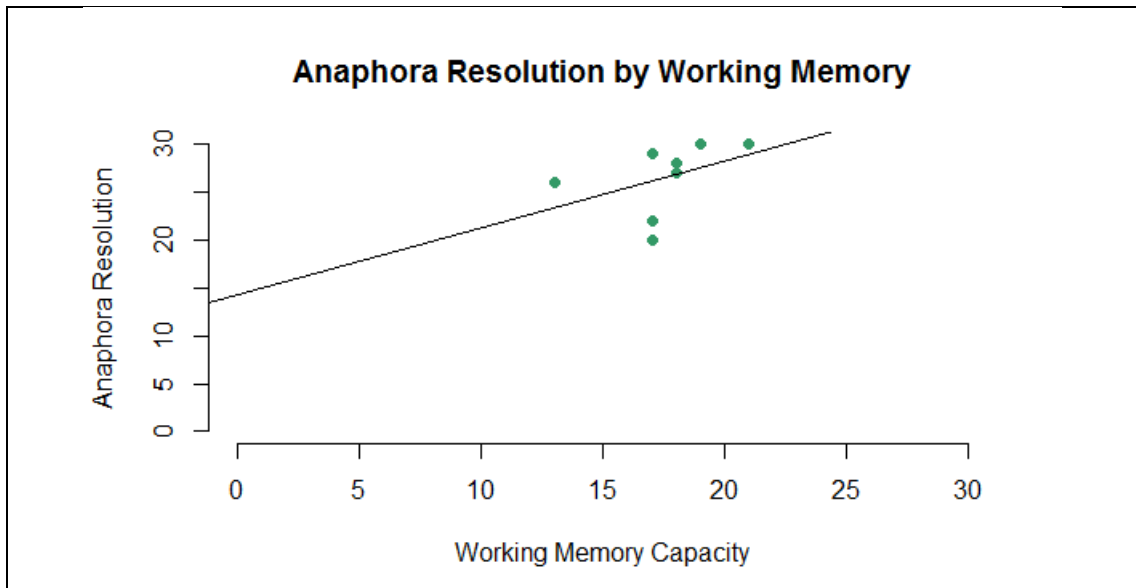
Source: the author (2021)

Second, the correlation between vocabulary proficiency (VLT) and working memory (SNL-WM test) was examined. The results of the Spearman's Rank Order Correlation show that there is a significant association between WMC and L2 proficiency (r_s=0.8224729, p=0.01219). These results can be interpreted as an indication that the participants with a higher WMC also have higher proficiency in English as L2.

Figure 10 illustrates the relationship between vocabulary proficiency and working memory capacity.

Figure 10
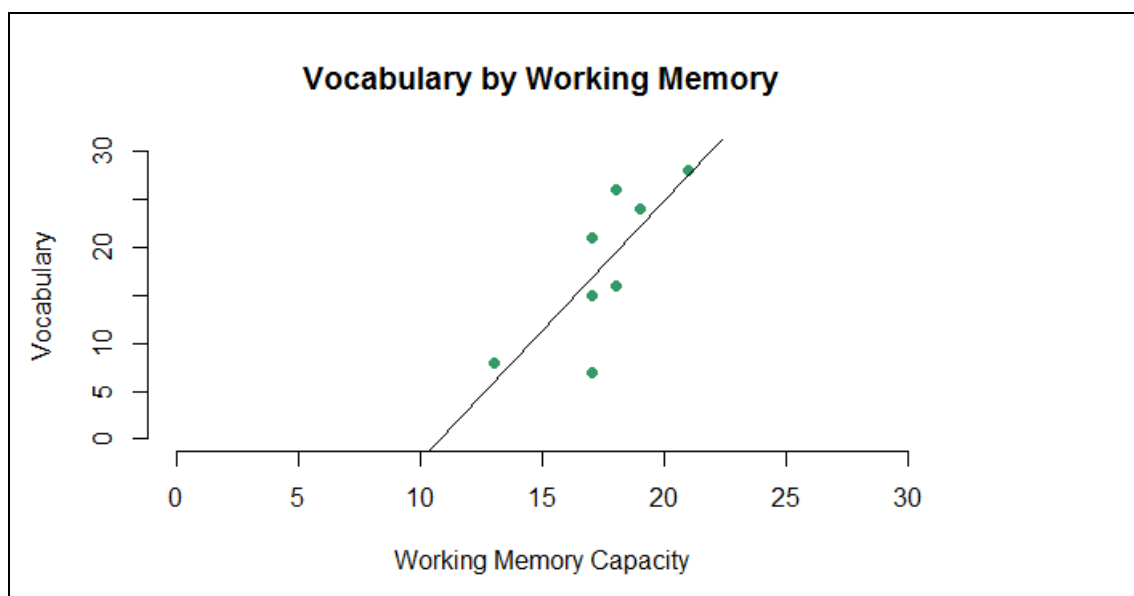
Source: the author (2021).

Third, the correlation between anaphora resolution (ART) and vocabulary proficiency (VLT) was examined. The results of Spearman's Rank Order Correlation showed that the association between anaphora resolution and L2 proficiency is not statistically significant (r_s=0.6227657, p=0.0991). These results can be interpreted as an indication that performance on the anaphoric resolution task is not related to proficiency, as measured by vocabulary knowledge, in the L2.

Figure 11 illustrates the relationship between anaphora resolution and L2 vocabulary proficiency.

Figure 11
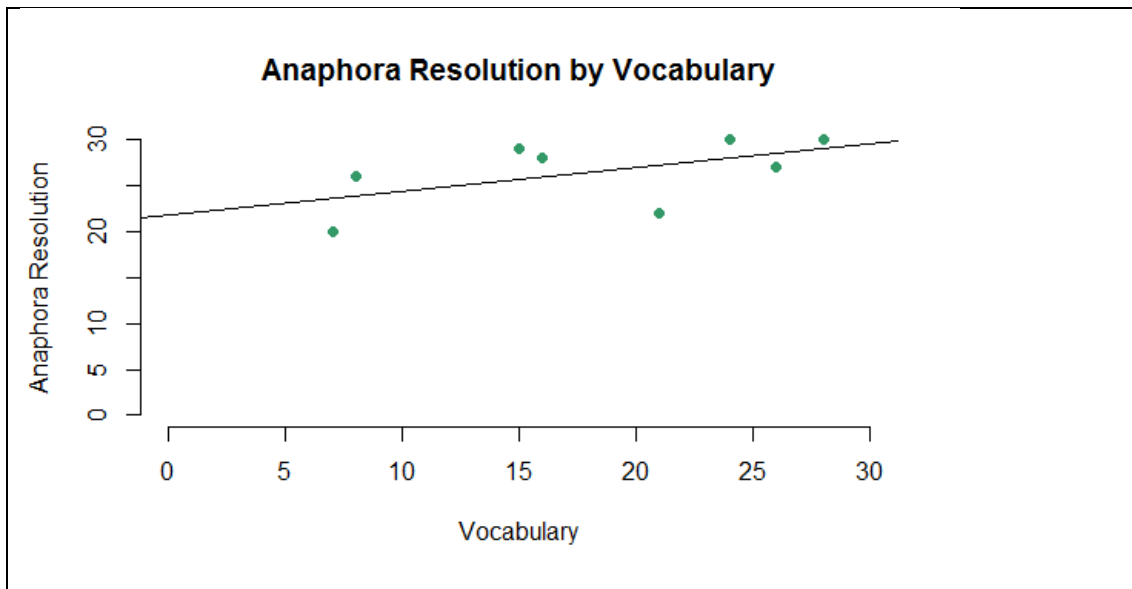
Source: the author (2021).

Finally, we examined the results of Spearman's Rank Order of Correlation for participants' performance on the ART and SNL-WM test, first, with the participant's subject pronoun output, then with the participant's object pronoun output separately. The results show that there is no statistically significant association between WMC and subject pronoun anaphora resolution only (r_s=0.5984081, p=0.1171) nor between WMC and object pronoun anaphora resolution only (r_s=0.5, p=0.207). These results show that, in the present study, even though WMC can be a predictor of anaphora resolution in English as L2 learners, it can not predict when subject pronoun anaphora resolution and object pronoun anaphora resolution separately. As demonstrated by the Spearman's Rank Order Correlation measure, participants with higher working memory capacity tended to demonstrate better performance on the ART. Regarding

the subject and object pronouns, the results were not statistically significant when correlated with WMC, which means that WMC did not seem to predict one's anaphora resolution of the subject or object pronouns separately.

4.3 DISCUSSION

The current study aims at investigating the relationship between working memory and the processing of anaphoric resolution, by examining whether participants' working memory capacity correlates with the interpretation of subject and object pronouns in sentences in English as L2.

Eight students attending the first year of high school in a public school in Florianópolis were required to perform a vocabulary test, aimed at assessing their vocabulary proficiency in English as L2, an L1 working memory test, aimed at assessing their working memory capacity, and an L2 anaphora resolution task, aimed at assessing subject and object pronoun anaphora resolution. The results of Spearman's Rank Order Correlations show that there is a positive correlation between WMC and L2 anaphora resolution, indicating that participants with higher working memory capacity were also better able to correctly interpret subject and object pronouns in L2 sentences, and between WMC and L2 proficiency, indicating that participants with higher WMC also have displayed higher proficiency in English as L2, as measured by a vocabulary test. In addition, there is no statistically significant correlation between anaphora resolution and L2 proficiency, which indicates that anaphora resolution in English as L2 is not associated to L2 proficiency. Finally, no statistically significant relationship was found between WMC and subject pronoun anaphora resolution only, nor between WMC and object pronoun anaphora resolution only. That is, WMC cannot anticipate whether subject and object pronouns separately are relevant in determining the referent of an anaphora.

The positive relationship between WMC and L2 anaphora resolution is in line with Nowbakht (2019, p. 366) who found that WM had a significant role in predicting variation in both anaphoric processing and comprehension. Working memory capacity is characterized as the ability to keep information in an active state while we concurrently process information necessary for the performance of a complex cognitive task, such as anaphora resolution. To perform anaphora resolution, we need to keep possible referents active while processing other information that appears in the sentence to find the correct referent for the anaphoric expression. According to Nowbakht (2019, p. 365), in order to process anaphora, learners use linguistic

information and prior knowledge to create an mental representation of what they read, combining new information with information already given in the text to create a mental representation of the text. In this sense, Nowbakht (2019, p. 365) says that "learners can do this [process anaphora] by identifying and tracking referential continuity, focusing on the text and the shifts on the focus of the text". Another factor that might affect the processing of anaphora resolution is individual differences in learners' WM. That is, "the higher WMC an individual possesses, the faster he/she can resolve the anaphoric expression, find the antecedent, process the text" (NOWBAKHT, 2019, p. 365). Nowbakht (2019) shows that, whereas L2 proficiency is strongly related to anaphora processing and comprehension, it does not have the same significant influence on anaphoric resolution as does WMC.

