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**Positive Emotions, Working Memory Focus of Attention, and English as a
Foreign Language Reading Through Singing: reflections and proposals**

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Foreign Language Reading through Singing: reflections and proposals**

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Positive Emotions, Working Memory Focus of Attention, and English as a Foreign Language Reading through Singing: reflections and proposals

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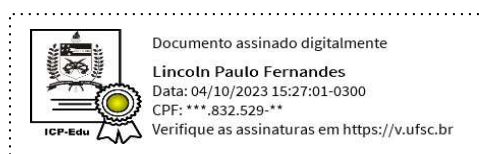
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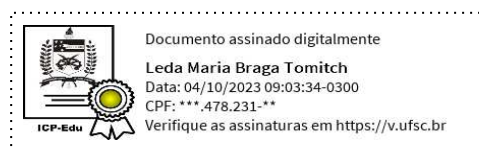
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Lincoln P. Fernandes Dr. - Coordenação do Programa de Pós-Graduação



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To my mother, Carmelita Woelfer, for being my sunrise,
my father, Raimundo Woelfer, for being my sunset,
and to the infinite Power of Consciousness for being the continuous light that
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Your outer journey may contain a million steps; your inner journey only has one: the step you are taking right now. As you become more deeply aware of this one step, you realize that it already contains within itself all the other steps as well as the destination. This one step then becomes transformed into an expression of perfection, an act of great beauty and quality. It will have taken you into Being, and the light of Being will shine through it. This is both the purpose and the fulfillment of your inner journey, the journey into yourself.

(TOLLE, 1999, p. 88 – 89)

ABSTRACT

Applied Linguistics research on learning as a byproduct of English as a foreign language (EFL) reading is extensive. Much of it exclusively investigates variables inherent to cognition. However, studies of Positive Psychology (PP) and Second Language Acquisition from the perspective of Positive Psychology (PP in SLA) have investigated new variables contributing to a more comprehensive understanding of the learning phenomenon. By investigating the effect of emotion on the scope of attention and cognition, such studies have also sought theoretical support in Cognitive Psychology. They have suggested that positive emotions broaden the scope of attention and cognition and that negative ones narrow these same arrays. Several studies have also found that positive emotions triggered by EFL reading through singing are associated with enhanced learning among different populations. However, a research gap was identified: no study has investigated whether the practice of EFL reading through singing by triggering positive emotions may be associated with broadened working memory (WM) focus of attention and enhanced vocabulary learning among adolescents. To investigate this gap, three theoretical pillars grounded this research: (1) *The Broaden-and-Build Theory of Positive Emotions* developed by Fredrickson and Branigan (2005); (2) *The Comprehensive Model of Affect in the Reading Process* proposed by Mathewson (1985); and (3) *The Embedded-Processes Model of Working Memory* developed by Cowan (1988; 1999). Due to the context of the Covid-19 Pandemic, the initial doctoral research proposal had to be adapted since data collection at schools was no longer possible. Thus, instead of applying an experimental study, the present research sought to raise bibliographical support to discuss the research gap. The research reviewed thirty studies through an unsystematic approach and provided the following reflections and proposals: (1) mild positive emotions appear to cause WM focus of attention to devote its resources to a broader sensorial capture of relevant textual information, broader activation and retrieval of relevant information from long-term memory (LTM), and thus, broader maintenance and processing of both types of information. In the case of EFL reading through singing, this broadening effect seems to be beneficial for vocabulary learning for its spreading resources to the automatization of melody, phoneme-grapheme mapping, and to versification chunking; (2) mild negative emotions appear to cause WM focus of attention to devote its resources to a narrowed sensorial capture of small units of relevant textual information, narrowed activation and retrieval of small units of relevant information from LTM, and thus, narrowed maintenance and processing of both types of information. In the case of EFL reading through singing, this narrowing effect seems beneficial because it allocates resources to the detailed processing and maintenance of information that may improve vocabulary learning; (3) strong positive emotions appear to cause WM focus of attention to devote its resources to a broader sensorial capture of irrelevant external stimuli, broader activation and retrieval of irrelevant information from LTM, and thus, broader maintenance and processing of both types of stimuli. This broadening effect, in the case of EFL reading through singing, seems detrimental to vocabulary learning for its spreading resources to distractive information; and (4) strong negative emotions appear to cause WM focus of attention to devote its resources to the processing and maintenance of exogenous and endogenous threatening information, with no resources being left to learning. Besides, memory and body may tend to focus on the threat, the willingness to learn is put at risk, and rumination of negative thoughts possibly hampers learning. Besides, the research included the implementation of an experimental study prior to the pandemic.

The study aimed to design and test a tool for collecting adolescents' reading span measures, namely *The Reading Span Test for Adolescent Speakers of Brazilian Portuguese (RSTA)*. It would be used as a tool in the initial research proposal. Although the tool has not been posteriorly applied, the study that gave rise to it remains in this doctoral dissertation for being part of the whole research. The RSTA resulted from a three-month quasi-experimental study conducted in 2019. Participants were Brazilian public-school students ($N = 47$) aged 12-14 ($M = 12.95$, $SD = 0.82$) recruited through convenience sampling. All of them provided consent forms. Materials comprised two expository texts. Instruments included the *Reading Span Test* (DANEMAN; CARPENTER, 1980), adapted to Brazilian Portuguese by Tomitch (2003b), the RSTA, an open-ended task, and a multiple-choice task. Four individual sessions with each participant were necessary to collect the WM span scores (i.e., 236 individual sessions), and ten collective sessions were needed to collect the reading comprehension scores. Quantitative analysis suggested that the test efficiently assessed adolescents' WMC, as shown by the correlations with measures of reading comprehension obtained using multiple-choice questions. The test, however, needs to be submitted to new experimental studies to be consolidated as a reliable tool.

Keywords: positive emotions; working memory focus of attention; working memory; English as a foreign language reading; singing; vocabulary learning.

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RESUMO

É extensiva a pesquisa em Linguística Aplicada com foco na aprendizagem como subproduto da leitura em inglês como língua estrangeira. Grande parte dela investiga exclusivamente variáveis inerentes à cognição. No entanto, estudos da Psicologia Positiva (PP) e da Aquisição de Segunda Língua na perspectiva da Psicologia Positiva (PP em SLA) têm investigado novas variáveis que têm contribuído para uma compreensão mais abrangente do fenômeno da aprendizagem. Ao investigarem o efeito da emoção no escopo da atenção e da cognição, esses novos estudos também têm buscado suporte teórico na Psicologia Cognitiva. Eles sugerem que as emoções positivas ampliam os escopos da atenção e da cognição e que as emoções negativas os diminuem. Vários estudos descobriram também que as emoções positivas associadas à prática da leitura em inglês como língua estrangeira (ILE) através do canto resultaram em melhor aprendizagem em diferentes populações. Porém, dentro desse cenário foi identificada uma lacuna: nenhum estudo investigou se a prática da leitura em ILE através do canto, por desencadear emoções positivas, pode estar associada à ampliação do foco de atenção da memória de trabalho (MT) e a uma melhor aprendizagem de vocabulário em uma população de adolescentes. Para investigar essa lacuna, três pilares teóricos foram adotados: (1) *The Broaden-and-Build Theory of Positive Emotions* desenvolvida por Fredrickson e Branigan (2005); (2) *The Comprehensive Model of Affect in the Reading Process* proposto por Mathewson (1985); e (3) *The Embedded-Processes Model of Working Memory* desenvolvido por Cowan (1988; 1999). Devido ao contexto da Pandemia do Covid-19, a proposta inicial da pesquisa de doutorado teve que ser adaptada, uma vez que a coleta de dados nas escolas não foi possível. Assim, ao invés de aplicar um estudo experimental, a presente pesquisa buscou levantar suporte bibliográfico para discutir a lacuna identificada. A pesquisa analisou trinta estudos através de uma abordagem não sistemática e apresentou as seguintes reflexões e propostas: (1) as emoções positivas brandas parecem fazer com que o foco de atenção da MT despenda os seus recursos à uma captação sensorial mais ampla de informações textuais relevantes, numa ativação e rememoração mais amplas de informações relevantes da memória de longo prazo (MLP) e, portanto, numa manutenção e processamento mais amplos de ambos os tipos de informação. No caso da leitura cantada em ILE, este efeito de ampliação parece ser benéfico para a aprendizagem do vocabulário, uma vez que permite a utilização de tais recursos para a automatização da melodia, do mapeamento fonema-grafema e do agrupamento de versos (i.e., versification chunking); (2) as emoções negativas brandas parecem fazer com que o foco de atenção da MT despenda os seus recursos à uma captação sensorial reduzida de pequenas unidades de informações textuais relevantes, numa ativação e rememoração reduzidas de pequenas unidades de informações relevantes da MLP e, portanto, numa manutenção e processamento reduzidos de ambos os tipos de informações. No caso da leitura de ILE através do canto, este efeito de redução parece ser benéfico porque destina recursos a um processamento detalhado e à manutenção de informação que podem melhorar a aprendizagem de vocabulário; (3) as emoções positivas fortes parecem fazer com que o foco de atenção da MT despenda os seus recursos à uma captação sensorial mais ampla de estímulos externos irrelevantes, à uma maior ativação e rememoração de informações irrelevantes da MLP e, portanto, numa maior manutenção e processamento de ambos os tipos de estímulos. Este efeito de ampliação, no caso da leitura de EFL através do canto, parece ser prejudicial para a aprendizagem do vocabulário devido à dispersão de recursos para informações

distrativas; e (4) as emoções negativas fortes parecem fazer com que o foco de atenção da MT despenda os seus recursos no processamento e na manutenção de informações exógenas e endógenas ameaçadoras, ficando sem recursos para processamento da aprendizagem. Além disso, a memória e o corpo podem tender a concentrar-se na ameaça, a vontade de aprender possivelmente é posta em risco e a ruminação de pensamentos negativos pode dificultar a aprendizagem. Essa pesquisa de doutorado também implementou um estudo experimental antes do período da pandemia. O estudo teve como objetivo criar e testar um instrumento de coleta de medidas de MT de adolescentes, o *Reading Span Test for Adolescent Speakers of Brazilian Portuguese (RSTA)*. Ele seria utilizado na proposta inicial da pesquisa. Embora o instrumento não tenha sido aplicado posteriormente, o estudo que lhe deu origem permanece nesta tese de doutorado por ter feito parte do estudo como um todo. O RSTA resultou de um estudo quase-experimental de três meses realizado em 2019. Os participantes foram estudantes brasileiros de escolas públicas ($N = 47$) com idades entre 12 e 14 anos ($M = 12,95$, $DP = 0,82$) recrutados por amostragem de conveniência. Todos os participantes forneceram termos de consentimento. Os materiais incluíram dois textos expositivos. Os instrumentos incluíram o *Reading Span Test* (DANEMAN; CARPENTER, 1980), adaptado para o português brasileiro por Tomitch (2003b), o RSTA, uma tarefa com perguntas abertas e uma tarefa de múltipla escolha. Os escores de MT foram obtidos em quatro sessões individuais com cada participante (236 sessões individuais), e em dez sessões coletivas para os escores de compreensão de leitura. Análises quantitativas sugeriram que o teste foi eficiente na obtenção de medidas de MT dos adolescentes, conforme mostraram as correlações com medidas de compreensão de leitura obtidas por meio de questões de múltipla escolha. O teste, no entanto, precisa ser submetido a novos estudos experimentais para se consolidar como um instrumento confiável.

Palavras-chave: emoções positivas; foco de atenção da memória de trabalho; memória de trabalho; leitura de inglês como língua estrangeira; canto; aprendizagem de vocabulário.

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LIST OF ACRONYMS

α	Cronbach's α
APA	American Psychological Association
CE	Central Executive
CNPq	Conselho Nacional de Desenvolvimento Científico e Tecnológico
DMN	Default Mode Network
E	Edge/s
EFL	English as a foreign language
ESL	English as a Second Language
ESOL	English to Speakers of Other Languages
F	Flesch Index
FL	Foreign language
FLCA	Foreign language classroom anxiety
FLE	Foreign language enjoyment
fMRI	Functional magnetic resonance imaging
G	Graph
H	Hypothesis
IF	Incidence-Fidelity
L1	First language
L2	Second language
LAD	Language Acquisition Device
LTM	Long-term memory
M	Mean
N	Number
NILC	Núcleo Interinstitucional de Linguística Computacional – USP
p	P-value
PHEs	Periods of heightened learner engagement
PNLD	Programa Nacional do Livro e do Material Didático
PP	Positive Psychology
PPGI	Programa de Pós-Graduação em Inglês
RST	Reading Span Test
RSTA	Reading Span Test for Adolescent Speakers of Brazilian Portuguese
SLA	Second Language Acquisition
SSIMH	Song stuck in my head
STM	Short-term memory
TEI	Trait emotional intelligence
TPD	Teachers' professional development
UFSC	Universidade Federal de Santa Catarina
V	Vertex/vertices
WM	Working memory
WMC	Working memory capacity
ZPD	Zone of proximal development
τ	Kendall rank correlation coefficient
χ^2	Chi-square

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1 INTRODUCTION

Science need not inevitably leave you holding a flat corkboard with a dismembered butterfly pinned to it. Science can also glorify, painting a colorful and multidimensional roadmap for a more potent life journey, one that eliminates the detours of false hopes, false prophets, false claims, and charts a course toward the real thing. It can leave the butterfly alive and whole and set it free. (FREDRICKSON, 2013, p. 13).

1.1 MUSICAL ELEMENTS IN THE DEVELOPMENT OF HUMAN LIFE AND LANGUAGE

Around week five, a tiny heart starts beating within the woman's womb. From that moment on, that rhythm yields intrauterine blood circulation and ensures the embryo's development by supplying it with nutrients and oxygen (MURKOFF, 2019). From week twenty-four on, when the auditory fetal system has its structure more fully developed, the to-be born can hear their mother's heartbeat and also becomes sensitive to her voice through the perception of melodious low-frequency vowel sounds (KISILEVSKY *et al.*, 2009; STROMSHOLD, 2015). The sounds of the mother's speech help orchestrate the beat of the new life inside her, decelerating and calming down its heart rate (DECASPER *et al.*, 1994; FIFER; MOON, 1994; LECANUET, J.; MANERA, S.; JACQUET, 2002; VOEGTLIN *et al.*, 2013). In the last trimester of pregnancy, when life is already sounding in a duet, the fetus, besides being involved by the acoustically rich intrauterine environment, can also discriminate and shortly memorize external sounds that enrich even more the ongoing musical composition (HUOTILAINEN *et al.*, 2005). In this artistic arrangement, however, the maternal voice becomes so significant for the future newborn that s/he, in the early postnatal period, in addition to showing a preference, may also be able to differentiate it from other female voices, which suggests some form of prenatal auditory learning (DECASPER; FIFER, 1980; DECASPER; SPENCE, 1986; MOON; ZERNZACH). Moreover, the

same voice, in the form of lullabies or calm songs sung during the prenatal period, may reduce the mother's stress and anxiety and, in the postnatal period, the baby's cry. Her singing may also make her feel positive feelings that strengthen her closeness with the baby (CAROLAN *et al.*, 2012; FANCOURT; PERKINS, 2018; PERSICO *et al.*, 2017) and also maintains the baby's attentiveness to her (NAKATA; TREHUB, 2004; SHENFIELD; TREHUB; NAKATA, 2003). Finally, postnatal infants' attention, preferably directed to human speech rather than other naturally occurring signals, plays a significant role in language learning (MOON; FIFER, 2000; SHULTZ; VOULOUMANOS, 2010). Portrayed this way, life appears to be a piece of music with its harmony continuously enriched during gestation and after childbirth. A masterpiece that is only interrupted by the ultimate living compass of life that sounds *piano* and moves *al fine rallentando in tempo*.

In a sense, these are some of the initial elements of a musical composition that accompany human beings from conception to birth and reinforce mother-infant bonding. This almost literary, however still initial expository paragraph, attempts to illustrate how music is deeply intertwined with humans' life and language development.

As noticed in this introduction, science presents pieces of evidence that “[...] Our musical perceptions of melodies, voices or sounds of musical instruments start very early and remain in our memory.” (FONSECA-MORA; MACHANCOSSES, 2019, p. 359). In these initial words, it is also remarkable that music evokes human cognition and the emotions accompanying it. Bearing that in mind, something else inherent to this early period of life also depends on this entangled evocation of cognition and emotion: vocabulary learning. This occurs when vocabulary is learned through songs, initially orally and later in written form. Its source may be the singing of mommy's or daddy's nursery rhymes to the songs sung by students and teachers in kindergarten and schools.

Now, touching more specifically on the object of study of this doctoral dissertation which is the practice of English as a foreign language (EFL) reading through singing for vocabulary learning, some points need to be underscored.