Furthermore, cues within the sentence may interfere with the retrieval of an anaphora expression. As illustration, consider the following sentence participants were required to read in the ART of the present study: *George is on TV. People like to watch him.* In this sentence we can consider this two plausible cues (TV and watch), which could help participants to understand the sentence, assisting in the resolution of the anaphora. However, in order to come up with the resolution, WMC comes into place because individuals must retain a specific item online (TV) to then match this with a subsequent combination (watch), which would help locating the anaphoric expression (him) for the antecedent who is linked to the previous cues. Participants need to store information temporarily that must be immediately available in working memory, while also simultaneously carrying out a number of operations, such as syntactic and semantic processes (PARKER, 2019, p.30).

An aspect that may have been critical for the participants to be able to resolve the anaphora is put forward by The Centering Theory, which proposes the anaphoric centers principles. According to these principles, individuals recover the referent more readily when a pronoun is employed rather than when the noun is repeated (GORDON et al., 1993). In this sense, the experimental sentences of the present study actually optimized anaphoric processing since they did not lead to the Repeated Name Penalty, which, according to Grodon et al. (1993), can result in processing costs.

Cowan (1015, p. 30) points out that WM characteristics, such as storage, process and limited capacity, may also be understood linguistically. When examined from a psychological standpoint, verbal language can take into account certain WM features. According to Cowan (2015, p. 30), the complexity of the task to be performed will be determined by each individual's

memory capacity. That is, if the task is really demanding, the chance of having a low working memory capacity is high. Cowan (2015, p. 30) explains that people plan in advance to later express themselves with words and that, modifications that are not in accordance with the speaker's L1 jeopardize language processing and might disrupt these planning stages. In order to locate the referent of an anaphoric expression, participants must deal with some competitors along the way (i.e. as they are faced with new information presented by the text/sentence) and, therefore, keep them (competitors) active in memory to later determine which one solves the anaphora.

According to Lyons (1977, p. 647-648), there are general connections between lexemes like demonstratives and third-person pronouns and they are comparable in the sense that they share specific characteristics. Lyons (1977) explains that the personal third-person pronouns, such as those also employed in the stimuli of the anaphoric task of the present study (he, she), are demonstrative pronouns, distinguished in terms of gender and number, but not local indicators. When a demonstrative pronoun (*that*, for example) is used to refer to a reference expression, it indicates the location of the referent, or subject, of the sentence, whereas third-person personal pronouns (such as *he*) provide some information about the referent's qualities and attributes, but they make no mention of its location. While the demonstrative pronoun *this*, for instance, implies someone close to me, the pronoun *she* indicates that the person is female. The first provides information about the antecedent's location, whereas the second provides information about the antecedent's attributes. Lyons (1977, p. 647-648) explains that "clearly, the more information, whether locative or qualitative, that is encoded in a deictic expression, the easier it is for the addressee to identify its referent". Under similar conditions, research has demonstrated that both native and second-language English speakers use gender information to limit possible connections with accessible referents under ambiguous conditions (CUNNINGS, FOTIADOU, TSIMPLI, 2017, p. 27). In light of the above assumption, it's possible to argue that, equally for the anaphoric resolution, the more information available about the referents (encoded), the easier it will be to identify them in expressions that are intended to address them.

The process under which people cope with concurrent information within immediate memory seems to be more holistic than stated. In the case of Cowan's (2015, p. 32) embedded model of WM, the distinction between specific information as a straightforward classification is not so limited to what underpins the function of one's WM. For Cowan (2015), the well-known Baddeley and Hitch (2000) multicomponent WM model, which requires a trinary categorization, is quite elementary. According to this model, (category 1) phonological stimuli

have their own storage, (category 2) visuospatial stimuli have their own storage, and (category 3) stimuli that do not fit into any of these categories go into the episodic buffer. Given the intricacy of our brain's capacity and the synaptic connections that humans may form over the course of their lives, the Baddeley and Hitch (2000) multicomponent WM model appears to be oversimplified. Cowan (2015, p. 32) then suggests, in his proposal for understanding the WM system, that this division is not so limited, especially under circumstances where the language in question is not the speaker's mother tongue. He argues that diverse information might emerge in a coordinated manner within WM and a stimulus might activate many characteristics simultaneously. That is, "the language user may have to interpret orthography and spatial or visual context, as well as semantic and pragmatic context, in addition to phonological information" (Cowan, 2015, p. 32). From this perspective, the different features that arise as a result of the existence of a stimulus would thus enable language processing to take place. Therefore, as stated by Lyons (1977, p. 648), the more information is encoded in a sentence, whether verbal or non-verbal, the easier it is to determine the referent of an anaphoric expression. This assertion might explain why the participants of the present study performed quite well on the ART. They may have used information other than phonological ones. They may have combined a variety of representations, including semantic and pragmatic ones, in a coordinated manner, to help them find the referent for each anaphoric expression. They might also have used the context, as well as their background knowledge, calling upon their long-term memory, to assist them locate the referent for each anaphoric expression.

In psycholinguistics, the coordination between the referent and its anaphoric expression has been the subject of much discussion. How can we understand more broadly the path the participants of the present study went through to form the link between the anaphoric expression and its potential antecedent? What is the language-processing aiding the underlying retrieval process? Parker's (2019) research may be able to offer some insight into the answers to these concerns. The author investigated which type of cue combination is most relevant in accessing the referent of an anaphoric expression based on a computational model, within the realm of the reflexive pronoun's dependency, through a self-paced reading test. Two models of cue combinations were analyzed: linear (summative) and non-linear (build up) rules. Broadly put, the first asserts that each cue contributes directly to an item match, albeit in an independent and cumulative way, whereas the second asserts that cue combinations cannot be independent, since they rely on one another to reach a general degree of correspondence, triggering memory retrieval (PARKER, 2019, p.4-5). Both models, in their own way, argue for the subsequent

reinforcement of memory retrieval. Parker's (2019, 24-25) findings indicated that, in relation to the reflexive pronoun, the non-linear rule showed better results than the linear rule, providing evidence that the retrieval for dependence formation is not linear. Taking this outcome into account, although Parker's (2019) study focused on reflexive pronouns rather than third-person pronouns, as is the case in the present research, his findings may help to elucidate the retrieval process one undergoes while solving the anaphora. The results of his study may indicate that one of the ways to reach the target referent is to combine cues that have a strong association with the referent, bearing in mind the degree of matching, rather than merely considering a mix of diverse cues.

Accuracy is found when there is the proper correlation between the anaphoric expression and its antecedent, or corresponding. Joseph et al. (2015, p. 623) also may help us to understand more clearly how the participants come up with the referents in the ART. According to the authors, semantic reasons underpin this process, which implies that the most accessible anaphora are linked to more suitable referents (JOSEPH et al., p. 623). They claim that there is a significant relationship between an individual's ability to solve anaphora and their reading skills, since the former helps with a more global understanding of the text (p.625). Finally, they are in favor of two aspects that we may consider in order to understand the process an individual goes through while recovering the antecedent, which are: (1) typicality (anaphors that present a semantic link to their referent) and (2) distance (between the antecedent and its anaphoric expression) (JOSEPH et al., 2015).

In light of these two above-mentioned aspects (typicality and distance), let us analyze two examples of the present study stimuli. The stimuli of the present study contain nine items in each ART sentence, with the subject always occurring at the beginning of the sentence. These sentences are composed of two clauses. The referent (subject) appears in the first clause, while the anaphora (whether subject or object pronoun) appears in the second clause. Given that the antecedents and anaphors of the current study's experimental sentences are typical since they agree in number and gender, they are neither atypical nor strange in that sense, and they can be readily matched. In terms of distance, it is feasible to argue that there is a significant length between the antecedent and the anaphoric expression in the case of object pronoun anaphora, but not in the case of subject pronoun anaphora. See the example of the stimuli in (**vii**) and (**viii**).

(**vii**) **Mauro** is quite clever. **He** plays games really well.

(**viii**) **Lola** gives children chocolate. Carla sometimes disagrees with **her**.

In (**vii**), although there are three items between the antecedent and the anaphora, the distance between them is relatively short, but in (**viii**) there are seven items between the antecedent and the anaphora. In his study, Joseph et al (2015, p. 626) manipulated semantic typicality and distance by monitoring participants' eye movement in order to examine the period needed to resolve the anaphora and related this to individual differences in verbal working memory and reading comprehension in children. The findings showed that youngsters aged 10 to 11 years old struggled to solve anaphora in more difficult situations, such as distance and atypicality (p. 637). The findings also revealed that verbal working memory, as well as reading skills, interfere with the ability of children to process anaphora. Considering these findings, we may argue that, as the stimuli of the current research present characteristics that would enhance anaphoric resolution, such as typicality and the short distance between the referent and the anaphora, in the case of subject pronoun, this may have aided the participants' anaphoric processing. On the other hand, in the case of object pronoun, the distance between the antecedent and the object pronoun might have interfered in processing, since the average number of correct answers was lower for object pronouns in comparison to subject pronouns (although the difference between subject and object pronoun resolution was not statistically significant). Participants performed better in subject pronoun sentences, in which the distance between the pronoun and the referent was smaller.

As mentioned by Nowbakht (2019, p. 354), anaphora may appear explicitly or implicitly. Depending on the intricacy of the sentences, anaphoric resolution will be easier or more difficult. In this sense, sentences with an apparent or explicit referent have faster and more accurate retrieval. However, in cases when the sentences include an implicit referent, that is, one that is not evident, Nowbakht (2019) says this implies a higher processing cost for the subjects, as they will have to make a greater effort to find the antecedents, especially in relation to L2 learners. The present study's experimental sentences, included in the ART, show a pattern in terms of both the number of items and the existence of proper names in subject position. The subjects are all found in the first clause, at the beginning of the sentence, which are retrieved later by means of both the subject and the object pronouns within the same sentence. See (**ix**) for an example with a subject pronoun and (**x**) for an example with an object pronoun.

(**ix**) **Marina** frequently does exercises. **She** is feeling very happy. (Subject pronoun)

(**x**) **Bob** sings very beautifully. John Always listens to **him**. (Object pronoun)

The development of the stimuli within this pattern allows us to classify the referents as explicit, resulting in sentences with a low degree of complexity. That is to say, the participants of the present research may have performed well in the anaphoric test precisely because the antecedent was explicitly placed in the sentences, requiring less WM resource allocation and processing costs.

Another aspect that may help us to understand participants' performance on the ART is about pronominal reference, which is related to how a pronoun is understood in light of one's knowledge of the text. According to Frederiksen (1982), there are principles that a reader may employ to help with the process of anaphoric reference using pronoun interpretation techniques. Some textual features of these principles can be explored, according to the author, in order to understand how they can affect the difficulty of locating the antecedent of an anaphoric expression. The first criterion is that, unlike other types of referential expressions, when a pronoun occurs, there is an instant requirement to locate the lexical item that refers to it. Thus, "a pronoun serves the pointer function" (FREDERIKSEN, 1982, p. 3-4), keeping, or retrieving, in immediate memory the possible referents that will be more easily chosen, since pronouns also have the benefit of presenting information about gender and number. The second possible principle is that pronouns appear more frequently than their referents. Therefore, anytime a pronoun is found, it can be replaced with the most recent referent to test if they match. If this does not occur, a fresh reference procedure is initiated. The third possible principle is to establish preferences for reference selection. In this case, the topicalization effect can be used to emphasize some referents, such as when a referent noun phrase is placed in the subject position. Frederiksen's (1982, p. 50) findings demonstrated that the first principle had a beneficial influence on pronominal resolution. Thus, when confronted with a pronoun in a sentence, a list of potential antecedents that agree in number and gender with the pronoun is generated, while also obeying semantic constraints across sentences. Having said that, we may consider the ART stimuli of the present study to have well-defined characteristics, such as the fact that all of the proper names presented in the experimental sentences are singular, thus the referential pronouns used are third-person singular pronouns referring to both the feminine and masculine genders. In light of the aforementioned, we may suggest that the participants in the present research had less difficulty solving the anaphora of each sentence, possibly because they employed Frederiksen's (1982, p. 3) first principle, which advocates the immediate

encounter of the referent when a pronoun appears in a sentence, by locating it using cues such as gender and number.

Contemori, Asiri and Irigoyen (2019) investigated the interpretation of pronoun resolution (anaphoric and cataphoric pronouns) in English (non-null subject language) learners with an intermediate level of proficiency in L2, whose L1 was Mexican Spanish (null subject language). Contemori, Asiri and Irigoyen (2019, p. 975) examined how a specific grammatical structure (i.e. the referent in subject position) interferes with the resolution of subject pronouns, also seeking to find out if different languages differ in how they refer to accessible referents. Contemori, Asiri and Irigoyen (2019, p. 996) findings demonstrate that non-native English speakers have comparable referent choices as native English speakers in simple sentences. Participants locate the referent of the pronoun when the sentences are reasonably simple, with the subject appearing in a prominent position. That is, considering the grammatical role played by the antecedent, a referent in the subject position is more easily interpreted as an antecedent of a pronoun in the subject position than a referent that is not in the subject position (p. 972). Non-natives, on the other hand, struggled to locate the referent when the sentence structure was more complex and the alternative subjects were equally apparent, instead of only one subject being in a prominent position (p. 996). Although there appears to be L1 cross-linguistic interference in L2 learner pronoun resolution in the more complex structure, Contemori, Asiri and Irigoyen (2019, p. 996) could not make this inference since they did not test a group of participants with identical sentence interpretation bias. Similarly, the current study employed simple experimental sentences with the referent in the subject position, or in a prominent position, in the ART, allowing participants to easily identify the pronoun referent. Complex structures with potential referents equally in prominent positions were not used in this study. Thus, the experimental sentences, which are comprised of just one salient referent, contributed to making anaphora resolution easier for the participants.

Cunnings, Fotiadou and Tsimpli (2017, p. 4) examined how L2 speakers from a null subject language (Greek) process and interpret overt pronouns in a non-null subject L2 in a visual world paradigm study, where participants' eye-movements were recorded. They also investigated reanalysis during L2 sentence processing to determine if L2 learners were prone to reanalyzing their first antecedent choice. Participants had to answer a comprehension question after hearing a sentence and viewing some displays. Cunnings, Fotiadou and Tsimpli (2017, p. 27) findings show that as soon as L1 and L2 English speakers were faced with the pronoun, they attempted to resolve the ambiguity by using gender information to limit the possibility of co-reference in relation to the possible referents. The results indicate that L2

English learners, like L1 English speakers, process and interpret overt pronouns in a likely native way (p. 36) even though their native language (Greek) is characterized by null-subject pronouns. Furthermore, as compared to L1 speakers, L2 learners had no greater difficulty in integrating multiple online information sources to resolve ambiguous pronouns (p. 39). Regarding the reanalysis of the first choice English L1 and L2 made in relation to the antecedent, L2 learners were less likely than L1 speakers to revise their initial interpretation of the pronoun referring to the subject of the sentence, when the following information (after the pronoun appeared) contradicted this interpretation (CUNNINGS, FOTIADOU, TSIMPLI, 2017, p. 40). In this regard, as Contemori, Asiri and Irigoyen (2019, p. 996) pointed out, it is difficult to draw strong conclusions about the cross-linguistic interference of L1 on the L2 interpretation of pronominal ambiguities. This is because L2 speakers perform as native speakers when finding the referent of a pronoun, even though their L1 is characterized as a null subject pronoun and their L2 is characterized as a non-null subject pronoun. In the present study, experimental sentences contained either subject pronoun anaphora or object pronoun anaphora. In line with Contemori et al (2019), participants in the present study were more accurate in the resolution of subject pronoun anaphora than in the resolution of object pronoun anaphora, although the difference is not statistically significant. Nevertheless, given participants' accuracy in interpreting anaphora and the fact that in both types of sentences the pronouns are in the same position as in L1 sentences (Brazilian Portuguese), it is possible to assume that cross-linguistic interference did not play a significant role in the processing of anaphora resolution in the L2.

Concerning the L2 leaner's proficiency as a predictor for pronoun resolution, Cunnings, Fotiadou, and Tsimpli (2017) conducted a study including L2 proficiency as a continuous variable. Cunnings, Fotiadou, and Tsimpli (2017, p. 40) did not find strong evidence to assume that successful reanalysis predicted an increase in proficiency, nor did proficiency predict the preference for the correct antecedent when the participants answered the comprehension questions (p. 28). Similarly, Nowbakht (2019) shows that, while his findings provide support for L2 proficiency as related to anaphora processing and comprehension, WMC was more relevant in predicting one's anaphoric resolution than L2 proficiency. Contemori, Asiri and Irigoyen (2019, p. 995), on the other hand, demonstrated that participants with intermediate proficiency can achieve nativelike preferences for subjects in the most prominent position, but that participants with a lower level of proficiency do not always make the same choices as native speakers. Contemori, Asiri, and Irigoyen (2019, p. 994) finding implies that a lower level of proficiency in L2 may have a negative impact on pronominal resolution. In the present study

there was no statistically significant correlation between L2 vocabulary proficiency and anaphora resolution, which might be an indication that L2 vocabulary proficiency did not play a relevant role in participants' choice of the antecedent in subject or object pronoun sentences in L2.

4.4 READDRESSING THE RESEARCH QUESTIONS

In this section, the research questions and hypotheses for the current study are readdressed.

Research question 1– Is there a relationship between working memory capacity and the processing of subject and object pronoun anaphoric resolution in English as L2?

Hypothesis 1 – There is a positive correlation between working memory capacity and the processing of anaphoric resolution in English as L2. Participants with a higher working memory capacity will be better able to relate the anaphoric subject pronoun as well as the anaphoric object pronoun to their respective antecedents.

The results of Spearman's Rank Order Correlation show a statistically significant positive association between WMC and the processing of subject and object pronoun anaphoric resolution by L2 English learners. Participants with a higher working memory capacity were also better able to recover the antecedent of a subject pronoun and of an object pronoun when reading sentences in the L2. These findings are consistent with Nowbakht (2019), who also found empirical evidence that variance in the participants' WM might potentially be added to the consideration that WM can influence anaphoric resolution. According to Nowbakht (2019), variation in participants' WM can have a significant impact on their ability to recover the antecedent and keep track of the referent. WMC plays a role in anaphoric processing since in order to assign the referent to a pronoun comprehenders need to keep the pronoun active while simultaneously processing different types of information in the sentence to find the correct antecedent for the anaphoric expression (PRETORIUS, 2005, p. 522). Anaphora resolution draws on WM because to process the anaphora, the L2 comprehender must hold the pronoun active while locating the antecedent and this concurrent in part explains why WM and anaphora resolution are related to one another (NOWBAKHT 2019, p. 366). As pointed out by Cunnings (2017), the L2 comprehender is more susceptible to interference than L1 speakers in retrieving information from memory during anaphora resolution. For instance, Cunning (2017) states that L2 comprehenders tend to rely more heavily on discourse-based cues to antecedent retrieval

than on local, syntactic cues. In this sense, WM is required for anaphoric resolution because, in order to locate the correct antecedent, it is necessary to maintain active and process different types of information, syntactic and non-syntactic, in order to assign which referent correctly refers to the anaphoric expression. Successfully carrying out memory (storage) and linguistic processing will in part depend on one's individual working memory capacity.

Research question 2– Is there a relationship between working memory capacity and the comprehension of subject and object pronoun anaphoric sentences in English as L2?

Hypothesis 2 – There is a positive correlation between working memory capacity and the comprehension of subject and object pronoun anaphoric sentences in English as L2. Participants with higher WMC are more capable of interpreting L2 subject and object pronouns in sentences.

The answer to the second research question is as well positive and show statistically significant correlations between WMC and comprehension of anaphora. As shown by the tests output, WMC can be said to be related to participants' comprehension of subject and object anaphoric resolution. Participants of the present research were able to answer the comprehension questions correctly, which is indication of their accuracy regarding the resolution of anaphora within each experimental sentence. This result is also consistent with Nowbakht (2019), who showed that WMC could account for 70% of the variation in anaphoric sentence comprehension.

CHAPTER V
FINAL REMARKS

In this chapter, I present the concluding remarks related to the present study. First, I present a summary of the findings (5.1). I also highlight the limitations of the present study, providing suggestions for further research (5.2). Finally, I point out pedagogical implications for the L2 classroom (5.3).

The main objective of the present study was to investigate, based on previous research, the relationship between working memory capacity and anaphoric resolution involving subject and object pronouns, in L2 English learners, at the time of this study attending first year of high school is public schools.

I investigated if participants who could accurately solve anaphora, through ART, were the same who scored better in the memory test (SNL – working memory test). The objective was to look if WMC was a key variable in the processing and the understanding of complex cognitive language processes like anaphoric resolution, as shown in previous studies, however looking to the specific subject matter of subject and object pronouns anaphoric expression. In addition, the present research examined how participants' vocabulary proficiency test results could be associated to one's ability to resolve anaphora. The current study was organized as follows: Chapter I presented the introduction describing the context of the investigation, the significance of the research and the organization of this study. Chapter II brought forward the review of the literature, comprising theoretical and empirical studies. Chapter III within the method, there are the methodological procedures used in the present study for data collection and analysis. Chapter IV outlines the result and discussion where I readdress the research questions. Finally, chapter V presents the final remarks, summing up the results, explaining the limitations of the present research, giving suggestions to further research and justifying pedagogical implication of the findings.