It is well known that the same entanglement between cognition and emotion mentioned before characterizes adolescence. It is a period in which individuals go through troubled times involving psychological and physiological changes, abrupt emotional oscillations, disagreements with parents, and highly demanding efforts to establish social bonds. To increase this complexity, all these dynamics occur while

adolescents are intensely involved in school knowledge building (NORTH; HARGREAVES; O'NEILL, 2000; FONSECA-MORA; MACHANCOSES, 2019; MIRANDA, 2013; TER BOGT; SOITOS; DELSING, 2011). Thus, understanding EFL¹ vocabulary learning must encompass theoretical considerations and propose pedagogical practices that contemplate the dynamics of adolescence. To meet such demand, this doctoral dissertation built its theoretical framework over three basal pillars: (i) *The Comprehensive Model of Affect in the Reading Process* (MATHEWSON, 1985); (ii) *The Broaden-and-Build Theory of Positive Emotions* (FREDRICKSON, 1998, 2004, FREDRICKSON; BRANIGAN 2005); and (iii) *The Embedded-Processes Model of Working Memory* (COWAN, 1988, 1999; COWAN; MOREY; NAVEH-BENJAMIN, 2021).

Mathewson's model adds to the research the principle that affective factors precede and maintain readers' willingness to read and fuel cognitive reading processes. Fredrickson's theory adds to this research a body of evidence showing that positive emotions, as opposed to negative emotions, and better than neutral ones, broaden the individual's scope of attention to external stimuli and information already consolidated in memory. Finally, Cowan's working memory (WM) model attributes to the research the tenet that learning depends on one's capacity to store and manipulate information in real-time in the focus of attention.

Additionally, Mathewson's model proposes that affective factors, including positive emotions, trigger readers' attention to the text and improve the execution of primary and secondary reading processes such as comprehension and recall. From an evolutionary perspective, Fredrickson's theory postulates that positive emotions evoke human action urges of exploration and learning, leading to the consequential building of resources, including intellectual resources (i.e., conceptual knowledge). At last, Cowan's model defines the WM focus of attention as the workspace for concept building and vocabulary learning and that the more exciting the external stimuli, the greater the focused attention to the object of study (COWAN, 1999, 2015).

The dissertation dialogically sews the three basal theoretical pillars to conceive that songs as reading stimuli may constitute exciting external EFL reading stimuli for adolescents. Besides, it proposes that the singing practice may be a form of reading that triggers positive emotions in EFL readers' engagement. Furthermore, it explains

¹ The terms English as a Foreign Language (EFL), English as a Second Language (ESL or L2) will be used interchangeably in this doctoral dissertation.

why this form of reading may broaden EFL readers' focus of attention to the text in a loving, non-threatening environment, preventing readers' allocation of attentional resources to irrelevant external stimuli. At last, it conjectures that readers with a lower attentional span may be the primary beneficiaries of the practice of reading through singing: the use of their limited attentional resources, influenced by positive emotions, is optimized for the cognitive processing of pieces of information which are critical for vocabulary learning to take place. The dissertation conducts a more thorough discussion of this reasoning throughout its text.

This chapter initially presented a narrative on some musical elements accompanying human life and language development. Next, it follows by stating the purpose of this doctoral dissertation, its significance, and, at last, its organization.

1.2 STATEMENT OF THE PURPOSE

As mentioned above, this doctoral dissertation adopts a reading model encompassing affective factors (i.e., Mathewson's Comprehensive Model of Affect in the Reading Process). However, most studies on EFL reading in the language and cognition concentration area have focused on cognitive variables, given the inherent peculiarities of this research venue. Some of the variables the area has investigated are (i) readers' strategic behavior while EFL reading of online texts (DO AMARAL; TORRES; TOMITCH, 2018); (ii) metacognitive reading processes operated during the reading of digital texts in English as an L2 (PROCAILO; WOELFER; TOMITCH, 2020); (iii) factors involved in the process of EFL reading comprehension as a third language by deaf people who use *Libras* (Brazilian Sign Language) and Brazilian Portuguese (BASTOS; HÜBNER, 2020), among others. Nevertheless, research conducted by Immordino-Yang and Damásio (2016) makes the provocative claim that conceptual knowledge building devoid of emotions may impair the application of that knowledge in authentic contexts. The researchers claim that knowledge built in meaningful emotional contexts enables learners to think deeply about using knowledge in practice. Following this line of thought, they proposed that emotional tags added to conceptual knowledge constitute a set of memory features, namely *academic intuitions* that inform learners "[...] about, how, when and why to use their knowledge." (IMMORDINO-YANG; FAETH, 2016, p. 104). Specifically, Immordino-Yang and Damásio (2016), based on studies on brain-damaged patients, found that rational thinking dissociated

from emotions can result in inconsequential use of knowledge and compromised decision-making. Thus, investigations on learning processes that intertwine cognition and emotion seem most welcome to widen the scope of understanding of how emotions support and influence the applicability of the learning outcomes derived from EFL reading. More to the point, research on EFL reading that considers readers' emotions can contribute to the field because purely conceptual knowledge learning, such as vocabulary learning, is insufficient. Conceptual knowledge must accrue emotional knowledge in a world where pure rational thinking has been the source of great problems.

As introduced earlier, this research involves built-up knowledge of emotions grounded in the Broaden-and-Build Theory of Positive Emotions (FREDRICKSON, 1998; 2004; FREDRICKSON; BRANIGAN, 2005). Studies that have taken the tenets of Fredrickson's theory have investigated the relationship between (i) positive emotions, resilience, and life satisfaction (COHN *et al.*, 2009); (ii) positive emotions and interventional strategies for the treatment of diseases sparked by negative emotions such as depression (FREDRICKSON, 2000); (iii) positive emotions and the development of an upward spiral of health that leads individuals to a continuous cycle involving feeling positive, having motives to develop and engage in health behaviors that result in feeling positive again and so on (FREDRICKSON; JOINER; 2018), to mention some. To the knowledge of this doctoral researcher, no study has taken Fredrickson's theory to research EFL reading. This research thus aims to add to the body of evidence that has been consolidating this theory as one of the most influential theories within Psychology, Positive Psychology (PP), and SLA from the perspective of Positive Psychology (PP in SLA).

This research also includes Cowan's (1988, 1999) Embedded-Processes Model of Working Memory in its theoretical framework. Research on working memory (WM) and EFL reading is extensive. Studies have investigated, for example, (i) WM and the ability to formulate questions about EFL texts (BARETTA; TAVARES, 2018); (ii) WM, inference generation, and reading comprehension in L2 (ROSCIOLI; TOMITCH, 2022); (iii) correlations between working memory capacity (WMC) and foreign language reading comprehension taking into account first language knowledge as a potential source of interference (OLIVEIRA; TOMITCH, 2021); (iv) WMC as a predictor of literal comprehension, inferential comprehension and reading times of hypertext in proficient bilinguals in multitasking settings (DE AZEVEDO; OLIVEIRA; FINGER; TOMITCH,

2022), among others. Except for the ongoing studies by Mikels et al. (2008) and Mikels and Reuter-Lorenz (2019), little research investigates how emotions are processed and stored in WM and how they may influence simultaneous cognitive processes in EFL reading for vocabulary learning. Furthermore, to this doctoral researcher's knowledge, no research has investigated how positive emotions may affect WM focus of attention supporting its rationale in the theoretical premises of Cowan's WM model. This research may thus increase the knowledge built up on the dynamics between cognition and emotion in WM and their involvement in building vocabulary knowledge from EFL reading.

Finally, studies in the specific research niche of this doctoral dissertation have devoted most of their focus to learners' and teachers' well-being, anxiety, engagement, emotional awareness, emotional regulation, and other affective factors. Some examples are the studies on (i) language enjoyment and foreign language classroom anxiety (DEWAELE; MACINTYRE, 2014); (ii) foreign-language enjoyment fluctuation through time (SHIRVAN; TAHERIAN; YAZDANMEHR, 2020); (iii) the reduction of the detrimental effects of anxiety on foreign language learning (JIN, DEWAELE; MACINTYRE, 2021), among others.

As Dewaele *et al.* (2020) concede, the effort invested in investigating affective factors has occurred at the expense of less effort on studies targeting linguistic factors. Based on this portrayal, a specific research gap is identified. There is no study on SLA from the perspective of Positive Psychology that seeks to investigate vocabulary learning in EFL reading considering the cognitive factor of WM focus of attention and the affective factor of positive emotions. On top of that, most of the studies reviewed for the current research focus on college students, children, and teachers; adolescents appear to constitute an underinvestigated population. Considering the complex scenario of adolescence earlier outlined and the teaching experience of this doctoral researcher as an EFL teacher, adolescents were chosen to compose the target population of this research.

Based on that, this doctoral dissertation aims to raise bibliographical support to claim that the practice of EFL reading through singing, for its yielding positive emotions and broadening of WM focus of attention and cognition, enhances vocabulary learning among adolescents. Based on this purpose, the doctoral dissertation has five main objectives: the first, second, third, and fourth to be achieved through literature reviews, and the fifth, through a quasi-experimental study. The objectives are:

(1) Chapter II: to situate the present doctoral dissertation in its research niche from a historical perspective and to introduce its theoretical framework through a multidisciplinary review of studies;

(2) Chapter III: to review The Broaden-and-build Theory of Positive Emotions (FREDRICKSON, 1998, 2004; FREDRICKSON; BRANIGAN, 2005) and studies of Positive Psychology in SLA tracing theoretical associations between the theory and the studies' findings;

(3) Chapter IV: to review Mathewson's (1985) Comprehensive Model of Affect in the Reading Process and draw theoretical consonances between the model and the Broaden-and-build Theory of Positive Emotions (FREDRICKSON, 1998, 2004; FREDRICKSON; BRANIGAN 2005) through a review of studies on EFL reading through singing;

(4) Chapter V: to operationalize the constructs of working memory (WM) and working memory capacity (WMC) based on Cowan's (1988, 1999) Embedded-Processes Model of Working Memory and propose theoretical discussions on the role of positive emotions evoked by the practice of EFL reading through singing in WM focus of attention. Besides, the objective extends to tracing theoretical associations among the model, the Broaden-and-build Theory of Positive Emotions (FREDRICKSON, 1998, 2004; FREDRICKSON; BRANIGAN 2005), and The Comprehensive Model of Affect in the Reading Process (MATHEWSON, 1985);

(5) Chapter VI: to present a three-month quasi-experimental study conducted in the year 2019 aimed at devising a tool for collecting adolescents' working memory capacity measures, *The Reading Span Test for Adolescent Speakers of Brazilian Portuguese*.

1.3 SIGNIFICANCE OF THE WORK

The school is one of the contexts where adolescents undergo the study and use of the English language more intensely. Inherent to that is the development of the reading skill, which is a complex process. Considering that, a question arises: is there an ideal way to teach vocabulary through EFL reading?

Based on Johnson (1999), it all depends on who students and teachers are, their prior knowledge, educational expectancies, and how the school and community

view them. Within the scope of this doctoral research, teaching vocabulary in EFL reading also depends on individual differences in readers' emotional states and cognition. EFL adolescent readers may oscillate in a continuum between positive and negative emotions; the same applies to their WM focus of attention. According to prior research, Cavanagh (2016) proposes that freeing up WM does not guarantee learners' use of its capacity for task-related demands. Following the researcher, learning *also depends* on affective factors; otherwise, learners may not be interested in the object of study. EFL reading through singing may be one of the golden keys to spark and enliven emotion and cognition.

The significance of this doctoral research thus lies in its search for theoretical and empirical clues that may support the design of EFL reading practices aimed at enhancing vocabulary learning in the classroom. These practices may be better scientifically informed, considering individual differences in adolescents' emotional states and their WM focus of attention capacity. In the case of the Brazilian context, this research may have special significance for public schools. If learning depends on many factors, the Brazilian public-school context multiplies them since it constitutes a complex stained-glass window that needs science's support to bring its parts together.

1.4 ORGANIZATION OF THE DISSERTATION

The organization of this doctoral dissertation reflects the design of the research reported. However, it does not follow the traditional structure of this textual genre due to limitations imposed by the Covid-19 Pandemic in its initial proposal. In the first version, the proposal raised hypotheses, selected studies for the literature review, and chose methods and statistical models. Nevertheless, the impossibility of accessing the target population, public school EFL adolescent learners, required a research design essentially constituted by a literature review organized into dialogic chapters. The dissertation, however, presents a quasi-experimental study in Chapter VI, conducted before the Pandemic. Its objective was to build a data collection instrument for the initial research proposal. Having commented that, it follows the organization of this dissertation:

Chapter I, the present chapter, establishes the contextualization of the research and, as previously presented, starts with (i) an introduction proposing how musical

elements intertwines with human life and language; (ii) the presentation of the statement of the purpose; (iii) a proposal for the significance of the work; and (iv) the current organization of the dissertation;

Chapter II sets the research niche of this doctoral research and presents a historical overview of Positive Psychology. Then, it introduces the research's theoretical framework through a multidisciplinary review of studies that discuss the influence of positive emotions (i) on people's general well-being; (ii) and their influence on learning. At last, the chapter focuses on presenting a historical overview of Positive Psychology within Applied Linguistics and Second Language Acquisition (SLA) and reviews a first set of studies on positive emotions in SLA;

Chapter III strengthens the theoretical framework of this doctoral research and investigates more deeply the role of positive emotions on the broadening of cognition and WM scope of attention. It also explores how positive emotions underlie the building of intellectual and other types of human resources. In what follows, the chapter reviews a second set of studies on positive emotions in SLA. Besides, it poses a question and proposes an answer on the sufficiency of positive emotions for effective learning. Last, it presents a semantic network of cliques from seven relevant studies describing the Broaden-and-Build Theory of Positive Emotions;

Chapter IV defines this doctoral research view of reading and discusses the positive emotion underlying EFL reading motivation: *interest*. Then, it questions Descartes' cartesian view of the human body, establishing relationships between the topic and educational practices that tend to slip up the body and brain. This discussion suggests that EFL reading through singing may constitute an effective practice for effective vocabulary learning. To maintain the proposition, the chapter subsequently covers a comprehensive review of studies (i) on the role of music in adolescence; (ii) on the relationship between singing and motivation for EFL learning; (iii) on the relationship between singing and reading development in general; and (iv) on the specific topic of vocabulary learning and the practice of EFL reading through singing. To conclude, the chapter explores studies that bring theoretical and empirical evidence about integrating melody and text in memory for songs and the contribution of involuntary rehearsal phenomena to EFL vocabulary learning.

Chapter V defines the referential WM model of this research to establish a theoretical proposal on the critical role of positive emotions in the real-time information maintenance and processing involved in EFL vocabulary learning. The chapter also

encompasses three final arguments in favor of beneficiary outcomes derived from the practice of EFL reading through singing, namely (i) automatization of melody for vocabulary retrieval; (ii) phoneme-grapheme mapping automatization for fluent reading; and (iii) versification chunking. At last, it elaborates on a theoretically-based rationale for the effect of positive emotions on WM focus of attention.

Chapter VI, as described in its objective, describes a quasi-experimental study conducted to design a tool to obtain WMC measures from adolescents. The chapter presents (i) an introduction; (ii) a literature review on WM and WMC; (iii) hypotheses; (iv) methods that define participants, materials, instruments, procedures for data collection, procedures for data analysis, pilot study, and information concerning the Ethics Review Board; (v) results, including tests for internal reliability, analysis of normality of distributions; correlations between the two reading comprehension measures of the study, and hypotheses testing; (vi) discussion; (vii) final remarks; and (viii) pedagogical implications, limitations, and suggestions for future research.

Chapter VII, the last chapter, presents (i) proposals, reflections, and conclusions of the research; (ii) final remarks; (iii) limitations and suggestions for further research; and (iv) pedagogical implications.

The chapters end with a summary, except for Chapters I and VII, due to their contents.

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2 POSITIVE PSYCHOLOGY IN SECOND LANGUAGE ACQUISITION: PREPARING THE THEORETICAL TERRAIN TO PROPOSE ENGLISH AS A FOREIGN LANGUAGE READING THROUGH SINGING AS A PRACTICE TO ENHANCE VOCABULARY LEARNING

Our emotions are connected to our outlooks via a simple cause-and-effect relationship. As positivity flows through our hearts, it simultaneously broadens our minds, allowing us to see both the forest and the trees.

(FREDRICKSON, 2009)

2.1 INTRODUCTION

This chapter initially sets out the research niche of this doctoral dissertation and presents a brief contextualization containing its objective. It posteriorly outlines the aims of Positive Psychology (PP) and reviews studies of this subfield on well-being and learning. Then, it presents a historical overview of PP in Applied Linguistics and Second Language Acquisition (SLA)². The chapter then reviews a first set of studies of PP in SLA. At last, it provides a summary.

This doctoral dissertation falls within the Positive Psychology in Second Language Acquisition (PP in SLA) research niche. Positive psychology studies humans' strengths, such as hope, optimism, and well-being, without denying their weaknesses, such as anxiety and fear (GALLAGHER; LOPEZ, 2021). PP in SLA concerns similar factors targeting learners, teachers, and institutions (GABRYS-BARKER; GALADJDA, 2016).

This chapter reviews studies proposing that positive emotions interact with human cognition, promoting (i) learners' well-being (ALGOE; GABLE; MAISEL, 2010; ALGOE; FREDRICKSON; GABLE, 2013; FREDRICKSON; JOINER, 2002) and (ii) optimal cognitive conditions for the construction of personally relevant resources

² The terms Second Language Acquisition (SLA) and Second Language Learning will be used interchangeably in this doctoral research. This choice is due to the fact that the vast majority of the studies reviewed in this doctoral dissertation does not differentiate between the processes of acquisition and learning. They focus on the development of learners' L2 skills in general and the influence of emotions on this process.