5.1 SUMMARY OF THE FINDINGS

The findings of the current study demonstrate that there is a positive association between WMC and L2 anaphoric resolution and between WMC and L2 vocabulary proficiency, but that there is not a statistically significant correlation between anaphora resolution and L2 vocabulary proficiency. Participants with higher working memory capacity could successively accomplish

the anaphoric resolution task by identifying the referent of the anaphoric expression, whether it was a subject or an object pronoun. Participants with higher working memory capacity also demonstrated better vocabulary proficiency in English as L2. Nevertheless, L2 proficiency and L2 anaphora resolution are not statistically associated in the present study, indicating that variance in one of these variables is not linearly related to variance in the other variable. Finally, results show that there is not a relationship between the interpretation of subject pronoun only or object pronoun only with WMC, which means that WMC cannot anticipate whether subject and object pronouns separately are relevant in determining the referent of an anaphora.

5.2 LIMITATIONS OF THE STUDY AND SUGGESTIONS FOR FURTHER RESEARCH

The present study sought to investigate the relationship between working memory and L2 anaphoric resolution in order to contribute to the field of psycholinguistics, particularly L2 language processing and comprehension, as well as L2 learning.

Although the current study shows that there may be a relationship between WMC and anaphoric resolution, we cannot claim that our findings are completely accurate due to some limitations, which will be discussed below.

Unfortunately, this research took place in a COVID-19 pandemic scenario. At the time of data collection, in person meetings were not possible due to the restrictions related to social distancing. For this reason, data collection took place remotely. The remote data collection affected the quality of the data since, for some of the tests (e.g., the working memory test), a controlled setting, such as a quiet room, would have been ideal. During the application of the tests, some participants were lying on top of their mattresses, with external noise (e.g., dogs barking) and this probably interfered with their performance. Future research should conduct the data collection ideally in person, especially for better control in the memory test.

The COVID-19 pandemic also affected the recruitment of volunteers. Therefore, the second limitation of the present study is its sample size. The findings of the statistical tests should be considered as a tendency since the minimum number of participants required to carry out a statistical test was not achieved in the present study. Therefore, future research should consider a larger sample size as well as meeting the criteria of recruiting at least thirty participants.

The outcome of the vocabulary proficiency exam is another factor to consider. Assuming that the findings of the VLT had no detrimental impact on the anaphoric resolution

test, convincing conclusions can not be drawn due to the small sample size. Future studies can shed light on the issue by investigating whether proficiency is, in fact, a strong influencing factor in pronominal resolution.

Another issue to consider is the anaphoric resolution task, which appeared to be quite easy to perform by the participants. Future research should consider making this task more complex.

In addition, despite being in the same school year, being the same age, and attending the same school (district public schools, in Florianópolis), participants did not have the same gender ratio. The sample included two males and six females. For this reason, future research should ensure participants' genders matched.

The statistical test was also non-parametric due to the limited sample size and the non-normal distribution of the data. Thus, future research should consider recruiting a larger sample size in order to achieve results that are more robust.

Another relevant aspect to take into account is that studies, according to Jackson (2020), pursuing to investigate working memory and L2 learners should take "longitudinal design, measured repeatedly" since these two variables output are dynamic, without fixed characteristics.

In the next section, the pedagogical implications of the present study will be addressed.

5.3 PEDAGOGICAL IMPLICATIONS

According to the results of this study, L2 English learners, who scored better in the memory test (SNL-WM) also performed well in the anaphoric resolution task, thus showing evidence that WMC seems to be related to referent retrieval through anaphoric expressions such as subject and object pronouns. In this sense, the results of this study show how WMC might influence L2 learning by interfering with the processing and interpretation of anaphors. WMC can anticipate how a learner may develop in school (GATHERCOLE, ALLOWAY, 2008) when we look, for instance, at students reading skills and thus teachers may interfere, assisting learners to overcome learning difficulties. Teachers need to be aware that WMC has significant influence on complex cognitive processes such as the understanding and resolution of anaphora. According to Nowbakht (2019) students can enhance their working memory capacity by training to keep various probable antecedents in mind while reading texts. Although the present

study has its limitations, it was noteworthy to corroborate with several studies in the field of the psycholinguistics, indicating how working memory can influence L2 processing. Jackson (2020) states that the relationship between WM and L2 learning depends on different aspects (like age) as well as individual differences. Teachers must be aware that students' understanding of the text will not be accurate if they have difficulties processing anaphora, which according to the outputs of the present study, is related to one's WMC.

The findings of the present study can help L2 teachers understand that students' WMC is also related to the comprehension of grammatical structures associated with pronominal resolution. Pronominal resolution is a type of linguistic processing that poses demands on WM. Depending on their working memory capacity, students will have more or less difficulty identifying the referent of subject or object pronouns in a sentence. In this sense, teachers may consider adopting teaching strategies to optimize students' WMC and, if necessary, provide them with training to enhance their WMC. Of course, for this to be possible, teachers need professional training to learn more about WM and its role in language learning, also keeping in mind that memory tests should only be given by specialists in the field, such as psychologists.

REFERENCES

ADAMS, A. T. et al. **Theories of Working Memory: Differences in Definition, Degree of Modularity, Role of Attention, and Purpose**. Department of Psychological Sciences, University of Missouri, Columbia, 2018. DOI: org/10.1044/2018_LSHSS-17-0114

ARNOLD, J. E. et al. **The rapid use of gender information: evidence of the time course of pronoun resolution from eye-tracking**. University of Pennsylvania, Philadelphia, PA, USA. Received 10 November 1999; received in revised form 22 January 2000; accepted 1 March 2000.

ATKINSON, R. C., SHIFFRIN, R. M. **Human memory: a proposed system and its control processes.** Stanford University. 1968. Disponível em: https://cogs.sitehost.iu.edu/FestschriftForRichShiffrin/pubs/1968%20Human%20Memory.%20Atkinson,%20Shiffrin.pdf

BADDELEY, A. **Working memory**. Science 255.5044, 556-559, 1992.

BADDELEY, A. **Working memory: The interface between memory and cognition**. Journal of Cognitive Neuroscience, 1992, 4, 281–288.

BADDELEY, A. **Working memory: Looking Back and Looking Forward**. Department of Psychology, University of York, 2003.YoYO10 5DD, UK. DOI: 10.1038/nrn1201.

BADDELEY, A. **Working Memory, thought and action.** Department of psychology. University of York, UK, 2007.

BHAT, D.N.S**. Pronouns**. New York: Oxford University Press, 2004.

CAPLAN, D. and WATERS, G. **Verbal working memory and sentence comprehension.** Behavioral and Brain Sciences, 1999. 22(1), 77-94. DOI: 10.1017/S0140525X99001788

CARMINATI, M. H. **The Processing of Italian Subject Pronouns.** PhD Thesis, University of Massachusetts, Amherst, 2002.

CONTEMORI, C., ASIRI, O., IRIGOYEN, E. D. P. **Anaphora Resolution in l2 English: an analysis of discourse complexity and cross-linguistic interference**. Cambridge University Press. Studies in Second Language Acquisition 41, 971–998, 2019. DOI: 10.1017/S0272263119000111.

COWAN, N. et al. **On the capacity of attention: its estimation and its role in working memory and cognitive aptitudes**. Cognitive Psychology. 2005 August; 51(1): 42–100. DOI:10.1016/j.cogpsych.2004.12.001.

COWAN, N. **Working Memory Underpins Cognitive Development, Learning, and Education**. University of Missouri. Educ. Psychol. Rev. 2014 June 1; 26(2): 197–223. DOI: 10.1007/s10648-013-9246-y.

COWAN, N. **Second Language Use, Theories of Working memory and the Vennian Mind in Working Memory in Second Language Acquisition and Processing**. Bristol,

Buffalo and Toronto. Edited by Zhisheng E. Wen, Mailce Borges Mota and Arthur McNeill. Multilingual Matters, 2015.

COWAN, N. **The many faces of working memory and short-term storage.** Department of Psychological Sciences, University of Missouri, Psychonomic Society, Inc. 2016. DOI: 10.3758/s13423-016-1191-6. Accessed in May 2019.

COWAN, N. **Working Memory: The Information You Are Now Thinking of.** In: Wixted, J.T. (ed.), Cognitive Psychology of Memory, Vol. 2 of Learning and Memory: A Comprehensive Reference, 2nd edition, Byrne, J.H. (ed.). pp. 147–161, 2017. Oxford: Academic Press. DOI: org/10.1016/B978-0-12-809324-5.21040-7.

CRYSTAL, D. **A Dictionary of Linguistics and Phonetics**. Blackwell Publishing, 6th Edition, 2008.

CUNNINGS, I. **Parsing and working memory in bilingual sentence processing.** Bilingualism: Language and Cognition, 20, 712–721, 2017.

CUNNINGS, I., FOTIADOU, G., TSIMPLI, I. **Anaphora resolution and reanalysis during L2 sentence processing: evidence from the visual world paradigm**. Studies in Second Language Acquisition, 2017, 39 (4). pp. 621652. DOI: https://doi.org/10.1017/S0272263116000292 Available at http://centaur.reading.ac.uk/66563/

DANEMAN, M. **Working memory as a predictor of verbal fluency**. Journal of Psycholinguistic Research volume 20, pages445–464 (1991) DOI: https://doi.org/10.1007/BF01067637.

DYKE, J. A., JOHNS, C. L., KUKONA, A. **Low working memory capacity is only spuriously related to poor reading comprehension**. Elsevier B.V. Cognition 131, 373–403, 2014. http://dx.doi.org/10.1016/j.cognition.2014.01.007. Accessed in 22 July 2021.

EPOGE, N. K. **Reflexive Anaphora in VP-Elliptical Sentences of ESL Learners in Cameroon**. Syllabus Review 3 (1), 257 – 279, 2012.

ERIKSSON, J. et al. **Neurocognitive Architecture of Working Memory**. 2016. Neuron Perspective. http://dx.doi.org/10.1016/j.neuron.2015.09.020.

FORTKAMP, M. B. M. **Working memory capacity and L2 speech production: An exploratory study**, 2000.

FREDERIKSEN, J. R. **Understanding anaphora: rules used by readers in assigning pronominal referents**. Center for the Study of Reading. University of Illinois at urbana-champaign. Bolt Beranek and Newman inc.50 Moulton stree Cambridge, Massachusetts, april 1982.