(FREDRICKSON, 1998; FREDRICKSON; BRANIGAN, 2005). As stated by Fredrickson (2009), resources are “ [...] reserves – any enduring part of yourself that you might draw on later, when you face challenges, setbacks, or new opportunities. They are the tools in your toolbox, the resources at your disposal.” (p. 90). A *resource* thus refers to individuals’ gains. This doctoral dissertation underscores the role of positive emotions in building knowledge, knowledge as an *intellectual resource* (i.e., English as a foreign language vocabulary).

The chapters’ review of studies presented later proposes initial inferences suggesting that emotions such as joy, interest, and contentment are associated with better learning for improving language input awareness (DEWAELE *et al.*, 2020, p. 15). More precisely, the inferences propose that English as a foreign language (EFL) reading through singing is a pedagogical practice that may induce learners to experience positive emotions and to broaden their working memory (WM) focus of attention. Chapter V will explore this topic thoroughly. As the inferences of the current chapter will propose, positive emotions and broadened WM focus of attention may constitute preconditions for vocabulary learning.

Given this brief contextualization, the objective of this chapter is to situate the present doctoral dissertation in its research niche, as done above, and to introduce its theoretical framework through a multidisciplinary literature review. The chapter structures the literature review utilizing the *Narrative Review Method* to meet this objective. The Narrative Reviews Method follows an unsystematic approach to selecting the studies presented, analyzed, and contrasted (PARÉ; KITSIOU, 2016). Its primary purpose is “[...] to provide the reader with a comprehensive background for understanding current knowledge and highlighting the significance of new research.” (CRONIN; RYAN; COUGHLAN, 2008, p. 38). Furthermore, this method encompasses consultation of primary sources to present this research’s basal constructs, models, and theories. The interweaving of these constructs, models, and theories was careful to avoid contradictions among theoretical assumptions since they derive from distinct fields such as Applied Linguistics, Education, and Psychology (ALVES-MAZZOTTI; GEWANDSZNAJDER, 2004).

2.2 POSITIVE PSYCHOLOGY: HISTORY, AIMS, AND RESEARCH ON WELL-BEING AND LEARNING

The earliest insights on Positive Psychology emerged in 1906 with the work of William James, which already included an interest in individuals' optimal functioning. However, Abraham Maslow, the renowned representative of Humanistic Psychology, was the researcher who first mentioned specific terms opening the path to the to-be-born branch of Psychology (FROH, 2004; MACINTYRE; MERCER, 2014). Maslow claimed that psychology was only devoted to one part of its mission: dealing with the dark and unhealthy side of individuals. Their potential side remained understudied (MASLOW, 1954).

Even considered a pioneer in this subfield, the lacking of empirical robustness in Maslow's research methods is criticized. (MACINTYRE; MERCER, 2014; SELIGMAN; CSIKSZENTMIHALYI, 2000). This gap started to be filled decades later with Martin E. P. Seligman after the 1998 American Psychological Association (APA) Convention in San Francisco. Seligman, in that period, occupied the presidency of APA and counted on the research carried out by Mihaly Csikszentmihalyi to pave the way toward the already newborn branch of the field (FREDRICKSON, 2003).

Csikszentmihalyi is known for his research on the concept of *flow*. According to him, flow is “[...] the state in which people are so involved in an activity that nothing else seems to matter; the experience itself is so enjoyable that people will do it even at great cost, for the sheer sake of doing it.” (CSIKSZENTMIHALYI, 2008, p. 4). Flow, closely associated with quality of life and well-being, is characterized by one's experience of positive emotions, including happiness. It will be mentioned throughout this doctoral dissertation as one of its forms of experience is through symbolic thinking³, including reading (CSIKSZENTMIHALYI, 2008). The researcher points out that reading and singing are conducive to flow, and the latter's patterns influence listeners' desired moods.

In a word, the experience of flow, besides involving positive emotions and learning, is strongly associated with the skill focused on this research, EFL reading, and the advised form of its practice, through singing.

PP, thus, has its roots in the desire to broaden the scope of Psychology far beyond healing, a curative mission mostly inherited from the post-period of World War

³ Symbolic thinking, according to the APA dictionary is “[...] the ability to think about objects and events that are not within the immediate environment. It involves the use of signs, symbols, concepts, and abstract relations, as evidenced by language, numeracy, and artistic or ritual expression.” (<https://dictionary.apa.org/symbolic-thinking> , accessed on January 27th, 2022).

II (SELIGMAN; CSIKSZENTMIHALYI, 2000). As acknowledged by the researchers, other aspects besides human suffering, including people's productivity and fulfillment and high talent nurturing, had already been within psychology's scope before World War II. However, after that period, people's wide range of pain-related mental disorders required urgent treatment. That need, as pointed out by Seligman and Csikszentmihalyi (2000), demanded specific types of knowledge for the cure. According to them, the same need turned psychology into a field primarily illness-oriented and, thus, concerned with damage repair. Other than that, research predominantly focused on negative emotions given its merge with pathology (TUGADE; DEVLIN; FREDRICKSON, 2021). Counter to that, Positive Psychology (PP) proposed a broader scope based on solid empirical evidence that encompasses the study of factors not limited to cure but to the systematic nurture of individuals' lives.

As described by Seligman and Csikszentmihalyi (2000), PP is concerned with preventing physical and mental illnesses. According to them, it seeks to support the development of positive traits, including courage and optimism, mainly in individuals of at-risk groups (i.e., children depending on poor parental care, individuals from genetically vulnerable groups tending to develop depression, or getting into drug abuse). As they illustrate, courage, optimism, and other traits are expected to act as energizing forces that give these individuals the necessary strength to face mental and physical issues or, maybe, avoid their occurrence in the future. Furthermore, PP focuses on people's individual and social spheres. Seligman and Csikszentmihalyi (2000) explain that, at the individual level, PP is concerned, among others, with people's capacity for love, courage, originality, and perseverance. The social level concerns tolerance, responsibility, moderation, work ethic, and others, aiming to promote better citizenship. Otherwise stated, PP focuses on people's flourishing and coping with adversities to live better (MACINTYRE; MERCER, 2014; PINIEL; ALBERT, 2018).

It is imperative to observe that PP reckons benefits inherent to negative emotions. Nevertheless, considering their adversities, it focuses on helping individuals build wellness, happiness, and optimal functioning from them (DEWAELE *et al.*, 2020; LAKE, 2013; LI; XU, 2019).

It is also critical not to confound PP with the mass-media culture of positivity and self-help. This movement tends to turn happiness into an obligation, sometimes triggering the arousal of guilt in those who struggle and feel negative during difficult life

periods (KOMOROWSKA, 2016). As put by the researcher, this is just a simplified, popular version of PP. Komorowska explains that PP utilizes rigorous research methods to support humans' ability to consciously monitor their emotions, cope with them and build resilience.

Departing from this succinct historical introduction of PP, the chapter now reviews studies of PP on the overall effects of positive emotions on people's (1) well-being; (2) learning; and (3) second language acquisition.

2.2.1 Studies on the effects of positive emotions on people's well-being

Aligned with the aims of PP, several studies have investigated the overall effects of positive emotions on people's well-being (FREDRICKSON; JOINER, 2002; FREDRICKSON *et al.*, 2003; KOK *et al.*, 2013; PFATTHEICHER *et al.*, 2020; WEST *et al.*, 2021), to mention some.

Positive emotions can broaden attention and cognition, fostering coping with life's adversities and maintaining well-being (FREDRICKSON; JOINER, 2002). Broadened cognition enables individuals to think more deeply about their attitudes in difficult times. According to Fredrickson and Joiner (2002), current well-being predicts the prospective experience of positive emotions and, consequently, future well-being in a building-on cycle. In this line, Fredrickson and Joiner (2002) investigated the effect of positive emotions on individuals' current well-being and the maintenance of this emotional state toward the future. Participants were university students (mean age 20, $SD= 1.3$), and data were collected over five weeks. The study predicted a continuous build-on relationship between positive emotions and broad-mind coping, leading to a progressive succession of positive experiences, namely an *upward spiral of positive emotions*. Chapter III will discuss this hypothesis more deeply. The study confirmed the researchers' expectation: positive emotions constitute the initial triggering force that broadens thinking, and broadened thinking builds on positive emotions, and so on. This upward spiral successively creates a long-lasting problem-solving skill (i.e., an intellectual resource) that supports present and future life quality. The study presents unfoldings of educational nature since it indicates that experiencing positive emotions was associated with sharper cognitive processing. Problem-solving is a critical cognitive skill in various school subjects, such as math and physics. It is also essential

for adequate reading comprehension for its beneficiary effect on semantic mapping and inference-making processes, for instance. This finding suggests that school activities that simultaneously promote cognitive processing and the experience of positive emotions result in the gain of intellectual resources and psychological resources (i.e., well-being) in the classroom. Teaching English as a foreign language reading through singing for vocabulary learning may be one example of these activities. Chapter IV will explore this proposal in more detail.

People's psychological resilience to crises is another topic of interest in Positive Psychology (PP) as it concerns individuals' use of broadened thought-action triggered by positive emotions to tackle adversity.

In other words, resilience is a psychological resource that expands how one thinks, behaves, and adapts to life when it becomes challenging. Guided by this rationale, Fredrickson *et al.* (2003) investigated the effect of positive emotions on individuals' resilience in the context of the September 11th, 2001, terrorist attacks. Participants were college students and recent graduates of the University of Michigan. The researchers used a pre-posttest experimental design and found that continuous experiences of positive emotions were associated with developing resilience through broad-minded coping. The study also indicated that those individuals who presented higher resilience traits in the pre-crisis period were those who experienced fewer symptoms of depression following the attacks. The study also found that resilient people demonstrated higher life satisfaction, optimism, and tranquility even after the severe crisis period. As asserted by the researchers, positive emotions seem to build durable psychological resources, including the resiliency needed to cope with periods of crisis. Resilience is also undeniably essential for keeping learners engaged. Adolescents, the target population of this doctoral dissertation, struggle with intense physiological, emotional, cognitive, and social changes in this life period, as stated before. Resilience derived from broad-minded coping is a fundamental characteristic for them to face all adversities inherent to their ages. One way to approach the topic of resilience, even in EFL classes, is through singing. Singing songs that bring adolescents' reality to the fore may be the source of classroom debates that trigger the adolescents' broadened thinking needed for coping.

Positive Psychology also focuses on the role of social relationships in individuals' cognitive and emotional regulation. For instance, Kok *et al.* (2013) examined the impact of a meditational intervention on individuals' emotional and

cardiovascular autonomic regulation as a function of the social connections and positive emotions promoted by this practice. The sample comprised 65 participants (median age = 37.5), employees of the University of North Carolina at Chapel Hill. Data included measures of vagal tone⁴, social connections, and positive emotions. Theorists have proposed that higher vagal tone measures indicate better cognitive and emotional regulation, cardiovascular health, and healthier lives. Thus, the study hypothesized that participants in the experimental condition would: (i) present better autonomic regulation and, consequently, increased changes in positive emotions; (ii) due to the increase of positive emotions, they would be more able to perceive positive social connections; and (iii) that better perception of social connections would generate higher vagal tone (i.e., better autonomic regulation). Measures included daily assessment of meditation practice, emotions, and social connection. Vagal tone was assessed through spectral frequency analysis of heart rate data to obtain high-frequency heart rate variability. Results demonstrated that participants in the experimental condition reported more positive emotions, perceived better social connections, and presented higher vagal tone measures. More specifically, the study indicated that the causal link between positive emotions and higher vagal tone was participants' perceptions of their positive social connections as a function of the meditational intervention. Neuroscience has found evidence that happiness is socially contagious, eases depressed moods, reduces stress and anxiety, and shifts one's focus from physical pain (KORB, 2015). A study conducted by Fowler and Christakis (2008) in 1983-2003, for instance, showed that happiness is a collective phenomenon that spreads from person to person who lives nearby and interacts.

The study considered happiness to consist of positive emotions essential for people's well-being and health. Besides, health promotion practices conducive to social connections may trigger well-being and learning outcomes in educational contexts. For example, singing in the classroom may cause students to attune and manifest meaning through voice. It synchronizes their attention to a unique socially shared object, the song (CAMLIN, DAFFERN; ZESERSON, 2001). The practice is motivating and enjoyable and promotes student interaction and bonding (SHIN, 2017).

⁴ As explained by Diamond, Fagundes, and Butterwoerth (2011), vagal tone is considered a physiological index of emotion regulation, empathetic capacities and socioemotional behaviors. According to them, vagal "[...] refers to the functioning of the 10th cranial nerve, which provides inhibitory input to the heart via the parasympathetic nervous system (PNS) and helps to regulate metabolic output in response to environmental events." (DIAMOND; FAGUNDES; BUTTERWORTH, 2011, p. 166).

Moreover, singing, a form of reading, is a means of acquiring intellectual resources, such as EFL vocabulary.

Another topic of interest in Positive Psychology is altruism, one's actions on behalf of others with no reward intention. Pfattheicher *et al.* (2020) conducted a study within this realm in the context of the COVID-19 pandemic focusing on the role of empathy in people's prosocial behavior. The researchers implemented four studies with 3.718 participants from Western countries, including the US, the UK, and Germany. The study intended to examine whether participants' motivation to adhere to two prosocial behaviors, namely wearing masks and maintaining social distancing from those most vulnerable to the virus, would correlate with measures reflecting personal empathy. According to the researchers, even though prosocial behaviors bring personal costs, such as being far from beloved ones and stopping to partake in social events, people adopt them because they encompass measures that, besides protecting themselves, protect others. In other words, positive emotions drive prosocial behaviors through altruism, empathic care, and love for the next. Results showed a correlation between the variables tested, but presenting participants with information devoid of an affective appeal was not enough to awaken their empathy. The study informs policymakers to consider adding emotional content in campaigns to adopt prosocial behaviors. Furthermore, the study demonstrates that the induction of positive emotions in health campaigns can directly impact the protection of human life in pandemic contexts. The educational implications of this study will be discussed after the following study reviewed below due to their relatedness.

Aligned with Pfattheicher *et al.*'s (2020) study described above, West *et al.* (2021) tested correlations among individuals' emotions, prosocial tendencies such as empathy and love of humanity, and prosocial attitudes, including handwashing, mask-wearing, and social distancing during the COVID-19 pandemic. The study predicted that mutual care and a sense of oneness would generate prosocial tendencies to slow the spread of COVID-19. More specifically, the researchers hypothesized that individual differences in prosocial tendencies would correlate with individual differences in the self-perception of daily *positive resonance*⁵ and prosocial tendencies

⁵ As defined by West *et al.*, the theory of positive resonance "[...] holds that shared pleasant states that include the key features of mutual care and a sense of oneness through behavioral synchrony, function to build prosocial tendencies (e.g., self-transcendent and other-oriented dispositions of felt unity, empathy, altruism and general positivity toward humanity)." (2021, p. 1).

in favor of reducing the viral spread. To test the hypotheses, West *et al.* conducted two online studies with US participants from college and national samples, all over 18 years old. Results obtained from 1.286 participants suggested that empathy cross-sectionally and prospectively affects health behaviors that can decrease viral spread. The study showed that positive emotions are associated with prosocial behavioral tendencies that help protect the community in pandemic contexts. The studies by Pfattheicher *et al.* (2020) and West *et al.* (2021) suggest that building positive emotions plays a crucial role in adopting empathic behaviors. Despite its scientific achievements, the world has recently faced unprecedented issues concerning the refusal of prosocial behaviors during the pandemic. Considering that, schools should reflect on which type of citizens they are forming. Those owning pure conceptual knowledge which can be turned out into any outcome, including destructive ones, or those who acquire conceptual knowledge and apply it empathetically. Besides that, what can schools do in that sense? A possible answer is in Sprenger (2020) on prosocial behavior, viewed as taking attitudes that, guided by school norms, aim at the goodness of others without any desiring reward.

Schools constitute one of the most promising contexts for developing prosocial behavior where learners need to live in a plural community and be aware of what they can and cannot do in a shared environment through prosocial norms applicable in and out of school. Otherwise put, when the school delimits norms of prosocial behavior, it helps learners to understand that the interconnectedness among people implies attitudinal responsibility to the whole group involved (CAVANAGH, 2016). Positive resonance, as one may assume, synchronizes learners through positive emotions, making them realize that *what one does affects others*, and this awareness, as underscored by Sprenger, applies to out-of-school contexts. Besides that, and more specifically, how can practices of EFL reading through singing trigger prosocial behavior in learners?

Teachers play a fundamental role in the choice of songs presented to students in that they have to be linked to the curriculum and thus include appropriate linguistic or thematic topics to be debated in class (ADNYANI; DEWI, 2020). When singing songs that contain meaningful societal topics, the teacher may use songs to catalyze emotions and promote classroom discussions (FONSECA-MORA; MACHANCOSES, 2019). This is one of the most significant values of singing; it consists of an emotional

form of reading that may inspire learners to think about their attitudes and societal roles while learning the language.