GARCÍA, M. et al. **Mental models in propositional reasoning and working memory's central executive. Thinking & Reasoning**. 2007. 13:4, 370 – 393 DOI: 10.1080/13546780701203813 URL: http://dx.doi.org/10.1080/13546780701203813

GARCIA, M. et al. **Executive Functions and the Improvement of Thinking Abilities: the intervention in reading comprehension**. Front. Psychol.7:58. 2016. DOI: 10.3389/fpsyg.2016.00058

GATHERCOLE, S. and ALLOWAY, P. T. **Working Memory and Learning: A Practical Guide for Teachers.** SAGE Publications, 2008. https://www.academia.edu/2651164/Working_Memory_and_Learning_A_Practical_Guide_for_Teachers_-_By_Susan_E._Gathercole_and_Tracy_Packiam_Alloway. Accessed in May 2019.

GERNSBACHER, M. A. **Mechanisms that improve referential access.** University of Oregon. HHS Public Access. *Cognition*. Author manuscript available in PMC 2015 June 15.

GORDON, P. C. GROSZ, B. J., GILLIOM, L. A. **Pronouns, Names, and the Centering of Attention in Discourse.** Cognitive Science. 17, p.311-347, 1993. https://doi.org/10.1207/s15516709cog1703_1. Accessed in February 2019.

GROSJEAN, F. **Processing mixed language: issues, findings, and models**. *In*: WEI, L. The Bilingualism Reader, New York, 2005. cap. 18, p. 408-434.

JACKSON, D. O. **Working memory and second language development: A complex, dynamic future?** Studies in Second Language Learning and Teaching. Department of English Studies, Faculty of Pedagogy and Fine Arts, Adam Mickiewicz University, Kalisz. SSLLT 10 (1). 2020. 89-109. http://dx.doi.org/10.14746/ssllt.2020.10.1.5 http://pressto.amu.edu.pl/index.php/ssllt

JAEGGI, S. M. ET AL. **Short- and long-term benefits of cognitive training.** Department of Psychology, University of Michigan, Ann Arbor, MI 48109-1043, 2011. DOI: 10.1073/pnas.1103228108. Accessed in 24 July 2021.

JOSEPH, H. et al. **Working memory, reading ability and the effects of distance and typicality on anaphor resolution in children**. Journal of cognitive psychology, Hove, England, 2015. *27*(5), 622–639. DOI:10.1080/20445911.2015.1005095

KEATING, G. D.; JEGERSKI, J.; VANPATTEN, B. **Online processing of subject pronouns in monolingual and heritage bilingual speakers of Mexican Spanish.** Bilingualism: Language and Cognition 19 (1), 2016, 36–49. Cambridge University Press 2014. DOI: 10.1017/S1366728914000418.

KARIMI, H., SWAAB, T. Y., FERREIRA, F. **Electrophysiological evidence for an independent effect of memory retrieval on referential processing**. Journal of Memory and Language 102, p. 68–82, 2018. Disponível em: https://doi.org/10.1016/j.jml.2018.05.003

KREMMEL, B.; SCHMITT, N. **Vocabulary Levels Test**. The TESOL Encyclopedia of English Language Teaching, 2018. DOI: 10.1002/9781118784235.eelt0499. Accessed in 12 of December 2019. file:///C:/Users/Sony/Downloads/Kremmel%20&%20Schmitt_VLT%20(2).pdf

LEWIS, R.,VASISHTH, S., DYKE, J. V. **Computational principles of working memory in sentence comprehension.** Trends in Cognitive Science, 10(10): 447–454, 2006. DOI: https://doi.org/10.1016/j.tics.2006.08.007. Accessed in 23 July 2021.

LINCK, J. A. et al. **Working memory and second language comprehension and production: A meta-analysis**. Psychonomic Society, Inc. Psychon Bull Rev, 2014. 21:861–883. DOI: 10.3758/s13423-013-0565-2 LOOS E. E et al. SIL Glossary of Linguistic Terms. 2003. Disponível em: <http://Website URL>. Acesso em: 25 fev. 2020.

LYONS, J. **Semantics: Volume 2**. Cambridge University Press, 1977.
MILLER, G. A., GALANTER, E., PRIBRAM, K. H. **Plans and the Structure of Behavior**. Harvard University. Library of Congress Catalog Card Number: 60-7982. United States of America, 1960.

FOSSARD, M. et al. **Working memory and semantic involvement in sentence processing: A case of pure progressive amnesia**. Neuropsychologia, 335–338, 2006. doi:10.1016/j.neuropsychologia.2005.06.007

MIYAKE, A. **Models of Working Memory: Mechanisms of Active Maintenance and Executive Control.** 1st edition. Cambridge University Press, April 13, 1999.

MOTA, M. B. **Sistemas de memória e processamento da linguagem: um breve panorama.** Revista LinguíStica / Revista do Programa de Pós-Graduação em Linguística da Universidade Federal do Rio de Janeiro. Volume 11, número 1, junho de 2015, p. 205-215. ISSN 2238-975X 1. http://www.letras.ufrj.br/poslinguistica/revistalinguistica. DOI: 10.17074/2238-975X.2015v11n1p205.

NATION, I. S. P. **Teaching and learning vocabulary**. Boston, MA: Heinle and Heinle. 1990.

NATION, I.S.P. **How Large a Vocabulary Is Needed For Reading and Listening?** The Canadian Modern Language Review, 2006.

NOWBAKHT, M. **The Role of Working Memory, Language Proficiency and Learners' Age in Second Language English Learners' Processing and Comprehension of Anaphoric Sentences**. Journal of Psycholinguistic Research, 2019. 48:353–370 https://doi.org/10.1007/s10936-018-9607-2.

PARKER, D. **Cue Combinatorics in Memory Retrieval for Anaphora**. Department of English, Linguistics Program, College of William & Mary. Cognitive Science, 2019, 43 e12715 Cognitive Science Society, Inc. ISSN: 1551-6709 online DOI:10.1111/cogs.12715

PRETORIUS, E. J. **English as a second language learner differences in anaphoric resolution: Reading to learn in the academic context**. United States of America. Applied Psycholinguistics 26 (2005), 521–539. DOI: 10.1017.S0142716405050289

SCHMITT, N.; SCHMITT, D.; CLAPHAM, C. **Developing and exploring the behaviour of two new versions of the Vocabulary Levels Test**. Language Testing 2001; 18; 55. Sage

publication. DOI: 10.1177/026553220101800103. Accessed in 14 of January 2020.
http://ltj.sagepub.com/cgi/content/abstract/18/1/55

SCHIMTT, N.; SCHMITT, D. **A reassessment of frequency and vocabulary size in L2 vocabulary teaching**. Language Teaching, 47, pp 484-503, 2014. DOI: 10.1017/S0261444812000018. Accessed in 22 of January 2020. https://afa4be34-0fda-46d9-8e64 5adf13d4216b.filesusr.com/ugd/5f2482_cd19ecc5ed2942fc8cc67dd38f2d7c04.pdf

SCHMITT, Norbert. **Journal Articles. Developing and exploring the behaviour of two new versions of the Vocabulary Levels Test**, 2001. Disponível em: https://www.norbertschmitt.co.uk/vocabulary-resources. Acesso em: 28 de abril, 2020.

SCHUSTER, E. **Anaphoric Reference to Events and Actions: A Representation and its Advantages**. Department of Computer and Information Science University of Pennsylvania Philadelphia, PA 19104-6389, 1988.

SEIGNEURIC, A.; MEGHERBI, H. **Working memory capacity and pronoun processing in children.** Elsevier france-editions scientifiques medicales Elsevier, 2008. DOI: 10.1016/j.psfr.2008.02.005

SERRATRICE, L. **Cross-linguistic influence in the interpretation of anaphoric and cataphoric pronouns in English–Italian bilingual children.** Bilingualism: Language and Cognition, p 225 – 238, 2007. DOI: 10.1017/S1366728907003045.

SORACE, A.; FILIACI, F. **Anaphora resolution in near-native speakers of Italian.** University of Edinburgh. *Second Language Research* 22, 3 (2006); pp. 339–368

SOUZA, R. A.; SOARES-SILVA, J. **Exploring the measurement of vocabulary size to differentiate brazilian portuguese-english bilinguals' access to grammatical knowledge in the l2**. Revista LinguíStica / Revista do Programa de Pós-Graduação em Linguística da Universidade Federal do Rio de Janeiro. Volume 11, número 1, junho de 2015, p. 187- 204. ISSN 1808-835X 1. http://www.letras.ufrj.br/poslinguistica/revistalinguistica. DOI: 10.17074/2238-975X.2015v11n1p187

STEEN A. A., STINE-MORROW E. A. L. **Language: Comprehension**. In: Pachana N. (eds) Encyclopedia of Geropsychology. Springer, Singapore, 2016. https://doi.org/10.1007/978-981-287-080-3_220-1

VASISHTH, S. ET AL. **Computational models of retrieval processes in sentence processing**. Trends in Cognitive Science, 23, 968-982, 2019. DOI: https://doi.org/10.1016/j.tics.2021.07.002. Accessed in 22 July 2021.

WEBB, S.; SASAO, Y.; BALANCE, O. **The updated Vocabulary Levels Test. Developing and validating two new forms of the VLT**. University of Western Ontario, Kyoto University, Victoria University of Wellington. ITL – International Journal of Applied Linguistics 168:1, 2017, 33–69. DOI: 10.1075/itl.168.1.02web. Accessed in 11 of January, 2020. file:///C:/Users/Sony/Downloads/Web%20et%20al%202017%20 (2).pdf

WEBB, Stuart. **BNC/COCA headword lists. Updated Vocabulary Levels Test Version B,** 2017. Disponível em: https://www.edu.uwo.ca/faculty-profiles/stuart-webb.html Acesso em: 05 de maio, 2020.

WECHSLER, D. **WISC-IV - Escala de Inteligência Wechsler para Crianças**. Pearson / Casa do Psicólogo, 4ª edição, 2013.

WEN, Z. E. **Working Memory in Second Language Acquisition and Processing: The Phonological/Executive Model**. Bristol, Buffalo and Toronto. Edited by Zhisheng E. Wen, Mailce Borges Mota and Arthur McNeill. Multilingual Matters, 2015.