Several other studies on Positive Psychology have suggested that positive emotions predict other benefits to individuals' well-being. They include the increase in trust (DUNN; SCHWEITZER, 2005; BURNS *et al.*, 2008), the development of a cross-racial feeling of oneness (JOHNSON; FREDRICKSON, 2005), the recovery from daily stress (ONG *et al.*, 2006), openness to interact with others (FREDRICKSON *et al.*, 2008), an increase of life satisfaction (COHN *et al.*, 2009), improvement in the quality of romantic relationships (ALGOE; GABLE; MAISEL, 2010; ALGOE; FREDRICKSON; GABLE, 2013) and long term adherence to positive health behavior (VAN CAPELLEN *et al.*, 2017), to mention some.

Having introduced some studies of Positive Psychology in people's general well-being and briefly tapped into the topic of EFL reading through singing, the following review looks for further evidence of new unfoldings of educational interest, specifically to effective learning.

2.2.2 Studies on the effects of positive emotions on learning

As stated in Chapter I, this doctoral dissertation aims to raise bibliographical support to claim that the practice of EFL reading through singing, for its yielding positive emotions and broadening of working memory (WM) focus of attention, enhances vocabulary learning among adolescents. Closer to this objective, research has suggested that how one feels may predict individual differences in learners' cognition. It includes the application of decision-making strategies, self-awareness of self-efficacy, information recall, visuospatial scope, and semantic associations, among others (ISEN; MEANS, 1983; ISEN *et al.*, 1985; TALARICO; BERNTSEN; RUBIN, 2009; ROWE, HIRSH; ANDERSON, 2007). The chapter reviews these studies next.

The first study now reviewed focused on how emotions may affect learners' decision-making abilities (i.e., an intellectual resource). A decision, generally defined, "[...] is simply creating an intention to move to a particular direction." (KORB, 2015, p.105). As stated by the researcher, decision-making alters the way our brains perceive the world around us since it narrows what is perceptually noticed by individuals. Korb states that this happens due to focused attention to what is relevant

to the individual and suppression of what is not, which speeds up processing and increases relevant information activation. Following this rationale, Isen and Means (1983), in a widely cited study, aimed at examining the influence of positive emotions on individuals' ability to apply decision-making strategies. The sample investigated by the researchers was composed of 22 undergraduates enrolled in an introductory psychology course. The researchers induced experimentals to a positive emotional state through different stimuli. After that, participants performed a decision-making task that demanded the manipulation and storage of multiple pieces of information. Results indicated that, compared to controls, experimentals: (i) performed the task faster; (ii) were better at keeping track of its aim; (iii) and were better at discarding irrelevant items. Overall, Isen and Means' study suggests that positive emotions improve individuals' decision-making efficiency. Keeping track of task goals, manipulating several pieces of information concurrently, and eliminating unimportant material from the focus of attention are cognitive processes inherent to working memory (WM) and learning.

From math operations to EFL reading, learners must keep the controlling task objective in memory to decide which information is relevant. In addition, they have to maintain those pieces of information in WM to be able to make up their decisions. While constructing meaning from songs, EFL readers must act as decision-makers because lyrics are full of metaphors and ambiguities. To do that, readers depend on the interaction of high and low-level reading processes to make informed decisions whenever necessary. To make informed decisions, readers must maintain pieces of information in the WM focus of attention while making sense of them.

The study of Isen and Means (1983) here reviewed signals that when this type of cognitive task is under operation, positive emotions broaden EFL readers' focus of attention, enabling better meaning assessment. The emotional facet of effective decision-making thus has to be taken into account. The perception of being under the control of situations through decision-making makes individuals more confident of what will happen to them (KORB, 2015). In the educational context, decision-making also involves students' awareness of the consequences of their choices to themselves and others (SPRENGER, 2020). In a word, decision-making involves reasoning cognitively while considering values and empathy.

Studies have also investigated the role of positive emotions on the recall of learners' autobiographical memories⁶. In Positive Psychology, the construct of autobiographical memory overlaps with the concept of *past selves*. According to Falout (2019), "Past selves are images of who one has been, and what one has gone through and done, as constantly assembled and reassembled through the self-stories one tells oneself, and hears about or co-constructs with others." (p. 112).

The construction of autobiographical memories and their emotional context have cognitive and emotional impacts on individuals. For instance, Talarico, Berntsen, and Rubin (2009) found that the recall of positive autobiographical memories was richer in detail than negative ones. The study participants were 170 Duke University undergraduates (M = 19 years old). It was found that recalling past everyday events marked by happiness, calmness, being in love, or having a positive surprise contained more peripheral information than recalling daily events involving negative surprise, anger, sadness, and fear. According to Fredrickson and Branigan (2005), negative emotions narrow attention to objects that represent a threat or worry to the individual. Positive emotions spread attention to the broader scenario since the individual does not need specific caution or self-protection. In other words, more is added to memory when individuals encode information while simultaneously experiencing positively-valenced emotions because they *see more* from the experienced occasion. Talarico, Berntsen, and Rubin's study adds to the seriousness of designing classes that allow students to experience positive emotions. As conjectured by the authors' findings, these classes will possibly be the most memorable ones for them and include richer details from the social relationships built and the contents taught. They consist of episodic memories biased by experiences' ups and downs that influence present and future decisions (WILIAMS; FORD; KENSINGER, 2022).

⁶ According to Anderson (2020), "Autobiographical memory refers to the memories that we hold regarding ourselves and our interactions with the world around us, that help to define who we were at different times in the past, who we are currently, and who we hope to be in the future. It includes *not only episodic memories* that form part of our life stories, but also semantic autobiographic memory that includes historical facts, traits, and knowledge states that are not unique to any particular place or time." (ANDERSON, 2020, p. 351, my emphasis). The emphasis was given to make it clear the differentiation between autobiographical memory and episodic memory. Following Anderson, (2020), "Episodic memory refers to our capacity to recollect specific experiences, and use this for "mental time travel"." (ANDERSON, 2020, p. 199, emphasis given by the authors). All in all, the basic difference is that autobiographical memories carry personal meaningful information, that, is, it is not only about a past event, such as *a Sunday lunch with my family in 1985*, but *a Sunday lunch with my family in 1985, the way I felt in that occasion and the person I was then*.

Based on the above, the recall of autobiographical memories, past selves, or episodic memories also has present and prospective emotional impacts on the process of EFL language learning. Given the long-term nature of this process, memories involving failure and anxiety, for instance, may prevent learners' current and future resilience and persistence (FALOUT, 2019). In contrast, research has shown that learners' autobiographical memories marked by positive emotions, as compared to negative ones, create the upward spiral of positive emotions, mentioned earlier, consisting of greater self-confidence and willingness to study the language in contexts other than the compulsory ones (FALOUT 2012; 2013). Falout (2019) also underscores that one of the consequences of past selves recall is the temporal self-comparisons the learner comes up with. The researcher states that learners use self-comparisons between the past and present of specific domains (e.g., EFL reading) to project self-change possibilities. Based on Anderson (2020), positive past autobiographical memories strongly influence this process due to their more pronounced bias; individuals' motivation to recall positive memories diminishes the recall of negative ones.

EFL teachers can act upon learners' construction of school autobiographical and episodic memories. Falout (2019) posits that the experience of positive emotions can diminish the negative valence of past selves and improve EFL learners' prospective view of themselves. The researcher also states that projections are associated with complex cognition that feeds into autobiographical past to process foresight and planning. Overall, the literature suggests that positive EFL learning experiences help build autobiographical memories, which help reshape past bad memories. Furthermore, positive emotions enhance detailed autobiographical recall and nurture a more optimistic view of the EFL selves. It is common sense in studies on the role of EFL reading through singing that this practice creates a welcoming environment in which students experience moments of relaxation, joy, and especially, motivation (CHEN; CHEN, 2009; DŽANIĆ; PEJIĆ, 2016; YAMAMI, 2016) among others. It is assertable that constructing knowledge under these conditions may help build richer autobiographical memories in detailed conceptual and emotional information.

The studies now reviewed (ROWE; HIRSH; ANDERSON, 2007; ISEN *et al.* 1985) are exceptionally informative for this doctoral dissertation, for their findings suggesting that positive emotions help readers establish vaster semantic relationships

among written words. They are informative because a song is a relatively short musical composition for the human voice, which features words or lyrics (MIDDLETON, 1990); to comprehend words and lyrics in the context of a song, readers must establish semantic relationships among them. If the literature suggests that positive emotions enhance this process, thinking of ways to induce EFL learners' positive emotions while reading is worthwhile. The study by Rowe, Hirsh, and Anderson (2007) examined the effect of positive emotions on university students' visuospatial and semantic access scopes. The researchers analyzed participants' ability to establish meaningful relationships between words under the effect of different emotional states *induced through music*. Results indicated that, compared to a sad and a neutral state, participants induced to a positive emotional one demonstrated amplified scope in both variables (i.e., visuospatial and semantic access). More specifically, the results suggested that positive emotions widen one's peripheral capture of visual information. It also showed that this positive emotional state broadens the individual's capacity to establish conceptual links among lexical items in memory.

Compatible with Rowe, Hirsh, and Anderson's findings, Isen *et al.* (1985) conducted a study with college students, inducing them to neutral, negative, and positive emotional states. They found that participants in the positive emotion condition produced a broader range of unusual associations among neutral-valenced words. They demonstrated a higher ability to establish unusual, creative, and unique linguistic connections. The researchers interpreted the result considering the contextualist position proposed by Cognitive Psychology. According to Isen and colleagues, this position holds that exogenous and endogenous factors simultaneously affect how memory processes information. The external stimuli context and the internal cognitive context that constitute the content activated in WM influence the extensiveness a given external stimulus is processed. The researchers point out that happiness triggers more varied and extensive content brought to WM. According to them, this extensiveness enables individuals to amplify their network of associations; feeling positive thus seems to allow individuals to see more semantic possibilities than feeling neutral or negative. If positive emotional induction leads individuals to extensive semantic associations, it may be that EFL reading through singing has a similar effect on readers for its yielding positive emotions.

The present section continued reviewing studies, providing evidence that positive emotions also assist learning. It kept presenting theoretically-based inferences

regarding the practice of EFL reading through singing in the classroom and its possible learning outcomes. The following section narrows this discussion even more, focusing on research in Positive Psychology in Second Language Acquisition.

2.3 POSITIVE PSYCHOLOGY IN SECOND LANGUAGE ACQUISITION

Emotions, interchangeably referred to as *affect* in earlier studies, have also been a topic of interest in research on second language acquisition (SLA). However, more extensive and intensive research on emotions in SLA has been conducted in the last decade, starting with the publication by MacIntyre and Gregersen (2012), *Emotions that facilitate language learning: The positive-broadening power of the imagination* (DEWAELE *et al.*, 2020; LI, 2019)⁷. For organizational purposes, this study and further information on this publication by MacIntyre and Gregersen will be reviewed in Chapter III.

This recency establishing links between PP and SLA occurred to fulfill a gap created by the predominance of studies from Cognitive Psychology, which besides prioritizing the sole observance of individuals' language production phenomena, also tended to consider emotions as irrational and non-statistically measurable (DEWAELE, 2022; PRIOR, 2019). This history, however, has suffered a dramatic change, given the advances in research on motivation for second language learning. Also, the already existent large array of studies on emotions in the field of Psychology undoubtedly fomented the theoretical terrain for the new research avenues. Finally, the multidisciplinary study of PP has evolved for its critical role in its consolidation as a scientific subfield (DEWAELE *et al.*, 2020) through empirical protocols and program implementation (LOPEZ; GALLAGHER, 2009).

The history of this new scientific subfield within Applied Linguistics, as proposed by Dewaele *et al.* (2020), can be divided into two periods: the first, namely *New Developments in the Periphery* (2012-2015), and the second, *The Flowering of PP Research in Applied Linguistics* (2016-Present). The studies conducted during the first period focused on motivation, affect, and emotions but maintained an emphasis on the effects of anxiety on L2 learning, that is, a bias toward negative emotions (DEWAELE

⁷ The publication of Lake (2013), *Positive L2 self: Linking positive psychology with L2 motivation*, is also mentioned as one of the first studies of PP in SLA for its literal application of PP concepts within SLA (MACINTYRE; MERCER, 2014).

et al., 2020; PADILLA; CHEN; LAKE, 2020). According to the researchers, these studies remained on the sidelines of the cognitivist perspective, with publications in less influential journals and participation neglected in significant events. According to Dewaele *et al.* (2020), the second period was (and is being) marked by the insertion of PP concepts in the studies that focus on individual differences among persons and groups and ways to promote concurrent well-being and L2 learning. During the current period, important events have been held, and texts have been published in more prestigious journals of Applied Linguistics. As put by Dewaele *et al.* (2020), studies on PP in SLA have also crossed Western borders and been conducted in Asian countries. New variables, data collection, and data analysis tools have been developed. According to the researchers, studies have also started focusing on institutions, teachers, their well-being, mindset, and behavior. However, they acknowledge a gap in this period: interventions mainly concern affective factors at the expense of linguistics, as put before.

The current doctoral dissertation thus finds a gap in its niche. It is a study on Applied Linguistics, more precisely investigating SLA from the perspective of PP. It presents reflections and proposals on the broadening effect of positive emotions in working memory (WM) information processing during EFL reading through singing for vocabulary learning; the reflections and proposals are grounded on results from a large body of studies to be reviewed in Chapter IV.

To conclude, a non-exhaustive list of three landmarks is worthy of being mentioned in this young 24-year-old new branch of science: (1) the publication of the *Special Issue on Positive Psychology* by the journal *Studies in Second Language Learning and Teaching* in 2014, which brings together earlier studies and theories on affect and motivation, their strengths and weaknesses, and introduces PP to SLA; (2) the publication of the volume *Positive Psychology Perspectives on Foreign Language Learning and Teaching* in the series *Second Language Learning and Teaching* in 2016, which presents theoretical and empirical studies exploring interrelationships between PP and foreign language learning and teaching; and (3) the publication of the e-Book *Positive Psychology and Learning a Second or Third Language* by the *Frontiers Journal Series* in 2020, presenting studies from researchers of different parts of the world whose work is guided by Positive Psychology. Studies from these and other publications are reviewed later on in this chapter.

In a nutshell, SLA from the perspective of PP (PP in SLA) deals with three distinct areas of study: (i) the positive characteristics and traits of people; (ii) positive emotions and feelings; and (iii) the role of contextual and environmental factors in the promotion of positive emotions (DEWAELE *et al.*, 2020; GABRYŚ-BARKER; GAŁAJDA, 2016). The first and the second focus on teachers and learners, and the third focuses on educational institutions. This doctoral dissertation is aligned with the first area and seeks to trace relationships between positive emotions, WM focus of attention, and adolescents' EFL vocabulary learning due to reading through singing.

These and more recent studies reinforce the aim of PP in SLA, which is to promote the improvement of learners' achievement, well-being, intrinsic motivation, and creativity (LI; XU, 2019).

Important to reinforce that PP does not aim to ignore negative issues inherent to teaching and some learning contexts; it aims to seek value in these issues and deal with them utilizing a strengths-based approach (KOMOROWSKA, 2016). In other words, the approach is concerned with identifying and strengthening human potentialities (MACINTYRE; MERCER, 2014). Finally, PP in SLA aims to inform teachers how to guide students' cognition to manage their emotions while learning a new language.

As emphasized earlier, teachers and researchers must also be fully aware that PP is Science, not pop psychology or self-help literature (GABRYŚ-BARKER; GAŁAJDA, 2016). It is not about suppressing students' negative emotions or neglecting the typical structural and pedagogical problems inherent to schools. Opposed to that, PP allows for the rigorous examination of the positive and negative sides of negative and positive emotions in the learning process without dichotomies (DEWAELE; MACINTYRE, 2014). It does not judge negative emotions as useless but seeks to help students build personally relevant resources (i.e., psychological, physical, social, and intellectual resources) to promote their well-being. Ultimately, its goal is to identify a balance between negative and positive emotions (DEWAELE *et al.*, 2020, p. 17).

As announced earlier, the subsequent review of studies narrows this literature review more. It keeps track of the rationale, premises, and findings proposed up to now, however, incorporating studies of PP in SLA.

2.3.1 Studies on positive emotions and second language acquisition

As signaled above, this subsection aims to review PP studies in SLA. These studies comprise a first set of studies of PP in SLA presented in this doctoral dissertation (DEWAELE; MACINTYRE, 2014; GALLO, 2016; GUZ; TETIURKA, 2016; PINIEL; ALBERT, 2018; LI, 2019; MACINTYRE; GREGERSEN; MERCER, 2020; SHIRVAN; TAHERIAN; YAZDANMEHR, 2020; JIN; DEWAELE; MACINTYRE, 2021). This review aims to open the gates to describing the *Broaden-and-Build Theory of Positive Emotions* (FREDRICKSON, 1998, 2001, 2003, 2004; FREDRICKSON; BRANIGAN, 2005), to be presented in Chapter III. A second set of studies of PP in SLA will be described in the very same chapter since the studies mentioned there are primarily grounded in that theory.

Two types of emotions commonly observed among learners are foreign language enjoyment (FLE) and foreign language classroom anxiety (FLCA). Enjoyment in SLA, on the one hand, can be defined as “[...] the pleasant feelings that originate from going beyond homeostatic boundaries as well as extending oneself to gain new experiences particularly when one encounters challenging tasks.” (SHIRVAN; TAHERIAN; YASDANMEHR, 2020, p. 138). On the other hand, the concept of anxiety in SLA can be described “[...] as the feeling of tension and apprehension specifically associated with second language contexts, including speaking, listening, and learning.” (MACINTYRE; GARDNER, 1994). More specifically, foreign language classroom anxiety (FLCA) refers to a “[...] distinct complex of self-perceptions, beliefs, feelings, and behaviors related to classroom language learning arising from the uniqueness of the language learning process.” (HORWITZ; HORWITZ; COPE, 1986). Dewaele and MacIntyre (2014), thus, aimed to check whether the first, FLE, considered a positive emotion and the latter, FLCA, a negative emotion, would present dichotomous or concatenated effects on learners. The study consisted of an internet-based survey with participants aged 11 to 75 ($M = 24$ years, $SD = 8.5$) worldwide, subdivided into different age categories. The study controlled for differences in educational level, foreign languages currently studied, foreign language proficiency, self-perception regarding foreign language achievement, and the number of foreign languages mastered. The researchers applied a 5-point Likert scale questionnaire to assess FLCA and examined results through quantitative analysis. They assessed FLE through essays in which participants were to write about past enjoyable foreign language class episodes. The essays were qualitatively analyzed. Statistical analysis showed a significant negative correlation between FLCA and FLE;

however, presenting a small effect size. The study maintained the tendency for dichotomous effects of positive and negative emotions in foreign language learning. In other words, the study suggests that FLCA and FLE compound different emotional dimensions. The small variance, however, suggests that FLE does not necessarily reflect an absence of FLCA: a learner may experience high levels of enjoyment while concurrently feeling some level of anxiety, and vice versa. In that sense, the study does not view the two types of emotions in focus as simple endpoints of a single continuum; it acknowledges them as distinct dimensions, that is, as emotions tending to move toward distinct directions with zones of overlapping (MACINTYRE; MERCER, 2014; PINIEL; ALBERT, 2018). Additionally, results showed that FLCA was lower among participants currently studying more foreign languages, among those with higher educational levels, higher foreign language proficiency, mastery of a higher number of foreign languages, and among those with more positive self-perception of foreign language achievement. This result suggests that prior knowledge may attenuate learners' anxiety, allowing for higher enjoyment during the learning process. Feeling positive about one's proficiency seems to have the same effect. If this interpretation is correct, this study may indicate an upward spiral between cognition and positive emotions, as Fredrickson and Joiner (2002) proposed in the study reviewed earlier in this chapter. Otherwise stated, cognitive gains promote enjoyment that promotes cognitive gains in a continuous upward chain. The proposal of the upward spiral of positive emotions hypothesis, as already stated before, will be fully explained in Chapter III. Besides, the qualitative analysis of Dewaele and MacIntyre's (2014) study here described found that enjoyment was associated with student-centered activities in 41% of the essays. Participants reported having a preference for some autonomy and empowerment in activities such as role-playing, debating, and *singing*! This result is relevant for this doctoral dissertation, given its proposition that activities involving the practice of reading through singing may predict better vocabulary learning outcomes. As stated before, a full review of studies on singing will be reported in Chapter IV. Enjoyment was also associated with teachers' attitudes, including organization, positivity, and the ability to alleviate the tension in the classroom. Peer and group activities were also remarkably associated with enjoyment and fear-free experiences. Finally, adolescents demonstrated higher levels of FLCA.

As it can be drawn from these results, teachers who try to attenuate anxiety through student-centered activities that trigger positive emotions may be on the right

path to boosting adolescents' cognition and emotions in favor of effective learning. Besides that, teachers should alert their students that negative emotions are part of people's complex psychological functioning, are important to a certain extent, and are transient. By doing that, teachers can contribute to fostering EFL learners' emotional self-perception and regulation to meet the demands of distinct contexts.

PP in SLA has also investigated foreign language enjoyment (FLE) in research on how Trait Emotional Intelligence (TEI) relates to positive emotions in EFL learning. According to Li (2019), and Li and Xu (2019), TEI is a theoretical model of emotional intelligence (EI). As defined by Petrides *et al.* (2016), TEI "[...] concerns our perceptions of our emotional abilities, that is, how good we believe we are in terms of understanding, regulating, and expressing emotions to adapt to our environment and maintain well-being." (p. 335). In other words, research adopting TEI considers learners' self-perception and capability to monitor their emotions to adapt to diverse contexts to maintain their quality of life. In this regard, Li (2019) investigated interrelationships between TEI, self-perceived and actual English as an L2 achievement, and FLE. Participants were 1.718 second-year senior high school students from three schools in China.

The researchers used psychometric scales to measure TEI and FLE, a 10-point scale to assess self-perceived L2 achievement, and a standardized English test to assess actual L2 achievement. Results showed a significantly positive correlation between TEI and FLE. The same was found among self-perceived L2 achievement, TEI, and FLE. The same scenario occurred regarding actual L2 achievement, TEI, and FLE. Finally, results were replicated concerning students' self-perceived and actual L2 achievement. Additionally, results indicated that FLE had a partial mediational effect on the relationship between students' TEI and self-perceived L2 achievement and the relationship between students' TEI and their actual L2 achievement. The mediational effect of FLE indicates that feeling positive about L2 learning broadens L2 self-perception optimistically and appears to have a broadening effect on cognition. In this study, enjoying the L2 learning process strongly predicted adolescents' self-confidence and actual L2 learning.

Schools are inevitably concerned about the quantitative measurement of their students' academic performances. However, Csikszentmihalyi (2008) warns that schools' prestige should depend on the enjoyment their practices make learners feel. The study of Li (2019) demonstrates that enjoyment enhances the regulation of

emotions and the achievement of L2 learning. It characterizes individuals who feel joy in acquiring new knowledge. A school limited to being concerned with its students' scores fails to fulfill one of its primary functions: preventing learners from resting on apathetic homeostasis of conceptual knowledge. When bringing songs to the classroom, EFL learners' TEI may be improved because songs lower their affective filter, sparks their curiosity, and help turn the classroom atmosphere from daunting to soothing (COYLE; GRACIA, 2014; DAVIS; FAN, 2016). In a word, the resulting enjoyment EFL classes atmospheres promote may be regarded as the fertilizer that nourishes the seed planted inside learners so that they can flourish as humans.

Adjacent to the studies of Dewaele and MacIntyre (2014) and Li (2019), PP in SLA has also tried to unravel how FLE fluctuates through time among EFL learners. Shirvan, Taherian, and Yazdanmehr (2020) conducted a study on this topic, intending to identify the dynamics of FLE as a function of ecological factors, such as self and social factors, and fractionating time into months, weeks, minutes, and seconds. Participants were two female students, with the assigned pseudonyms Sara and Sanaz (aged 21 and 20 years, respectively), enrolled in an intermediate course in English at a private language institute in Iran. Data collection was carried out in a 16-week semester utilizing the Ecological Momentary Assessment (EMA), which includes different tools to assess real-time information concerning FLE across time. The tools included the idiodynamic method for level 1 (i.e., seconds), enjoy-meters for level 2 (i.e., minutes), diaries for level 3 (i.e., weeks), and open-ended interviews for level 4 (i.e., months). The idiodynamic method, as explained by MacIntyre and Legatto (2011), consists in (a) recording a communicative task; (b) showing the recording to the participant; (c) having the participant use a technological device to rate the fluctuation of willingness to communicate from moment to moment based on pieces of evidence shown in the video, which generates a graph; and (d) in revising the graph to unveil the underlying reasons for the fluctuations depicted. Participants performed two tasks, the first an easy and the second a more challenging one. Following the procedure described, participants rated their enjoyment through a computer program, and at the end, they answered debriefing questions on the resulting graph. Enjoy-meters, as described by the authors, consisted of A4 size sheets in the form of thermometer-shaped figures representing, on a scale from 0 to 10, how much enjoyment they felt at each 5-minute interval. It also included participants' comments regarding the enjoyment fluctuations and their underlying reasons. Diaries asked participants to

email the researchers a weekly entry on the relationships between moments of enjoyment and the specific learning experiences associated with them. Finally, the interviews consisted of open-ended questions at the semester's beginning, middle, and end. Data were transcribed and qualitatively analyzed by the researchers through coding and categorization. The inter-coding agreement was 90%, and disagreements were discussed until a consensus was reached. In the end, interactions of the enjoyment patterns between the two participants were examined across time levels. The results of the study showed FLE variance in both participants. Even though they presented congruent behaviors and emotional states, Sara's enjoyment was mostly influenced by self-factors (i.e., her thoughts, emotions, self-judgment concerning her achievement, and evaluation of peers' judgment over her skills). Differently, Sanaz's enjoyment was mostly shaped by social factors (i.e., peer interaction and the teacher's positive appraisal and feedback). Consonant to Guz and Tetiurka (2016), they were congruently influenced by the teacher's behavior, practices, and mindset. Additionally, both of them were influenced by each other's behaviors and emotions. In agreement with Piniel and Albert (2018), Sanaz felt higher enjoyment in listening than speaking due to the fear of colleagues' judgment. Sanaz's behavior and emotions, consistent with Fredrickson and Joiner (2002), showed broadening thinking through problem-solving techniques to improve her performance during the semester. Endorsing Fredrickson's (2001, 2003) *Broaden-and-Build-Theory of Positive Emotions*, to be fully described in Chapter III, Sanaz's positive emotions experienced during the class activities, on the one hand, crossed the boundaries of the language institute, an indication that positive emotions build individuals' enduring social and intellectual resources. On the other hand, Sara's EFL enjoyment, influenced by the fear of colleagues' judgment, is informative for teachers who use EFL reading through singing for vocabulary learning. As shown by the study of Dewaele and MacIntyre (2014) earlier in this chapter, anxiety is a factor that hampers EFL learners' cognitive performance and emotional regulation. Thus, the practice of singing in the class has to be well thought out not to trigger the threat of exposure, anxiety, and fear of peer judgment. Following Millington (2011), choral singing serves this role well: it increases students' relaxation and lessens classroom-related threats. EFL reading through singing in a group can increase learners' confidence, avoid their enjoyment oscillation, and even help them benefit from contacting learners with higher reading proficiency. In sum, Shirvan, Taherian, and Yazdanmehr's (2020) study demonstrated the

usefulness of using ecological momentary assessments to investigate the enjoyment nuances inherent to specific timescales. It also showed how heterogeneous and complex the emotional dynamics inherent to foreign language enjoyment occurs within learners when comparing micro and macro levels and distinct ecological factors.

PP in SLA has also sought to test methods to reduce the detrimental effects of anxiety on foreign language learning. One of these methods is to induce learners to practice reminiscing (i.e., talking or writing about past experiences one remembers with pleasure). Reminiscing, within this context, could be explained as activating positive EFL learning experiences schemata and manipulating their content in working memory (WM). Within this realm, Jin, Dewaele, and MacIntyre (2021) investigated whether reminiscing about language achievements could decrease learners' foreign language classroom anxiety. This study ties in with Talarico, Berntsen, and Rubin's (2009) study reviewed earlier for its reference to retrieving autobiographical memories. Jin, Dewaele, and MacIntyre had 88 participants, students majoring in English from a university in South China. Experimentals were 42, with a mean age of 19.40 ($SD=.85$), and controls were 45, with a mean age of 19.33 ($SD=.85$), from the first or second years of the course. The researchers assessed anxiety through an online survey at the experiment's beginning and end. Experimentals, however, were instructed to practice reminiscing about their positive past EFL achievements during a 30-day intervention. Data were submitted to a mixed-method approach. The pre and post-anxiety assessment results were submitted to statistical analysis to check for anxiety reduction. Participants' reminiscing narratives were submitted to qualitative coding and categorization to identify specific emotion types. Codes, categories, and emotions identified were cross-checked. The statistical analysis found significant reductions in both overall and in two specific dimensions of anxiety, namely fear and worry, among experimentals. The qualitative analysis indicated that reminiscing led experimentals to reflect on their self-foreign language achievements throughout time and also made them experience different types of emotions. They reported gains in terms of skills, grammar, vocabulary, pronunciation, and knowledge of theories and approaches. Emotions reported were positive and negative, reflecting the complexity of learners' subjective emotional experiences in foreign language learning.

Concisely, the study by Jin, Dewaele, and MacIntyre (2021) showed a relationship between the reminiscing of EFL achievements and the feeling of positive emotions, which did not occur among controls. On the one hand, positive emotions

broaden attention to what is relevant and build intellectual resources (FREDRICKSON, 1998; FREDRICKSON; BRANIGAN, 2005). Negative emotions, on the other hand, do the opposite. As mentioned by Korb (2015), states of negative emotions lead individuals to experience a resource-consuming echoing of negative thoughts full of irrelevancies for learning, leading to anxiety. The researcher underscores that anxiety activates brain systems responsible for managing attention. Korb illustrates that people's memory stores much information, and its tiny portion on a smaller screen interferes with their actions. The screen, that is, WM focus of attention, once manipulating information under states of positivity, is freed from the repetitive rumination of past learning failures and gets attentional resources freed to the processing of relevant information.

Adjacent to that, and relevant to this doctoral study, is the research on the effect of song familiarity on individuals' autobiographical retrieval. Ford *et al.* (2016) investigated the effects of cueing the recall of autobiographical memory using familiar songs widespread in participants' childhood, adolescence, and early adulthood. Despite the individual differences observed among younger and older participants' recall, precious to this doctoral dissertation was the finding that songs activated positivity in individuals and supported the retrieval of autobiographical information across participants. In a word, songs enhanced the emotional valence of autobiographical memories, facilitating their recall. The study by Jin, Dewaele, and MacIntyre (2021), thus is insightful to EFL teachers by suggesting that providing EFL learners with the opportunity to build happy autobiographical memories in EFL classes involving singing may increase the likelihood of positive reminiscence in the future, which results in cognitive gains and the experience of novel positive emotions.

Besides L2 learners, PP in SLA has also focused on EFL teachers (GALLO, 2016; GUZ; TETIURKA, 2016; MACINTYRE; GREGERSEN; MERCER, 2020), among others. At first glance, a review of studies focused on EFL teachers seems beyond the scope of this dissertation. However, the reciprocal relationship between teachers and learners allows for a broadened scope; teachers' critical role in conducting activities to synchronize students' cognition and emotion for effective learning may justify that. The study by Guz and Tetiurka (2016,) to be reviewed later in this subsection, and the study by Shirvan, Taherian, and Yazdanmehr (2020), reviewed earlier, suggest that EFL learners are bound to mirror their teachers' mindset and emotions. Thus, how can we guarantee EFL learners' experience of positive emotions as a function of EFL reading

through singing if teachers' well-being is dysfunctional? That would be an illusory assertion since these gains result from a learner-teacher co-construction.

Within this subject matter, Gallo (2016) investigated the role of positive emotions on language teachers' professional development (TPD). The study went beyond teachers' knowing and doing; it examined emotions and the extent to which they would influence teachers' cognition and action after professional training. More specifically, the study investigated how university language teachers approach their professional development and the role of emotions in this process. Data were collected in two phases during a TPD project at the Language Centre of Ludwig Maximilian University in Munich: the first, 2005-2007, when teachers participated in TPD workshops, and the second, 2009-2010, in a follow-up interview. During the first phase, data were obtained through reflexive open-ended questionnaires applied before and after the workshops. The questionnaires assessed teachers' self-appraisal, prior knowledge, knowledge gains, expectations, and goals. The follow-up interviews assessed teachers' actual professional development and the use of knowledge from the workshops in their classroom practices. As already explained, data assessed the interaction between teachers' cognitive and emotional variables. Due to its exploratory and qualitative approach, data were coded into categories that naturally emerged from the participants' answers to the questionnaires. Results considered the nature of participants' goals setting and their ability to apply knowledge in authentic contexts. Four types of goals were identified: instructional (i.e., how to teach), occupational (i.e., how to make a living from the profession chosen); developmental (i.e., what teachers expected from their careers); and affective-emotional (i.e., the holistic perspective of the profession including a sense of mission and well-being). Results showed that those teachers whose goals had an affective-emotional facet, such as being happy as a professional or growing old as a teacher, presented better professional development, resiliency, and attainment of goals. These teachers got more effectively engaged in actions in the school context and could better transfer knowledge acquired during the workshops to the school context. Those teachers who did not present affective-emotional goals tended to report more aversion to the theories studied, had problems building meaning from theory, faced difficulties in coping with time management, and dealt with loneliness in the job context. This result indicates that positive emotions broaden teachers' cognition, augmenting the odds of conceptual knowledge application in school contexts. These outcomes are consonant with Fredrickson and

Joiner's (2002) study in that positive emotions generate positive work attitudes and new positive emotions in a cycle (i.e., the upward spiral).

Consistent with Fredrickson *et al.* (2003), positive emotions build individuals' resilience under challenging contexts. Talarico and colleagues' study reported that teachers declaring no positive emotional goals concerning their profession tended to be less resilient to teaching-related challenges. That also endorses findings from Immordino-Yang (2016). According to the neuroscientist, when cognition and emotion are intertwined in the learning process, and learning is personally meaningful, learners can manipulate knowledge accordingly and effectively in context when making self-decisions and acting in the world. Besides being an indicator for further studies, the findings of Gallo's (2016) study suggest that institutions should offer opportunities for professional development aimed to go beyond teachers' training for doing. These opportunities should care about teachers' emotional stand concerning their profession and not only what they can do after learning new theories and teaching methods. Enjoyment and happiness appear to assist teachers in understanding the meaningfulness of their social function in society and broaden their capacity to see the applicability of their knowledge at schools. Another teacher-related implication regards using coping strategies during intense changes or crises in school contexts. Teachers who avoid coping with difficulties tend to present heightened stress in such periods (MACINTYRE; GREGERSEN; MERCER, 2020). The finding calls for exceptional support for these professionals in tolerating difficulties, remaining resilient, delegating tasks, dealing with procrastination, and facing challenges. Focusing on their subjective emotional states and providing assistance on how to deal with these emotions seems critical for them to broaden their thinking and, in agreement with Fredrickson and Joiner (2022), foster problem-solving reasoning.