APPENDIX A – Letter of Consent Addressed to Participants Legal Representatives

Termo de consentimento endereçada aos responsáveis legais pelos participantes

Universidade Federal de Santa Catarina – UFSC
Centro de Comunicação e Expressão
Programa de Pós-Graduação em Inglês – Estudos Linguísticos e Literários
Pesquisa: **Preenchendo as Lacunas entre a Capacidade da Memória de Trabalho e a Resolução Anafórica: o processamento dos pronomes sujeito e objeto em L2.**
Mestranda: Fabiana Osvaldete dos Santos
Orientadora: Drª. Mailce Borges Mota

Termo de Consentimento Livre e Esclarecido (TCLE)

Senhores Pais/responsáveis,

Eu, Fabiana Osvaldete dos Santos, aluna de Mestrado do Programa de Pós-Graduação em Inglês – Estudos Linguísticos e Literários, sob orientação da professora Dra. Mailce Borges Mota na Universidade Federal de Santa Catarina – UFSC, com a autorização da Escola de Educação Básica Júlio da Costa Neves, em Florianópolis, gostaria de solicitar sua autorização para que seu/sua filho(a) seja convidado(a) a participar da minha pesquisa, intitulada **Preenchendo as Lacunas entre a Capacidade da Memória de Trabalho e a Resolução Anafórica: o processamento dos pronomes sujeito e objeto em L2.**

O objetivo geral dessa pesquisa é investigar a relação entre a memória de trabalho e o processamento da resolução anafórica. A memória de trabalho é caracterizada como a capacidade que um indivíduo tem de manter e usar informações por um período curto de tempo. Já o processamento de resolução anafórica é quando conseguimos, no caso específico desta pesquisa, associar um pronome ao seu referente, numa sentença, em língua inglesa. O público-alvo desta pesquisa serão falantes do português brasileiro, aprendizes de inglês como segunda língua, na faixa etária entre 15 e 16 anos.

Gostaríamos de convidar seu/sua filho(a) para participar como voluntário(a) deste estudo, com seu consentimento. Se seu/sua filho(a) aceitar o convite para participar da pesquisa, ele/ela será solicitado(a) a responder um questionário sobre a experiência dele/dela com a língua inglesa. Em seguida, ele(a) realizará uma tarefa sobre proficiência em vocabulário na língua inglesa. Após essa tarefa, ele(a) realizará uma tarefa sobre capacidade de memória de trabalho, que consiste em atividades de curta duração adequadas à faixa etária do participante. E por fim, ele(a) realizará uma tarefa de resolução anafórica, ou seja, em que irá ler frases em língua inglesa e associar alternativas a essas frases. O questionário de experiência linguística, a tarefa de vocabulário, a tarefa de capacidade de memória de trabalho e a tarefa de resolução anafórica serão aplicados individualmente.

A realização destas atividades não representa grandes riscos ao seu filho(a), mas seu filho(a) pode se sentir um pouco cansado(a), desconfortável, entediado(a), constrangido(a) ao se expor durante a realização das tarefas, ou com dor nas vistas por ter que ler várias sentenças no computador. Contudo, caso ele/ela sinta qualquer desconforto no momento da realização das

tarefas, seu/sua filho(a) pode desistir de realizar as tarefas a qualquer momento, sem prejuízo de qualquer natureza para ele/ela. Farei o possível para que a realização das tarefas seja tranquila e agradável. Darei intervalos entre uma tarefa e outra e me certificarei de que ele/ela só vai começar a próxima tarefa quando sinalizar que quer começar.

Mesmo não havendo benefícios, ou compensação, diretos aos participantes desta pesquisa, os resultados do estudo podem contribuir com o desenvolvimento da área de aprendizagem de língua inglesa.

Ao analisar os resultados dessa pesquisa, farei o possível para manter as informações de seu/sua filho(a) sigilosas. Não divulgarei nomes ou qualquer identificação pessoal dos participantes (ainda que eles precisem colocar o nome e a idade nas folhas das tarefas, essas informações têm como única função garantir que a pesquisadora não misture as folhas dos alunos). Embora em toda pesquisa haja o risco de quebra de sigilo, me comprometo a fazer tudo que estiver ao meu alcance para manter sigilosas as informações pessoais dos participantes. Codificarei os resultados individuais e cada participante receberá um número. Os dados serão mantidos, por um período de cinco anos após o término da pesquisa, em arquivo físico ou digital, sob minha guarda e responsabilidade, bem como da orientadora, e somente eu e a orientadora teremos acesso. Após esse período, os dados serão descartados.

Caso haja despesa comprovadamente relacionada à participação de seu/sua filho/a nessa pesquisa, haverá ressarcimento. Caso haja danos e indenização por possíveis danos comprovadamente resultantes da participação na pesquisa, seu/sua filho/a será indenizado. A pesquisa acontecerá no mesmo período das aulas de língua inglesa, porém será criada uma sala virtual, onde somente a pesquisadora e um participante por vez acessarão, para que as tarefas sejam realizadas individualmente. O tempo previsto para realização das tarefas é de 15 a 20 minutos. Seu/sua filho/a não será prejudicado pela ausência temporária na aula, pois combinarei com ele/ela e o(a) professor(a) o melhor momento para a realização das tarefas.

Informo que o/a Sr.(a) tem a garantia de acesso, em qualquer etapa do estudo, a qualquer esclarecimento sobre o estudo. Se tiver alguma consideração ou dúvida sobre a pesquisa, entre em contato pelos e-mails: fabfabi@gmail.com ou mailce@cce.ufsc.br ; ou pelo fone (48)984246337, da pesquisadora.

Caso o/a Sr.(a) queira entrar em contato direto com o Comitê de Ética em Pesquisa com Seres Humanos (CEPSH-UFSC), ele está localizado no Prédio Reitoria II, 4ºandar, sala 401, localizado na Rua Desembargador Vitor Lima, nº 222, Trindade, Florianópolis. Telefone para contato: 3721-6094. Horário de atendimento: Segunda à sexta-feira, das 7h às 19h.

O CEPSH é um órgão colegiado interdisciplinar, deliberativo, consultivo e educativo, vinculado à Universidade Federal de Santa Catarina, mas independente na tomada de decisões, criado para defender os interesses dos participantes da pesquisa em sua integridade e dignidade e para contribuir no desenvolvimento da pesquisa dentro de padrões éticos.

O/a Sr.(a) terá livre acesso às informações desta pesquisa sempre que julgar necessário, bem como a garantia de o participante se retirar da pesquisa sem qualquer prejuízo. Como informado acima, seu/sua filho(a) pode desistir de participar desta pesquisa a qualquer momento que ele/ela desejar, sem qualquer prejuízo ou punição para ele/ela.

Eu me comprometo, de acordo com a Resolução 510/16 do Conselho Nacional de Saúde, e conforme as orientações éticas e de proteção aos participantes da pesquisa, a utilizar os dados coletados somente para pesquisa e os resultados serão apresentados na forma de Dissertação de Mestrado e veiculados através de artigos científicos em revistas especializadas e/ou em encontros científicos e congressos.

O participante receberá acompanhamento e assistência durante todo o período da pesquisa. Por exemplo, o pesquisador estará presente junto do participante quando este estiver realizando as tarefas, bem como estará disponível para prestar qualquer assistência que o participante necessitar ou acionará pessoal competente para isso.

Esse documento deve ser assinado em duas vias, todas as páginas rubricadas, pelo Sr.(a) e pela pesquisadora, ficando uma via com o/a Sr.(a) e outra com a pesquisadora. A assinatura deste documento me permite convidar seu/sua filho/a para participar da pesquisa e usar os dados coletados. A sua via deverá ser guardada por você, pois isso assegurará os direitos do seu/sua filho(a) como participante.

Abaixo está o consentimento livre e esclarecido para ser assinado caso não tenha ficado qualquer dúvida.

Termo de Consentimento Livre e Esclarecido

Concordo voluntariamente em permitir a participação do(a) meu(minha) filho(a) na pesquisa intitulada, **Preenchendo as Lacunas entre a Capacidade da Memória de Trabalho e a Resolução Anafórica: o processamento dos pronomes sujeito e objeto em L2,** de autoria de Fabiana Osvaldete dos Santos. Obtive da pesquisadora todas as informações que julguei necessárias para me sentir esclarecido(a) e optar por livre e espontânea vontade consentir que meu filho(a) seja convidado a participar.

Poderei retirar o meu consentimento a qualquer momento, antes, durante ou após a pesquisa, sem penalidade, prejuízo ou perda de qualquer benefício que eu possa ter adquirido.

Por favor escolha uma das opções:

☐ Declaro que li e compreendi as informações do **Termo de Consentimento Livre e Esclarecido**. Compreendo o objetivo do estudo bem como os procedimentos que serão realizados. Eu compreendo meus direitos como responsável legal do/a participante da pesquisa, concordo que meu/minha filho/a participe deste estudo e em ceder os dados para a pesquisa.

☐ Não aceito participar da pesquisa.

APPENDIX B – Letter of Consent Addressed to Participants

Termo de assentimento endereçado aos participantes

Universidade Federal de Santa Catarina – UFSC
Centro de Comunicação e Expressão
Programa de Pós-Graduação em Inglês – Estudos Linguísticos e Literários
Pesquisa: **Preenchendo as Lacunas entre a Capacidade da Memória de Trabalho e a Resolução Anafórica: o processamento dos pronomes sujeito e objeto em L2.**
Mestranda: Fabiana Osvaldete dos Santos
Orientadora: Drª. Mailce Borges Mota

Termo de Assentimento Livre e Esclarecido para os participantes (TALE)

Olá, tudo bem?

Meu nome é Fabiana Osvaldete dos Santos. Sou aluna de mestrado da Universidade Federal de Santa Catarina e você está sendo convidado(a) a participar da minha pesquisa, intitulada **Preenchendo as Lacunas entre a Capacidade da Memória de Trabalho e a Resolução Anafórica: o processamento dos pronomes sujeito e objeto em L2.**

Essa pesquisa tem por objetivo descobrir o papel de um tipo de memória, chamada de memória de trabalho, ao identificar o referente de um pronome sujeito ou objeto na língua inglesa. Como vamos descobrir isso? Contando com a sua participação na pesquisa.

O que você vai precisar fazer? 1 – Um exercício sobre vocabulário. Você vai relacionar palavras da língua inglesa de uma coluna com a outra. 2 - Alguns exercícios que envolvem a memória. Por exemplo, o pesquisador vai ler uma sequência de números e letras e você precisa repeti-las, primeiro dizendo os números em ordem crescente e depois as letras em ordem alfabética. 3 – Um exercício sobre pronomes e seus referentes numa frase. Você fará a leitura de frases no computador, com a ferramenta PowerPoint e depois deverá escolher entre três alternativas qual delas melhor se relaciona com a frase lida anteriormente.

As tarefas são simples, mas você pode se sentir cansado(a), desconfortável, entediado(a), constrangido(a) ao se expor durante a realização das tarefas, ou com dor nas vistas por ter que ler frases no computador. Se isso acontecer, você pode parar para descansar um pouco. Você pode desistir de realizar a tarefa a qualquer momento, sem prejuízo de qualquer natureza. Farei o possível para que a realização das tarefas seja tranquila e agradável. Você terá acompanhamento e assistência durante todo o período da pesquisa. Por exemplo, eu estarei presente enquanto você estiver realizando as tarefas, bem como estarei disponível para prestar qualquer assistência que você possa precisar.