Another study on teachers investigated the effects of teacher-related factors on learners' classroom engagement. Guz and Tetiurka (2016) investigated the topic to identify teachers' behavioral characteristics and instructional practices conducive to young EFL learners' positive emotions and periods of heightened learner engagement (PHEs). The concept of PHEs, considered multifaceted, is broadly defined as "[...] the extent and manner of involvement manifested by the learner concerning academic tasks." (GUZ; TETIURKA, 2016, p. 136). Participants were 45 Polish pre-service teachers teaching 6 to 12 years old children, and data was collected in the period 2013-2014. The researchers first examined videotaped lessons with a focus on learners'

engagement, considered, in this study, an indication of positive emotions. Based on a theoretical framework built on previous studies, data, including verbal and non-verbal instances, were separately coded by each researcher and cross-checked. Secondly, they analyzed teacher-related factors that coincided with the emergence of positive emotions and PHEs. Aligned with Moeller (2021) and consistent with MacIntyre and Gregersen (2012), the results indicate that teachers' mindset, when cognitively and emotionally positive evoke a similar learners' mindset and are closely related to higher learning engagement, self-appreciation, and a sense of flow. Teachers' discourse and attitudes, when appreciative, resonate with their learners. They also suggest that higher learning engagement occurs in classes presenting (i) topic familiarity; (ii) the possibility of personalization; and (iii) in a level of difficulty placed within one's zone of proximal development (ZPD⁸) and continuous scaffolding (e.g., support from the teacher, such as modeling, provision of clear examples, feedback and instructions in L1 and L2).

Guz and Tetiurka's (2016) study also corroborates the construct of *positive resonance* (WEST *et al.* 2021) discussed earlier in this chapter by suggesting that teachers' cognitive and emotional mindsets and behaviors spread among learners. That also aligns with Cavanagh (2016) as to whether teachers under positive emotions are more effective in providing students with more precise associations between conceptual knowledge and its applicability in real-world contexts.

In other words, learners tend to be socially influenced and even mirror teachers' broadened or narrowed cognition and thought-action repertoires, making them more or less engaged while learning (GUZ; TETIURKA, 2016; SHIRVAN; TAHERIAN; YAZDANMEHR, 2020). This finding suggests that learners are holistically sensible to teacher-related factors and that their emotions, performance, and learning engagement may get attuned to what they notice around them.

Another construct worth bringing into this discussion that shares conceptual space with the concept of positive resonance (WEST *et al.* 2021) mentioned earlier is *positivity resonance* (FREDRICKSON 2013; 2015). Positivity resonance reflects biobehavioral synchrony, defined as "[...] the mirroring across people's behaviors,

⁸ As defined by Lev Vygotsky (1978), ZPD can be understood as "[...] the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers." (p. 86).

bodies, and brains that each moment of shared positive emotional connection creates.” (FREDRICKSON, 2013, p. 41). As proposed by Fredrickson, positivity resonance occurs in situations in which the positive emotion shared among individuals is love⁹. According to the researcher, love synchronizes people's heart and brain functioning, modifying their behavior and desire for mutual care. In this context, Fredrickson understands love as an emotion that lasts for short periods and then wanes. The researcher still emphasizes that love can manifest through different emotions (i.e., gratitude, awe, inspiration, interest, and joy). Besides, she states that for positivity resonance to occur, three factors are fundamental, “[...] a now shared positive emotion, biobehavioral synchrony, and an orientation toward mutual care.” (FREDRICKSON, 2013, p. 43). Following Fredrickson, positivity resonance does not occur at an abstract level; it requires individuals to be temporally and sensorially connected. Fredrickson explains that eye-to-eye contact, for example, causes the brain to perform internal simulations of other people's emotions, which echo throughout the body. Therefore, if a person sees, for example, a smiling face, they will tend to smile reciprocally.

Furthermore, the researcher underlines that as love becomes a shared state between or among people, its power to build resources and broaden mindsets becomes greater. It is reasonable to conclude that EFL reading activities that provide such resonance should compound teaching planning, and singing can be an ideal backdrop: positivity resonance has close ties to the mirroring behavior of learners. Their bodies and thinking may tune into those of their teachers through singing, creating an ideal environment for learning.

Even more relevant and adjacent to the current discussion is the phenomenon of *entrainment* that may occur when people sing together. Precisely, “The term ‘entrainment’ refers to the process by which independent rhythmical systems interact with each other.” (CLAYTON, 2012, p. 49, emphasis given by the author). When talking about musical entrainment, singers own independent rhythmical systems with oscillators, such as body movements, prosodic notion, and the focus of attention, for

⁹ Fredrickson follows theorists that underscore the idea that love is not a single emotion. Accordingly, she posits that “Love is complex, however, in that most theorists acknowledge that love is not a single emotion and that people experience varieties of it (e.g., romantic or passionate love vs. companionate love vs. nurturant love vs. attachment love). Moreover, love experiences need to be distinguished from love relationships. Whereas the latter might last a lifetime, the former, my focus here, last only moments.” (FREDRICKSON, 2013, p. 40).

instance. When singing, music may also yield a synchronization between or among individuals attuning them in rhythm, harmony and *tempo*, perception, and breathing (CAMLIN; DAFFERN; SEZERSON, 2020; CLAYTON, SAGER, WILL, 2004). Combining all the above, musical entrainment is a crucial phenomenon to consider in teaching vocabulary in English as a foreign language classes. By synchronizing teacher and students, and students and students through singing, there may be greater odds of engagement in the classroom and cognitive attunement to the content taught.

To conclude, students and teachers socially interact and learn from one another in ways that cannot be done justice by examining only the pure cold cognitive aspects of academic skills. Like other forms of learning and interacting, building academic knowledge involves integrating emotion and cognition in a social context. Building on Immordino-Yang and Faeth (2016), this doctoral researcher asks permission to turn the text into the first person and present contributions from his experiences as an EFL teacher. I have worked for 26 years in this profession and have taught English to children, adolescents, adults, and older adults. What my experience has shown is that attitudes such as (i) entering the classroom with a genuine smiling face; (ii) greeting students enthusiastically; (iii) demonstrating interest in their opinions; (iv) showing organization and commitment to deadlines; (v) and helping them dive deeper into reading waters of comprehension to build personal emotional, and meaningful knowledge, among others, are influential over their behavior. Even when working with students who present discipline problems, optimistic teachers' attitudes tend to resonate with students and make them more cognitively and emotionally engaged during class.

The Covid-19 pandemic was also a context for conducting studies of Positive Psychology in SLA, such as Pfattheicher *et al.* (2020) and West *et al.*'s (2021) earlier reviewed, as it was a period of changes that generated diverse emotions among learners and teachers. MacIntyre, Gregersen, and Mercer (2020) focused on the conversion of classes to the online format and its impact on teachers' stress and the use of coping strategies. According to Korb (2015), coping is fundamental to keep individuals from the negative effects of conscious or unconscious beliefs they consider threatening. The study by MacIntyre and colleagues more specifically assessed: (a) the most frequent stressors experienced by language teachers; (b) the coping strategies they used more often; (c) the correlation between approach (i.e., dealing with) and avoidance of coping with positive and negative emotions; and (d) the

correlation of specific strategies used for coping with stressful life events with positive and negative outcomes. The sample was gathered through snowball sampling¹⁰ and composed of 634 language teachers from around the world, ranging in age from 22 to 65 years. English teachers represented 75% of the sample. Participants varied in terms of nationalities, teaching experience, target populations they were currently teaching to, and the educational systems they worked for. All participants reported adapting teaching to the online format on short notice. Data was collected through an online survey between April 5th and April 19th, 2020. These data were analyzed using specific scales assessing coping strategies, stress, happiness, well-being, resilience, growth through trauma, anxiety, health, and negative emotions. MacIntyre *et al.*'s study found that (1) the most common stressors among teachers were workload and family health (i.e., caring for others' health due to the pandemic); (2) the most common coping strategies identified, despite the context, were acceptance and willingness to deal with the situation; (3) total stress correlated with approach and avoidance coping, with a significant and higher correlation with the latter, only. Avoidance coping also correlated with negative emotions but not positive ones; (4) approach coping and avoidance coping correlated with positive and negative outcomes, respectively. This study indicates that the blurred line between home and work, as a function of the Covid-19 pandemic, associated with the lack of time for teachers' adaptation, generated a fertile terrain for the teachers' stress emergence. It also suggested that avoidance is ineffective in reducing stressors and generating positive outcomes. In other words, positivity seems to help individuals face the problems imposed by unexpected events. Bearing that in mind, it is also imperative to emphasize that despite all the technological advances, the pandemic has also brought to the fore the need that teachers have for face-to-face contact. The classroom's physical space remains indispensable for consolidating social bonding and fostering the positive emotions necessary to develop successful teachers' careers.

Far beyond the scope of this doctoral dissertation is any full review of brain circuits that may underlie a cross-talk between rationality and emotions. However, neuroscientific contributions will be briefly mentioned to enrich the discussion on

¹⁰ Snowball sampling, according to Johnson (2014), is a "[...] nonprobability method of survey sample selection that is commonly used to locate hidden populations. This method relies on referrals from initially sampled respondents to other persons believed to have the characteristic of interest." (p. 1). For a full review on this sampling method, consult Goodman (1961).

teachers' difficulty with coping demonstrated by MacIntyre, Gregersen, and Mercer's (2020) study. Korb (2015) elaborates on the close link between the pre-frontal cortex and the limbic system, which forms the front-limbic system. According to the researcher, planning and problem-solving are inherent functions of the pre-frontal cortex, also known as the *thinking brain*. Emotions, such as fear and anxiety, are originated and managed by the limbic system, also known as the *feeling brain*. Korb puts it that, in this dynamic, worry and anxiety fulfill their functions, making individuals consider problems and keep individuals safe, respectively. Put another way, when mild negative emotions influence the communication between the systems, there are gains in human well-being.

For instance, fear informs the pre-frontal cortex that an individual may be in danger and that they will have to take some conscious protective action. Being mindful of that, it is necessary to consider that the profession of a teacher demands concentration, planning, problem-solving, love, and empathy, that is, rational and emotional aspects. It also demands mild negative emotions because they constitute a backdrop for a professional state of alertness to good practice. Together, these elements may equip teachers to bring their best and to provide students with good classes and learning. Undoubtedly, the pandemic affected the enlace of these elements. It did not only challenge teachers professionally but, from a more holistic perspective, as individuals in a world in danger. They had to learn to use new apps, platforms, and tools and adapt their teaching and evaluation methods. Those were stressors and generators of worry and anxiety, which probably compromised the harmonic functioning of their thinking and feeling brains. According to Korb (2015), strategic planning and coping, controlled by the pre-frontal cortex, are highly disrupted by the anxiety and worry loop that individuals get stuck in. When feeling exaggerated negative emotions, this disruption feeds into the brain circuitry that should be devoted to individuals' excellence in many tasks, including their jobs. In a word, the study by MacIntyre, Gregersen, and Mercer (2020) suggests that many of its participants' difficulty coping with the adversities of the pandemic led them to a downward spiral of negative emotions that reduced their capacity to see solutions beyond the storm they were in. As proposed at the beginning of the review of the three studies that focused on EFL teachers, the assertion remains that the well-being of these professionals is an indispensable factor for learners to have good learning experiences. The positive

emotions experienced in EFL classes involving singing flourish otherwise inside the people involved.

2.4 CHAPTER II SUMMARY

This chapter presented a multidisciplinary review of studies on the role of positive emotions on learners' well-being, learning in general, and in L2 learning. It initially introduced the leading researchers in the history of Positive Psychology, such as William James, Abraham Maslow, Martin E. P. Seligman, and Mihaly Csikszentmihalyi. Besides, the chapter highlighted the Positive Psychology search for a space within science and its consolidation through empirical robustness. It also defined this doctoral dissertation research niche. Next, the chapter reviewed studies on the general role of positive emotions in human well-being and learning. The studies focused on interplays among individuals' positive emotions, broad mind coping, decision making, resilience, social connections, prosocial behaviors, manipulation and storage of multiple pieces of information, recall of autobiographical memories, and one's ability to establish semantic relationships among words. Subsequently, the focus of the chapter turned to studies of Positive Psychology in SLA. It encompassed the role of positive emotions on foreign language enjoyment, foreign language classroom anxiety, trait emotional intelligence, foreign-language enjoyment fluctuations, effects of teacher's mindsets on learners, teacher's professional development, teacher-related factors on learners' engagement, and teacher's use of coping strategies.

The next chapter will review the first of the three basal theoretical pillars of the present doctoral dissertation: The Broaden-and-Build Theory of Positive Emotions (FREDRICKSON, 1998; FREDRICKSON; BRANIGAN, 2005). This theory will pave the way for a subsequent review of studies on EFL reading through singing, Chapter IV, and a discussion on the role of positive emotions in WM focus of attention, Chapter V.

3 THE BROADEN-AND-BUILD-EFFECT EFFECT OF POSITIVE EMOTIONS ON THE BUILDING OF INTELLECTUAL RESOURCES: SOLIDIFYING THE PROPOSAL OF ENGLISH AS A FOREIGN LANGUAGE READING THROUGH SINGING AS A PRACTICE TO ENHANCE VOCABULARY LEARNING

You may notice tiny furballs playing hide-and-seek throughout the words of this chapter. They are memories of an angelical four-legged love who passed away on January 16th, 2022. I miss her jumping over the keyboard, purring beside my pillow, napping over my slippers, cuddling my toes while immersed in this text. Despite the pain of her passage, Lilica brought Maninha, Julinha, and Tónico into my life; the latter, a cat I thought was a male, but that after a few months, gave birth to three kittens! They all remain inside and around me, shedding the light of positivity needed to intertwine reason and passion into this doctoral dissertation. This is personal; however, it, too, has much to do with the ideas to be elaborated next.

3.1 INTRODUCTION

This chapter first presents a brief contextualization. Subsequently, it reviews The Broaden-and-Build Theory of Positive Emotions (FREDRICKSON, 1998, 2004; FREDRICKSON; BRANINGAN, 2005). Then, it questions the sufficiency of positive emotions for effective English as a foreign language (EFL) vocabulary learning. Afterward, the chapter reviews a second set of Positive Psychology studies in Second Language Acquisition (SLA). Unlike the first set reviewed in Chapter II, this set discusses studies' findings that rely on Fredrickson's theory. In what follows, Chapter III describes and elaborates on a concepts centrality analysis based on a semantic network of cliques to identify the core pillars of The Broaden-and-Build Theory of

Positive Emotions. It discusses the network configuration of the core concepts of Fredrickson's theory and their relationships with the findings, reflections, and proposals presented throughout the doctoral dissertation. At last, it provides a summary.

According to Williams, Ford, and Kensinger (2022), emotions facilitate the retrieval and reexperience of memories and are more bound to affect behavior. However, research in the subfield of Positive Psychology has accumulated substantial evidence that human beings tend to contemplate the input in the environment more extensively when they are in positive emotional states. Behavioral, brain, and eye-tracking studies suggest that this contemplation derives from a cognitive and attentional broadening yield by positive emotions (FREDRICKSON, 1998, 2001, 2003, 2004; FREDRICKSON; BRANIGAN, 2005; FREDRICKSON; JOINER, 2018). Within this realm, research on Positive Psychology in Second Language Acquisition (PP in SLA) has also pointed out that positive emotions underlie EFL learner's deeper absorption of the language input (MACINTYRE; GREGERSEN, 2012), improving their proficiency (DEWAELE; ALFAWZAN, 2018). Also, research in this subfield has shown that positive emotions reduce EFL learners' anxiety, increase their contentment, and, as such, their desire to get involved in learning experiences repeatedly (GREGERSEN, 2016). Significantly, these studies do not fall into the fad of pop psychology that conveys the false idea that human beings can remain in continuous positive states. Instead, PP in SLA, as emphasized in Chapter II, recognizes the role and importance of negative emotions and how they can be salutary for learning when mild and in balance with mild positive emotions (MACINTYRE, GREGERSEN; MERCER, 2020).

Said that Chapter's III objective is to review The Broaden-and-Build Theory of Positive Emotions (FREDRICKSON, 1998, 2004; FREDRICKSON; BRANIGAN, 2005) and studies of PP in SLA, tracing theoretical associations between the theory and the studies' findings. As in Chapter II, Chapter III adopted the *Narrative Review Method* (PARÉ; KITSIOU, 2016), characterized by its unsystematic approach to selecting the studies presented, analyzed, and contrasted.

3.2 THE BROADEN-AND-BUILD THEORY OF POSITIVE EMOTIONS

The *Broaden-and-Build Theory of Positive Emotions* (FREDRICKSON, 1998, 2001, 2003, 2004; FREDRICKSON; BRANIGAN, 2005) is widely known in the subfield

of Positive Psychology (PP) and accumulates empirical evidence from a large body of studies. The theory proposes that:

[...] momentary experiences of mild, everyday positive emotions broaden people's awareness in ways that, over time and with frequent recurrence, build consequential personal resources that contribute to their overall emotional and physical well-being. (FREDRICKSON; JOINER, 2018, p. 194).

Fredrickson's theory postulates that thought-action repertoires are broadened or reduced according to the emotions one feels. Thought-action repertoires, following the theory, are constituted by the range of thoughts and actions brought to mind by or taken if individuals are under specific emotions. Emotions, as defined by Fredrickson and Branigan (2005, p. 313), "[...] are short-lived experiences that produce coordinated changes in people's thoughts, actions, and physiological responses."

Therefore, emotions are responses from different bodily systems triggered by the individual's interpretation of what is happening to them. They can be positive or negative, according to the interpreted prospective outcomes a particular situation or condition may yield to the self (FREDRICKSON, 2013). Following Fredrickson's operationalization of emotions, what is considered good or bad is a short-lived subjective product.

Fredrickson and Branigan (2005) elaborate on positive and negative emotions from an evolutionary and functional perspective. According to them, the action tendencies evoked while human beings are experiencing emotions are the result of evolutionary processes. As put by Tugade, Devlin, and Fredrickson (2021), these actions guaranteed our ancestors' survival in nature. As explained by Fredrickson and Branigan (2005), negative emotions evoke reactivity (i.e., hide, run), and because of that, thought-action repertoires decrease since the focus of attention gets narrowed to solving immediate threatening situations. As illustrated by Fredrickson (1998), "People experiencing certain negative emotions, then, tend to miss the forest for the trees, or perhaps more aptly, the assailant's garment type for the gun." (1998, p. 307). From the perspective of Cognitive Psychology, Eysenck (2020) refers to this phenomenon as the *tunnel vision hypothesis*, also known as the *weapon effect* (i.e., the assailant's garment type for the gun). Accordingly, negative emotional states caused by threatening or dangerous situations "[...] causes a narrowing of attention to central or

important stimuli which reduces people's ability to remember peripheral details." (EYSENCK, 2020, p. 403).

On the other hand, following the evolutionary perspective adopted by Fredrickson and Branigan, positive emotions do not tend to solely evoke immediate and autonomic reactivity since individuals are not at risk and need immediate protection. Instead, individuals' openness is widened, their focus of attention broadened, and their thought-action repertoires amplified: there is an ideal scenario for contemplation and enjoyment of the situation. One might enquire: what good were positive emotions for our ancestors' survival in nature? According to Fredrickson's theory, positive emotions evoke transient action tendencies and build *enduring personal resources* that, in the long term, have a qualitative impact on individuals' lives. Drawing on Fredrickson's studies, Dewaele and Alfawzan (2018) state that "While negative emotions are important at the time they are experienced, for example, causing a fight or flight reaction important for survival, positive emotions broaden the mindset over time." (2018, p.26). In Fredrickson and Cohn's (2018) words, strong reactivity caused by negative emotions is inherent to human evolution. In risk situations, their bodies must be mobilized to escape from injury and death. The benefit is immediate: it protects life. Positive emotions, according to the authors, build resources for the long term because they yield body relaxation, spark curiosity, and willingness to discover, explore and savor.

Metaphorically speaking, the theory predicts that as light causes certain flowers to open up to their fullness and beauty, so do positive emotions in humans. They widen humans' scope of attention and cognition to absorb more from the circumstances, improving their current and future lives. This improvement, based on the previous operational definition given to emotions, includes *physical, social, psychological, and intellectual resources*, to be fully detailed later in this chapter. Before presenting the primary hypotheses of the Broaden-and-Build Theory of Positive Emotions, it is pertinent to discuss what exactly Fredrickson's theory informs education and, consequently, learning.

Teachers, in general, would agree that schools are dynamic and complex. It is complex and dynamic in that the experiences learners undergo can lead them into different emotional states, causing them to withdraw out of anxiety or expand out of the warmth they feel. Consequently, it is essential to consider what these diverse behaviors may cause these learners regarding cognitive processing, including

managing working memory (WM) focus of attention. It is common sense that everyone wants participatory students who do not fear the school environment, teachers, and English classes. Thus, the theory reviewed in this chapter shows that one needs to be aware of the experiences promoted by schools. No one should want learners who run away from experiences and retreat into their narrowed WM focus of attention oriented to possible threats and negative thoughts ruminations. Instead, everyone should envision learners who are emotionally and cognitively open to building intellectual resources, in the case of this doctoral dissertation, EFL vocabulary. Likewise, everyone should envision learners who can find ways to spring and learn from the unavoidable negative emotions they might undergo. Bearing that in mind, the Broaden-and-Build Theory of Positive Emotions proposes five main hypotheses important to education: the *broaden hypothesis*, the *narrow hypothesis*, the *undoing hypothesis*, the *build hypothesis*, and the *upward spirals of positive emotions hypothesis* reviewed next.

The broaden hypothesis predicts that positive emotions increase the scope of attention, cognition, and actions. The narrow hypothesis, oppositely, predicts that negative emotions decrease them. The hypotheses respectively contend that positive emotions prompt individuals to pursue more actions and thoughts than is typical and that negative ones narrow such a repertoire. Notably, Fredrickson and Branigan (2005) include *willingness to read and do schoolwork within learners' thought-action repertoires*, which makes this theory even more relevant for this dissertation.

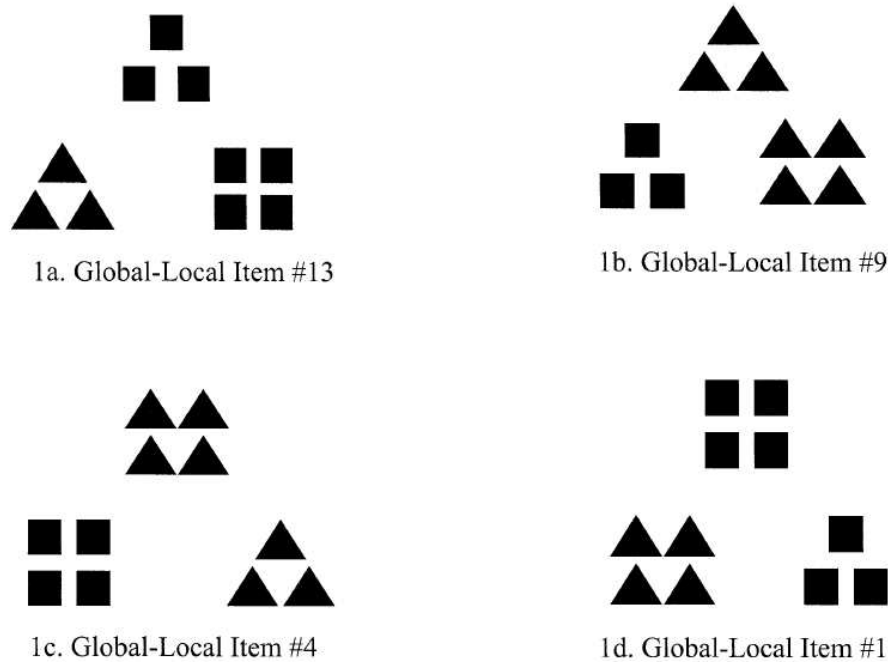
Fredrickson and Branigan first tested the theory in 2005. In that study, the researchers conducted two experiments to test whether specific discrete positive and negative emotional states, relative to neutral and negative ones, would broaden or narrow individuals' percepts, thoughts, and action urges. They tested two hypotheses: the first was that relative to a neutral state, two distinct positive emotions (i.e., amusement and contentment) would (a) produce a global bias, consistent with a broadened scope of attention, and (b) broadened momentary thought-action repertoires. The second was that relative to a neutral state, two distinct negative emotions (i.e., anger and anxiety) would (a) produce a local bias, consistent with a narrowed scope of attention and (b) narrowed momentary thought-action repertoires.

Participants were 104 university students enrolled in an introductory psychology course in the United States. Materials included (1) an emotion report form; and (2) five short, videotaped film clips, two of them aimed at eliciting the positive emotions tested, two of them eliciting the two negative emotions tested, and one of them eliciting a

neutral emotion, which served as control. As for dependent measures, the study had the scope of attention and breadth of momentary thought-action repertoires.

The researchers checked the scope of attention using an 8-item global-local visual processing task. Figure 1 presents a sample of the task.

Figure 1 - Sample from a Global-Local Visual Processing Task



Source: Fredrickson and Branigan (2005, p. 317), an example of global-local items.

Fredrickson and Cohn (2008) explain that this task asks participants to observe and select between options presenting a local or a global configuration. There are no right or wrong answers. To select the option they consider correct, they have to judge which of the two figures in the bottom position of each item is more similar to the standard figure positioned right above them (FREDRICKSON; BRANIGAN, 2005; FREDRICKSON, 2013). Participants' choice for the local configuration is associated with a narrowed focus of attention yield by one's current negative emotions (i.e., attention to the details, with less flexibility). Participants' choice for the global configuration reveals a broadened focus of attention and is associated with one's current positive emotions (i.e., attention to the whole, with more flexibility). Consider item 1a above again. Please observe that the bottom left figure presents the global configuration of the standard top figure (i.e., as a whole, it forms a triangle, like the top figure). Thus, when one opts for this figure, s/he is considering the big picture.

On the other hand, the bottom right figure presents the local configuration of the standard top figure (i.e., the squares that appear in the top figure, which are details of the whole forming a triangle). When participants select these items, they lose the forest for the trees. In other words, their choice derives from a focus of attention narrowed to details. The same pattern repeats in the other items. Later, in Section 3.3, the effect of positive emotions on attention (i.e., to the whole and details) will be elaborated on whether or not it has uniquely beneficial effects on EFL vocabulary learning.

Fredrickson and Branigan (2005) assessed the breadth of momentary thought-action repertoires using an open-ended statement test. Participants were tested individually and randomly assigned to watch one of the emotions-eliciting films. In experiment 1, they watched the films and were induced to the specific emotional states being investigated (i.e., amusement, contentment, anger, anxiety, and the neutral emotional state), took the global-local visual processing task, and finally, in the emotion report form, they rated their emotions while watching the film clips. In experiment 2, they watched the films (no participant watched the same film twice), reported their momentary thought-action repertoires, and then rated their emotions while watching the film clips.

Results from experiment 1 showed that the two positive films combined produced significantly larger global biases than the neutral film. The result, thus, was compatible with the broaden hypothesis. The corollary hypothesis was not confirmed. Results showed that the negative films, separately or combined, had no significant contrast relative to the neutral film. Results from experiment 2 showed that the two positive emotion films combined produced significantly larger thought-action repertoires than the neutral and negative films. Considering these results, the broaden hypothesis was confirmed, while its corollary did it only partially, given that negative emotions narrowed participants' thought-action repertoires only marginally below the neutral film. The researchers speculated, however, that their instruments were possibly insensitive to test the narrow hypothesis, producing a floor effect. Concerning the open-ended statements test, differences in the content of participants' responses across the five-film groups revealed that the positive and negative films biased participants' thought-action repertoires. The positive films urged participants to report a more comprehensive array of thought actions, such as being social and elated, relative to the neutral film. Oppositely, the negative films urged them to report fewer urges. Interestingly, participants' thought actions reflected a state of *unwillingness to*

read and more urges to be antisocial. In conclusion, experiments 1 and 2 supported the hypothesis that the scope of attention and thought-action repertoires broaden as a function of positive emotional states.

Continuing the earlier discussion on the experiences promoted by schools and their emotional impact on learners, there is something relevant to consider now. The results reported above suggest an *unwillingness to read* among individuals under negative emotional states. This doctoral dissertation adopts a view of reading based on a reading model that assigns a basal role to readers' affect before and while reading. The model was proposed by Mathewson in 1985 (i.e., *The Comprehensive Model of Affect in the Reading Process*) and will be reviewed in detail in Chapter IV. Following up on the above discussion, the model will be briefly summarized at this point of the dissertation. Overall, it proposes that the act of reading, its cognitive processes, and the readers' attentional state are influenced by their current emotional states concerning the reading situation. In simple words, the model proposes that the readers' emotional states determine their willingness to start reading and maintain or not its continuity: a positive emotional state, according to the model, would be related to better reading comprehension, while a negative emotional state would lead to the opposite. Based on that, when pleasurable, reading is bound to be associated with better text comprehension and better vocabulary learning since a positive emotional state is expected to improve the reading processes and enhance readers' focus of attention. This doctoral dissertation suggests that EFL reading through singing would have this effect.

As introduced earlier, the Broaden-and-Build Theory of Positive Emotions proposes another hypothesis, namely, the *undoing hypothesis* (FREDRICKSON; LEVENSON, 1998). The hypothesis broadly predicts that positive emotions not only trigger specific action tendencies; they also serve as antidotes that undo, that is, downregulate lingering effects of negative emotions¹¹ (FREDRICKSON, 1998; FREDRICKSON; LEVENSON, 1998). To test the hypothesis, Fredrickson and

¹¹ As exemplifies Fredrickson (2013), "Despair, for example, triggers narrowed, ruminative, and pessimistic patterns of thought alongside behavioral withdrawal and sluggishness, thought-action tendencies that serve to increase the odds that despair will continue and exacerbate in a self-destructive cycle. Positive emotions, by contrast, trigger broadened, curious, and optimistic patterns of thought together with more spontaneous and energetic behavior. These thought-action tendencies increase the odds that people find positive meaning in their future circumstances in ways that seed further positive emotions that decrease stress, provide emotional uplift, and support resilience." (FREDRICKSON, 2013, p. 34).

Levenson had participants watch different films reliably inducive of specific emotions. The first one induced them into the emotion of fear and aimed to trigger cardiovascular reactivity, a bodily characteristic of narrowed action tendencies. Subsequently, the other films induced participants to have different types of emotions. Cardiovascular reactivity was continuously assessed through physiological sensors during the whole experiment. Negative and positive emotions were also assessed through a rating dial which the participants controlled.

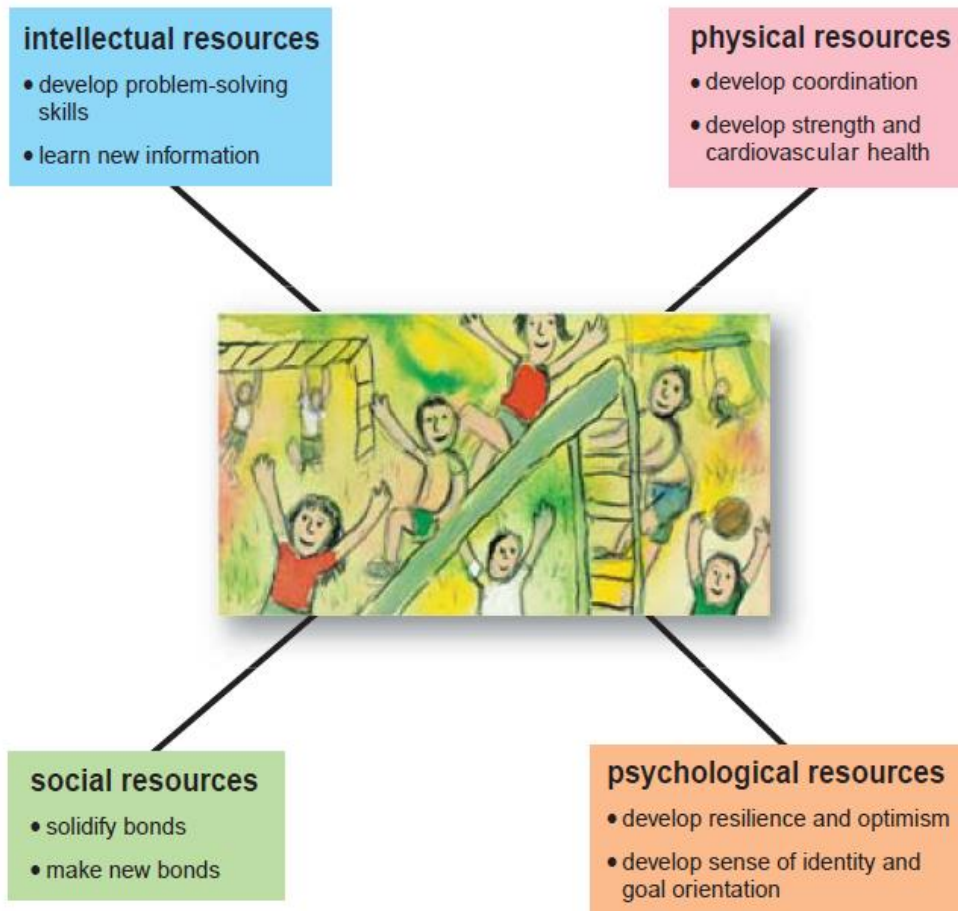
Results showed that only positive emotions effectively helped regulate cardiovascular recovery. That suggests that positive emotions play a role in physical healing and psychological well-being; they broaden cognition, and the broadening effect mediates undoing cardiovascular reactivity. In practice, under positive emotions, individuals can better picture their situations more comprehensibly and deal with specific events that may throw them off balance. (FREDRICKSON, 2001, 2003).