Informações sobre sua identidade pessoal não serão divulgadas em nenhum momento da pesquisa. Mesmo que em toda pesquisa haja o risco de quebra de sigilo, me comprometo a fazer tudo que estiver ao meu alcance para manter sigilosas as suas informações pessoais. Codificarei os resultados individuais e cada participante receberá um número. Os dados serão mantidos,

por um período de cinco anos após o término da pesquisa, em arquivo físico ou digital, sob minha guarda e responsabilidade, bem como da orientadora, e somente eu e a orientadora teremos acesso. Após esse período, os dados serão descartados.

Caso haja despesa comprovadamente relacionada à sua participação nessa pesquisa, você será ressarcido. Caso haja danos e indenização por possíveis danos comprovadamente resultantes da participação na pesquisa, você será indenizado. Você não será prejudicado pela ausência temporária na aula, pois combinarei com você e com o seu/sua professor(a) o melhor momento para a realização das tarefas.

Você não será de modo algum prejudicado(a) caso não queira mais participar das atividades por algum motivo ou se achar que não tenha realizado bem alguma das tarefas.

Você será um/a grande colaborador (ra) da Professora Fabiana Osvaldete dos Santos e para a ciência.

<u>**Termo de Assentimento Livre e Esclarecido**</u>

Concordo voluntariamente em participar da pesquisa intitulada **Preenchendo as Lacunas entre a Capacidade da Memória de Trabalho e a Resolução Anafórica: o processamento dos pronomes sujeito e objeto em L2**, de autoria de Fabiana Osvaldete dos Santos. Obtive da pesquisadora todas as informações que julguei necessárias para me sentir esclarecido(a) e optar por livre e espontânea vontade em participar dessa pesquisa.

Poderei retirar o meu consentimento a qualquer momento, antes, durante ou após a pesquisa, sem penalidade, prejuízo ou perda de qualquer benefício que eu possa ter adquirido.

_____ Data _____/_____/_____

Assinatura e nome do (a) participante

_____ Data _____/_____/_____

Assinatura da pesquisadora

Declaro que li e compreendi as informações do Termo de Assentimento **Livre e Esclarecido. Compreendo o objetivo do estudo bem como os procedimentos que serão realizados. Eu compreendo meus direitos como voluntário(a) da pesquisa, concordo em participar deste estudo e em ceder meus dados para a pesquisa.**

APPENDIX C – Letter of Consent from Institution

ESTADO DE SANTA CATARINA
SECRETARIA DE ESTADO DA EDUCAÇÃO
COORDENADORIA REGIONAL DA GRANDE FLORIANÓPOLIS
SUPERVISÃO DE GESTÃO DE REDE
R. das Camélias ,345 – Kobrasol – Ed. Empresarial Açores -São José – SC Fone: (48) 36656608

Ofício nº 016/SGR/2020   São José, 13 de janeiro de 2020.

Senhores Gestores

Com nossos cumprimentos, vimos por meio deste, **AUTORIZAR** a acadêmica: **Fabiana Osvaldete dos Santos**, regularmente matriculadas no Curso de Mestrado no Programa Pós-Graduação em Inglês da Universidade Federal de Santa Catarina, a realizar a partir de 06/02/2020 a aplicação do Projeto de Pesquisa "Preenchendo as Lacunas entre a Capacidade da Memória de Trabalho e a Resolução Anafórica em inglês como L2: os casos dos pronomes sujeito e objeto" .

O projeto tem como objetivo investigar o fenômeno linguístico, denominado resolução anafórica, na leitura de frases em inglês por alunos do Ensino Médio. A aplicação se dará nas escolas EEB Júlio da Costa Neves e EEM Vereador Oscar da Conceição – Escola Jovem do Sul da Ilha.

O responsável pela pesquisa é a Professora Drª Mailce Borges Mota , do Departamento de Língua e Literatura Estrangeiras.

Somos **FAVORÁVEIS** à aplicação do projeto, porém ressaltamos que as informações obtidas deverão ser utilizadas exclusivamente para fins pedagógicos de seus estudos, sendo conservada no anonimato a identificação dos sujeitos ao longo das atividades, assim como, não colocá-los em momento algum em situação de risco, constrangimento ou exposição vexatória.

Sem mais para o momento.
Atenciosamente

Júlio Cesar da Silva
Supervisor de Gestão de Rede

Marcelo Santino Machado
Técnico

Ilmos. Srs.
Diretores da EEB Júlio da Costa Neves e EEM Vereador Oscar da Conceição

APPENDIX D – Personal and Language Background Questionnaire

Questionário sobre informações pessoais e de experiência linguística do participante.

Universidade Federal de Santa Catarina – UFSC
Centro de Comunicação e Expressão Pós-Graduação em Inglês – Estudos Linguísticos e Literários Pesquisa: **Preenchendo as Lacunas entre a Capacidade da Memória de Trabalho e a Resolução Anafórica: o processamento dos pronomes sujeito e objeto em L2.** Mestranda: Fabiana Osvaldete dos Santos Orientadora: Drª Mailce Borges Mota

Questionário sobre informações pessoais e de experiência linguística do participante.

Section 1 of 4

Preenchendo as Lacunas Entre a Capacidade da Memória de Trabalho e a Resolução Anafórica: o processamento dos pronomes sujeito e objeto em L2.

Form description

Email *

Valid email

This form is collecting emails. Change settings

Questionário sobre Informações pessoais e experiência linguística

Instruções: Por favor, responda as questões a seguir.

Nome *

Short answer text

Data de nascimento *

Month, day, year

Sexo *

◯ Masculino

◯ Feminino

Nacionalidade *

Short answer text

Repetente? *

◯ Sim

◯ Não

Levantamento Sobre a Experiência Linguística do Participante

Instruções: Por favor, responda as questões a seguir.

1. A partir de que ano escolar você tem aulas de Inglês na escola? *

Short answer text

2. Qual habilidade você acha mais importante sobre aprendizado da Língua Inglesa? *

○ Falar

○ Ouvir

○ Ler

○ Escrever

3. Você já estudou ou estuda Inglês fora da escola? *

○ Sim

○ Não

4. Você já frequentou ou ainda frequenta algum curso de idiomas ou aulas particulares de Inglês? *

○ Sim

○ Não

5. Se você já estudou ou estuda Inglês fora da escola, diga por quanto tempo. *

◯ De 6 meses a 1 ano

◯ De 1 a 2 anos

◯ De 2 a 3 anos

◯ Mais de 3 anos

◯ Nunca estudei Inglês fora da escola

6. Se você já estudou ou estuda inglês fora da escola, indique a frequência de suas aulas? *

◯ 1 vez por semana

◯ 2 vezes por semana

◯ Mais de 2 vezes por semana

◯ Nunca estudei Inglês fora da escola

7. Você acha importante aprender a língua inglesa? *

◯ Sim

◯ Não

8. Você usa a língua inglesa fora da sala de aula? Se sim, qual situação você mais usa? *

◯ Usando a Internet

◯ Usando jogos eletrônicos

◯ Assistindo séries e filmes

◯ Lendo livros e revistas

◯ Ouvindo músicas

◯ Não uso a língua inglesa fora da sala de aula

Preenchendo as Lacunas Entre a Capacidade da Memória de Trabalho e a Resolução Anafórica: o processamento dos pronomes sujeito e objeto em L2.

Muito obrigada por você ter respondido o questionário. Fico muito feliz e agradeço por ter dedicado um tempinho para colaborar com a minha pesquisa.

Para finalizar, clique em "Enviar" logo abaixo.

Muito Obrigada.

Atenciosamente,
Fabiana Osvaldete dos Santos

Source: the author (2021).

APPENDIX E – The Vocabulary Levels Test

Sample of the Vocabulary Levels Test, adapted by the researcher and presented to the participants.

	1	2	3	4	5	6
	game	island	mouth	movie	song	yard
A land with water all around it						
B part of your body used for eating and talking						
C piece of music						

	1	2	3	4	5	6
	game	island	mouth	movie	song	yard
A land with water all around it		✓				
B part of your body used for eating and talking			✓			
C piece of music					✓	

The updated Vocabulary Levels Test (Webb, Sasao, & Ballance, 2017)

This is test that looks at how well you know useful English words. Put a check under the word that goes with each meaning. Here is an example.

	game	island	mouth	movie	song	yard
land with water all around it						
part of your body used for eating and talking						
piece of music						

It should be answered in the following way.

	game	island	mouth	movie	song	yard
land with water all around it		✓				
part of your body used for eating and talking			✓			
piece of music					✓	

1,000 Word Level

	choice	computer	garden	photograph	price	week
cost						
picture						
place where things grow outside						

	eye	father	night	van	voice	year
body part that sees						
parent who is a man						
part of the day with no sun						

	animal	bath	crime	grass	law	shoulder
green leaves that cover the ground						
place to wash						
top end of your arm						

	drink	educate	forget	laugh	prepare	suit
get ready						
make a happy sound						
not remember						

	check	fight	return	tell	work	write
do things to get money						
go back again						
make sure						

	bring	can	reply	stare	understand	wish
say or write an answer to somebody						
carry to another place						
look at for a long time						

	alone	bad	cold	green	loud	main
most important						
not good						
not hot						

	awful	definite	exciting	general	mad	sweet
certain						
usual						
very bad						

Webb, S., Sasao, Y., & Ballance, O. (2017). The updated Vocabulary Levels Test: Developing and validating two new forms of the VLT. *ITL - International Journal of Applied Linguistics, 168*(1), 34-70.

APPENDIX F – Stimuli – Anaphoric Resolution Task

Sean	reads	very	slowly.	Some	training	should	help	him.
Susan	is	so	adorable.	People	want	to	hold	her.
Bob	sings	very	beautifully.	John	always	listens	to	him.
George	is	on	TV.	People	like	to	watch	him.
Melissa	never	drops	anything.	Mary	can	definitely	trust	her.
Lauren	makes	delicious	cakes.	Everybody	wants	to	congratulate	her.
Carla	wants	a	pet.	Animals	are	good	for	her.
Brian	washes	the	dishes.	Mom	is	proud	of	him.
Mark	usually	gets	late.	Laura	has	to	call	him.
Mrs. Louise	respects	the	community.	Everyone	there	always	trusts	her.
Lola	gives	children	chocolate.	Carla	sometimes	disagrees	with	her.
Michel	usually	takes	risks.	Most	people	agree	with	him.
Alonso	drinks	many	beers.	Olavo	is	upset	with	him.
Fernando	crosses	the	road.	The	truck	almost	hits	him.
Robert	studies	very	hard.	Ricardo	is	not	like	him.
Karina	got	a	job.	She	is	feeling	very	happy.
Marina	frequently	does	exercises.	She	is	feeling	very	happy.
Mauro	is	quite	clever.	He	plays	games	really	well.
Steve	lives	in	Italy.	He	has	two	delightful	pets.
Julia	has	many	houses.	She	wants	to	sell	two.
Marla	looks	so	sad.	She	seems	to	be	sick.
Keven	never	plays	outside.	He	prefers	to	play	videogames.
Mary	is	pretty	old.	She	clearly	cannot	remember	everything
Flavia	hates	rainy	days.	She	loves	catching	birds	outside.
Max	eats	sugar	daily.	He	is	getting	very	fat.
Victor	is	sleeping	deeply.	He	is	tired	this	morning.
Dori	travels	a	lot.	She	visits	many	beautiful	places.
Laura	makes	delicious	cupcakes.	She	is	an	excellent	cook.
Alison	needs	to	schedule.	She	is	not	very	organized.
Marcos	definitely	adores	cake.	He	eats	chocolate	cake	daily.

Source: the author (2020)

APPENDIX G – Sample of the first Latin Square list for the ART

BLOCO 1	LISTA 1
A	Karina got a job. She is feeling very happy.
QUESTION	Quem está feliz?
FILLER	Arthur said he is going to have the money.
B	Sean reads very slowly. Some training should help him.
QUESTION	Quem seria ajudado pelo treino?
FILLER	I am going to need a hand with this.
C	Karina got a job. Lara is feeling very happy.
FILLER	They were told to get off the bus soon.
D	Sean reads very slowly. Some training should help Robert.
FILLER	There is a lot of water in the ocean.
BLOCO 2	
A	Marina frequently does exercises. She is feeling very happy.
QUESTION	Quem faz exercícios frequentemente?
FILLER	As you age, you need more light to read.
B	Susan is so adorable. People want to hold her.
QUESTION	As pessoas gostariam de abraçar quem?
FILLER	Put a period at the end of the sentence.
C	Marina frequently does exercises. Carla is feeling very happy.
FILLER	He lives on the bottom floor of the building.
D	Susan is so adorable. People want to hold Marco.
FILLER	Please don't sit on the edge of the seat.
BLOCO 3	
A	Mauro is quite clever. He plays games really well.
QUESTION	Quem joga muito bem?
FILLER	It is not safe at night in walking alone.
B	Bob sings very beautifully. John always listens to him.
QUESTION	John escuta quem cantar lindamente?
FILLER	I was thinking of going to the park later.
C	Mauro is quite clever. Sean plays games really well.
FILLER	Between you and me, she has had four divorces
D	Bob sings very beautifully. John always listens to Carl.
FILLER	The earth travels around the sun at great speed.

Source: the author (2021).

APPENDIX H – Latin Square List Board by participants

List board by participants					
NVAPL***	2	2	2	2	Observation
PART. *	L 1**	L 2	L 3	L 4	
1		X			Ok
Escluded			X		2º year
Excluded				X	2º year
2	X				Ok
3			X		Ok
4				X	Ok
5	X				Ok
6		X			Ok
7			X		Ok
8				X	Ok

Source: the author (2021).
* Participant
**List
*** Number of valid attempts per list.

LIST 1	LIST 2	LIST 3	LIST 4
A	B	C	D
B	C	D	A
C	D	A	B
D	A	B	C

APPENDIX I – Summary of the VLT test results

Escores							
28	21	15	8	16	26	7	24
Part. 1	Part. 2	Part. 3	Part. 4	Part. 5	Part. 6	Part. 7	Part. 8

Part. 1	Part. 2	Part. 3	Part. 4	Part. 5	Part. 6	Part. 7	Part. 8
price	choice	price	week	week	price	sweet	choice
photograph	photograph	photograph	photograph	photograph	photograph	price	photograph
garden	garden	choice	garden	price	garden	computer	garden

Part. 1	Part. 2	Part. 3	Part. 4	Part. 5	Part. 6	Part. 7	Part. 8
eye	eye	year	voice	eye	eye	night	night
father	father	father	father	father	father	father	father
night	night	night	eye	night	night	year	van

Part. 1	Part. 2	Part. 3	Part. 4	Part. 5	Part. 6	Part. 7	Part. 8
uncle	winter	winter	winter	uncle	uncle	winter	state
center	state	state	uncle	note	center	uncle	center
note	center	tomorrow	center	winter	note	center	note

Part. 1	Part. 2	Part. 3	Part. 4	Part. 5	Part. 6	Part. 7	Part. 8
brother	brother	brother	brother	brother	brother	brother	brother
hour	hour	our	plan	hour	hour	hour	hour
plan	plan	plan	box	plan	plan	plan	plan

Part. 1	Part. 2	Part. 3	Part. 4	Part. 5	Part. 6	Part. 7	Part. 8
grass	grass	grass	shoulder	crime	grass	bath	grass
bath	bath	bath	grass	bath	bath	grass	bath
shoulder	crime	shoulder	bath	law	shoulder	shoulder	shoulder

Part. 1	Part. 2	Part. 3	Part. 4	Part. 5	Part. 6	Part. 7	Part. 8
prepare	prepare	forget	laugh	forget	prepare	forget	prepare
laugh	suit	prepare	forget	drink	laugh	educate	educate
forget	forget	educate	drink	laugh	forget	drink	suit

Part. 1	Part. 2	Part. 3	Part. 4	Part. 5	Part. 6	Part. 7	Part. 8
work	work	work	check	work	work	check	work
return	return	return	work	return	return	return	return
check	check	fight	fight	check	check	work	check

replay	replay	replay	understand	wish	replay	understand	replay
bring	bring	wish	replay	stare	stare	can	bring
stare	stare	can	can	understand	bring	replay	stare

main	loud	loud	main	main	main	alone	main
bad	bad	bad	bad	bad	bad	bad	bad
cold	cold	cold	alone	cold	cold	green	cold

definite	definite	exciting	definite	definite	definite	general	definite
awful	exciting	sweet	general	exciting	sweet	definite	general
mad	mad	definite	exciting	mad	mad	exciting	awful

Source: the author (2021).

APPENDIX J – Summary of the SNL working memory test results

Escores							
21	17	17	13	18	18	17	19
Part. 1	Part. 2	Part. 3	Part. 4	Part. 5	Part. 6	Part. 7	Part. 8

x	x	x	x	x	x	x	x

x	x	x	x	x	x	x	x

x	x	x	x	x	x	x	x

x	x	x	x	x	x	x	x

x	x	x	x	x	x	x	x

x	x	x	x	x	x	x	x

x	x	x	x	x	x	x	x

x	x	x	x	x	x	x	x

x	x	x	x	x	x	x	x

x	x	x	x	x	x	x	x

x	x	x	x	x	x	x	x

x	x	x	x	x	x	x	x

x	x	x	x	x	x	x	x

x	x	x	x	x	x	x	x

x	x	x	x	x	x	x	x

x	x	x	x	x	x	x	x
x	x	x	x	x	x	x	x
x	x	x	x	x	x	x	x

x	x	x	x	x	x	x	x
x	x	x	x	x	x	x	x
x	x	x	x	x	x	x	x

x	x	x	x	x	x	x	x
x	x	x	x	x	x	x	x
x	x	x	x	x	x	x	x

x	x	x	x	x	x	x	x
x	x	x	x	x	x	x	x
x	x	x	x	x	x	x	x

x	x	x	x	x	x	x	x
x	x	x	x	x	x	x	x
x	x	x	x	x	x	x	x

Source: the author (2021).

APPENDIX K – Summary of the ART results per list

Escores		21	Subj=10	objc=11	28	Subj=15	objc=13	
		Lista 1			Lista 1			
	Part. 1	**Part. 2**	**Part. 3**	**Part. 4**	**Part. 5**	**Part. 6**	**Part. 7**	**Part. 8**
		X			X			
		X						
					X			
		X			X			
		X						
					X			
		X			X			
		X			X			
		x			x			
		x			x			

		X						
					X			
		X			X			
		X			X			
		X			X			
		X			X			
		X			X			
					X			
		X						
		X			X			
		X			X			

		X			X			
		X			X			
		X			X			
		X			X			
					X			
		X						
		X						
					X			
		X						
					X			
					X			
		X						

					x			
		x						
		x			x			
		x			x			
					x			
		x						

Escores	30	Subj=15	objc=15			27	Subj=12	objc=15
	Lista 2					Lista 2		
	Part. 1	**Part. 2**	**Part. 3**	**Part. 4**	**Part. 5**	**Part. 6**	**Part. 7**	**Part. 8**
	x					x		
	x					x		
	x					x		

	x					x		
	x					x		
	x					x		
	x					x		
	x					x		
	x					x		
	x					x		
	x					x		
	x					x		

	X					X		
	X					X		
	X					X		
	X					X		
	X					X		
	X					X		
	X					X		
						X		
	X							
	X					X		

						X		
	X							
	X					X		
	X					X		
	X					X		
	X					X		
	X					X		
	X					X		
	X					X		

					x			
	x							

Escores		29	Subj=15	objc=14		20	Subj=12	objc=8
		Lista 3				Lista 3		
Part. 1	**Part. 2**	**Part. 3**	**Part. 4**	**Part. 5**	**Part. 6**	**Part. 7**	**Part. 8**	
		x				x		
		x				x		
		x				x		
		x				x		
		x				x		
		x				x		
						x		
		x						

		x				x		
		x				x		
						x		
		x						
		x				x		
						x		
		x						
		x						
						x		
		x				x		
		x				x		
		x				x		

		x				x		
		x				x		
		x				x		
		x				x		
		x				x		
		x				x		
		x				x		
						x		
		x						
		x				x		

						x			
		x							
		x							
						x			
		x							
						x			
		x				x			
		x							
						x			

Escores			26	Subj=12	objc=14		30	Subj=15	objc=14
			Lista 4				Lista 4		
Part. 1	**Part. 2**	**Part. 3**	**Part. 4**	**Part. 5**	**Part. 6**	**Part. 7**	**Part. 8**		
			x				x		
			x				x		
			x						
							x		

			x				x		
			x				x		
			x				x		
			x				x		
			x				x		
			x						
							x		
			x				x		
			x				x		
			x						
							x		

			x				x		
			x				x		
			x				x		
			x				x		
			x				x		
			x				x		
			x						
							x		
			x				x		
			x				x		

			x				x		
			x				x		
			x				x		
			x				x		
			x				x		
			x				x		
			x				x		
			x				x		
			x				x		