Evidence of positive emotions' undoing effect can also be observed in studies reviewed in Chapter II. In the study by Fredrickson *et al.* (2003), for instance, the undoing effect can be observed in those participants who were able to bounce back and build resilience in the context of the September 11th, 2001, terrorist attacks. Individuals who were already more positive before the attacks were those who had more psychological resources to undo the negative emotions yielded by the tragic event. Similar undoing effects can be observed in MacIntyre, Gregersen, and Mercer's (2020) study, in which strategic coping attenuated the effect of stressors among teachers during the Covid-19 pandemic. Finally, the study of Jin, Dewaele, and MacIntyre (2021) suggested that reminiscing was effective in undoing anxiety among majors in English. All findings represent a relevant implication for EFL reading: EFL readers induced to positive emotional states are equipped with the psychological tools necessary to tackle or mitigate negative emotions.

In addition to the three hypotheses already described, the broaden hypothesis, the narrow hypothesis, and the undoing hypothesis, Fredrickson and colleagues propose the *build hypothesis* (FREDRICKSON; COHN, 2008; FREDRICKSON 2004). The Broaden-and-Build Theory postulates that positive emotions, even defined as *short-lived experiences*, help individuals build *long-lasting* personal resources (FREDRICKSON, 2001; VAN CAPPELLEN; EDWARDS; FREDRICKSON, 2021). As put before, negative emotions, from an evolutionary perspective, accompanied our ancestors' autonomic and immediate specific-action tendencies like escaping or hiding

in dangerous situations. Positive emotions, however, helped them accumulate intellectual, physical, social, and psychological resources on which they could count later (FREDRICKSON; COHN, 2008). Most of these resources, which are still accrued in modern humans, are depicted and described in Figure 2 below.

Figure 2 - Enduring Person Resources Built by Positive Emotions



Source: Fredrickson (2003, p. 333). "Positive emotions broaden people's momentary thought-action repertoires. Joy, for example, encourages playful behavior. These broadened thought-action repertoires, in turn, build intellectual, physical, social, and psychological resources for the future. Such resources translate into greater odds of survival and reproductive success." (FREDRICKSON, 2003, p. 333).

From this perspective, resources built through various experiences, including exploration and play fueled by positive emotions, impacted humans' lives. They served as durable reserves for future retrieval in various situations. (FREDRICKSON, 2001; 2003). This means that emotions enabled our ancestors to increase the amount and types of their resources and advance beyond merely fleeing, protecting themselves, and fighting; to advance to learning, discovering, and creating. Intellectual resources, for instance, included better executive control, physical resources included better

health, social resources included social support networks, and psychological resources included higher resilience (FREDRICKSON; BRANIGAN, 2005). Importantly, these resources were not exclusively valuable for future situations involving the emotions that initially gave birth to them but in any situation where the resource turned into adjacent thoughts and actions (FREDRICKSON, 1998). Positive emotions associated with the urge to play, for example, accrue intellectual resources of imaginative nature since play is partially unscripted (FREDRICKSON, 1998). The individual improvises, imagines situations, and develops more flexible and inventive thinking. Flexible and inventive thinking might have boosted our ancestors' capacity not only to find fast solutions for immediate survival but also to create tools and come up with ideas to facilitate their everyday lives in other ways (and why not to speculate, to create the greatest inventions of the human history). Speaking of which, the proposition that positive emotions served as the catapult for boosted cognition goes hand in hand with some archaeologists' research. Their studies have suggested that the evolutionary enhancement of working memory (WM) might have given our ancestors the necessary processing and storage capacity to imagine things and create art (BALTER, 2010). Thus, it is assertable that evolutionarily enhanced WM and the effects of positive emotions in broadening its scope of attention may indeed have been critical ingredients for developing humans' symbolic thinking. All told, these resources, separately or together, helped our ancestors live longer, think of better solutions for their problems, deal with psychological issues, and manifest ideas through inventions and art. The studies reviewed in this dissertation show that these resources remain fundamental nowadays, including those derived from learning processes.

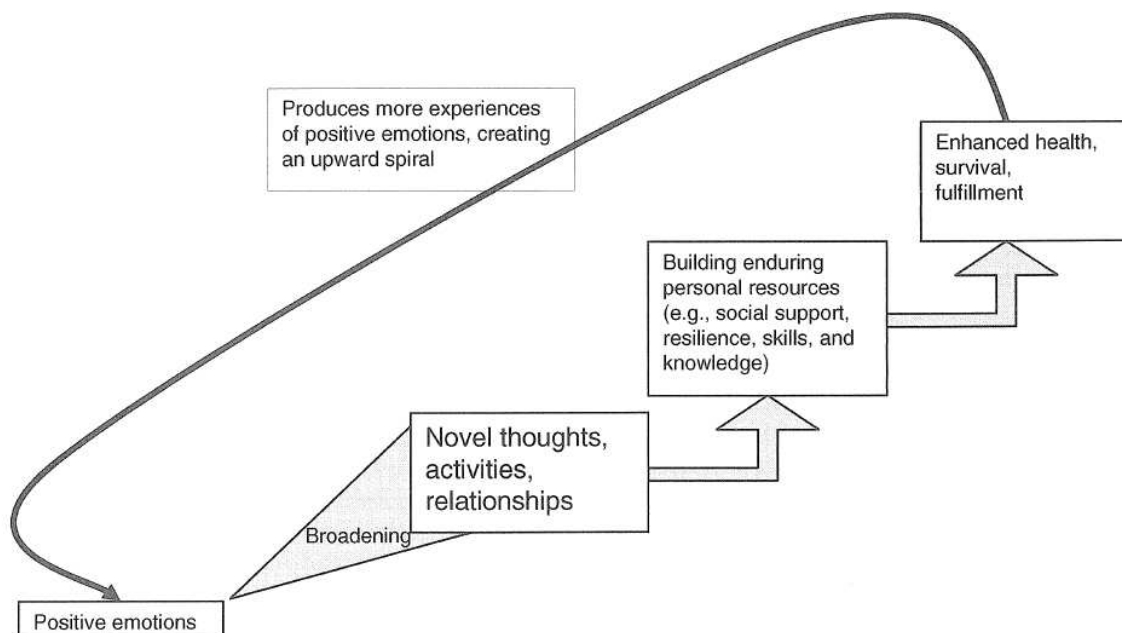
Learning new information, such as EFL vocabulary, falls within the category of intellectual resources. In the light of Cognitive Psychology, intellectual resources can constitute knowledge built and stored in long-term memory (LTM)¹² for the learner's retrieval and use in current or future situations. On top of that, social, physical, and psychological resources add to intellectual resources in that they support learners to

¹² Long-Term Memory (LTM) refers to the relatively stable and long-lasting portion of knowledge stored in memory that is consisted of: (a) knowledge whose meaningfulness is rooted and dependent on associations that are made with specific episodic experiences undergone by individuals (i.e., episodic memory); (b) knowledge which is purely conceptual, generic and autonomous from specific episodic experiences (i.e., semantic memory); and (c) knowledge that encompasses expertise on how to perform a wide range of activities (i.e., procedural knowledge) (BADDELEY, 2010; SEARLEMAN; HERRMANN, 1994).

flourish and accumulate reserves of distinct nature for the future, such as social bonds and resiliency.

In addition to the four hypotheses presented, the broaden hypothesis, the narrow hypothesis, the undoing hypothesis, and the build hypothesis, the Broaden-and-Build Theory proposes the *upward spiral of positive emotions hypothesis* (FREDRICKSON, 2001, 2004; FREDRICKSON; JOINER 2002), mentioned in Chapter II. As accounted by Fredrickson and Joiner (2018), “[...] everyday positive emotions, as fleeting as they may be, can initiate a cascade of psychological processes that carry enduring impact on people’s subsequent emotional well-being.” (p. 195). The hypothesis is depicted in Figure 3:

Figure 3 - The upward spiral of positive emotions



Source: Fredrickson and Cohn (2008, p. 783), Figure 48.1, the Upward spirals of positive emotions.

The core idea of the hypothesis is that: (1) positive emotions broaden individuals’ attention and cognition; (2) attentional and cognitive broadening subsequently builds on individuals’ long-lasting resources; (3) these resources constitute a pre-condition for the individual’s current and future well-being; (4) finally, individuals’ well-being becomes the prerequisite for them to currently and prospectively experience positive emotions again. This cycle constitutes the upward spirals of positive emotions (FREDRICKSON, 2003; FREDRICKSON; COHN, 2008).

Despite its significant empirical evidence, the Broaden-and-Build Theory is not free from weaknesses. According to Revord, Sweeny, and Lyubomirsky (2021), the theory does not explain, for example, when or why negative emotions may be more appropriate than positive emotions.

Gasper (2003), for example, found that states of sadness tie individuals to data until they have enough evidence to think of distinct alternatives and thus use creativity. In this case, narrowed cognition during creative processes becomes critical if the individual is not to fall into derived inferential traps based on insufficient data. This topic will be explored in detail later in the text in the context of EFL reading. The author of this doctoral dissertation highlights another point to be accounted for in this regard. In schools where English classes become the only moment and space for emotional expression and cognitive creativity, learners may have difficulty identifying the boundary between feeling amused and maintaining the focus of attention on the content taught. It is incumbent on the teacher to build class rules with students to help them monitor their attention while feeling amused by particular activities, such as EFL reading through singing. Despite an exacerbated positive emotional state, learners may get distracted when not informed about the importance of paying attention during classes.

Researchers advocating for the Broaden-and-Build Theory of Positive Emotions acknowledge the weaknesses mentioned above. It is stated in the theory that *mild positive emotions* such as contentment and enjoyment are those that should be fostered in individuals (FREDRICKSON, 1998; FREDRICKSON; BRANIGAN, 2005). As already emphasized in Chapter II, Positive Psychology is not about leading individuals to euphoric states or the negligence of negative emotions (KOMOROWSKA, 2016; DEWAELE; MACINTYRE, 2014). It is about promoting emotions that may assist these individuals in pursuing positive emotions that will help them cope with adversity to enjoy an upward cascade of personal gains. As put before, this cascade has been associated with generating cumulative resources to be used in the present and future (FREDRICKSON; JOINER, 2002). Finally, as explicitly admitted by Fredrickson and Cohn (2008), "There are important questions about when and how to experience positive emotions, and which emotions are appropriate in different situations [...]." (FREDRICKSON; COHN, 2008, p. 791). Therefore, the researchers recognize the theory's weaknesses and follow in search of empirical evidence that can fill in its pitfalls. Next, a second set of Positive Psychology (PP) studies in Second

Language Acquisition (SLA) will be reviewed. As said before, these studies specifically rely on tenets of the Broaden-and-Build Theory of Positive Emotions.

3.2.1 Studies on Positive Psychology in SLA and the Broaden-and-Build Theory of Positive Emotions

As advanced in Chapter II, PP in SLA is a recent subfield of research. MacIntyre and Gregersen (2012) pioneered the subfield with an initial literature review of experimental studies to provide guidelines on how learners could benefit from positive emotions to reduce L2 learning anxiety. Based on Fredrickson's studies, the researchers propose that positive emotions permeate the construction of resources because they leave learners' cognition in a state of better absorption of the language input. Consistent with the undoing hypothesis previously presented (FREDRICKSON, 1998; FREDRICKSON; LEVENSON, 1998), MacIntyre and Gregersen, based on L2 motivation theory (DÖRNEY, 2008), proposed a set of cognitively mediated strategies aimed to induce learners to reach a balance between positive and negative anticipatory and anticipated emotions¹³. They proposed that cognitively mediated strategies such as imagery and self-suggestion, to mention some, may underlie positive broadening. In agreement with Fredrickson's build hypothesis (FREDRICKSON; JOINER, 2002, 2018), the ultimate goal of these strategies is to act upon higher-order emotion schemas¹⁴, augmenting the undoing effect of positive emotions over L2 learning anxiety. Harmonious with the premises of PP, MacIntyre and Gregersen (2012) postulate that positive emotions in SLA do not aim to eliminate negative emotions, but to lessen their effects, considering their implications for one's L2 learning development. The strategies they propose include, for instance, raising learners' self-awareness about L2 learning failure to trigger their willingness and strategic coping. This inclusion corroborates the premise that positive and negative emotions coexist in a continuum

¹³ Following Baumgartner, Pieters and Bagozzi (2008) “[...] a person may currently experience an emotion due to the prospect of a desirable or undesirable future event (i.e., hope or fear). These affective reactions are anticipatory emotions, because they are currently experienced due to something that may happen in the future. On the other hand, a person may imagine experiencing certain emotions in the future once certain desirable or undesirable future events have occurred (e.g., anticipated joy or regret). These affective reactions are anticipated emotions.” (p. 685).

¹⁴ According to MacIntyre and Gregersen (2012), “Higher-order emotion schemas can be simple or complex combinations of emotions, mixed with cognitive and self-regulation elements, that allow for interpretation and continual interaction with the surrounding context.” (p. 196).

and sometimes overlap (PINIEL; ALBERT, 2018). In addition, Dewaele and MacIntyre (2014) state that appreciation and anxiety can be essential in maintaining a balance between the desire for exploration and focused action taken.

The usefulness of positive emotions in coping, not avoiding or escaping from negative emotions, is evident in the above. Recognizing such usefulness is essential because, in everyday practice, it is virtually impossible for a teacher, for an activity, or for the school context not to trigger some forms of negative emotions in learners. An oral presentation, for instance, may narrow WM focus of attention to the risk of peer judgment. The same may happen with singing. Some students are more introspective and avoid exposure. The same tasks, however, depending on one's previous experiences, may have a counter effect and evoke enjoyment.

In addition, researchers have defended that positive and negative emotions are ambivalent in certain situations. As illustrated by MacIntyre and Mercer (2014), one can feel simultaneously anxious and confident because of the same experience. Moreover,

[...] anxiety, anger, sadness, and loneliness have a role to play in successful functioning: anxiety alerts us to potential dangers, sadness is associated with preventing loss, loneliness promotes social interaction by motivating us to regain connections with other people, and anger is useful in removing obstacles thereby restoring pursuit of an important goal. However, each of these emotions, if sustained over a long period of time, can be problematic and maladaptive in larger doses. (MACINTYRE, GREGERSEN; MERCER, 2020, p. 5).

Conforming to MacIntyre and Mercer (2014), emotional ambivalence also supports learners' concomitant and reduced demonstration of positive and negative emotions, such as apathy. Altogether, MacIntyre and Gregersen's (2012) study indicates that besides being concerned with conceptual knowledge building, teachers must give an ear to the detrimental effects of complex negative emotion schemata on learners' performance. Their classes should consider teaching learners to monitor and benefit from negative emotions, which may *a/so* mediate resource building. To state it poetically, it would be the same as allowing the lotus to feed itself with the energy from the mud it is rooted in to flourish from the positivity of the sunlight

Another study of PP in SLA theoretically grounded in the tenets of the Broaden-and-Build Theory of Positive Emotions was conducted by Gregersen (2016). Using a

mixed-method approach, the study aimed to examine the effect of six PP interventions on L2 learners' subjective experiences. The study sample consisted of three Brazilian and two Japanese female second language learners, students of Academic English at a U.S. university, aged between 20 and 23. Tutors trained in PP and experts in teaching and learning accompanied them. The experiment consisted of twelve weeks and applied six PP interventions. The interventions were personalized according to each participant's interests drawn from preliminary interview data. Based on previous research, these interventions sought to evoke participants' positive thinking and emotions through (1) gratitude; (2) altruism; (3) music; (4) pet; (5) laughter; and (6) exercise. All interventions were integrated into conversations between the participants and their tutors. Quantitative data was obtained through an emotion self-rating scale administered at each intervention's beginning, middle, and end. Qualitative data were assessed through participants' and tutors' comments, respectively reported through journal observations at the end of each session and a final interview about the whole intervention. The statistical analyses showed a mean change increase of positive emotions in all the interventions, as follows: gratitude ($M= +1.6$); altruism ($M= +1.2$); music ($M= +1.9$); pet ($M= +1.6$); laughter ($M= +.2$); and exercise ($M= +2.2$). The qualitative analyses demonstrated participants' openness and engagement.

Following Fredrickson (2000), the psychological broadening effect generated by positive emotions increases the possibility that the individual will be willing to experience the events that generate such emotions again.

Building on Fredrickson's theory, Gregersen's study suggests that when L2 learners experience positive emotions during their classes, their eagerness to undergo those experiences again turns the classroom into an ideal scenario for generating upward spirals of positive emotions. Gregersen (2016) elaborates that gratitude allows us to appreciate our lives' blessings, pursue goals, and promote well-being. Altruism, according to her, builds social bonds and compassion for others. In tune with Immordino-Yang (2016), compassion pertains to social emotions associated with improved cognitive skills. According to the neuroscientist, compassion involves deeper introspectiveness and activating an alternative attentional neural system, the Default Mode Network, to be described later. Still accordant to Gregersen's conclusions, music is associated with relieving negative emotions and, *in the form of singing in L2 classes*, is associated with linguistic gains and learners' and teachers' well-being. Gregersen (2016) also maintains that interactions with pet companions improve individuals'

physical and mental health (tiny furballs roll softly around here). Finally, the two top improvements in Gregersen participants' emotions were due to laughter and exercise. Drawn on Gregersen, laughter may help people disengage from emotional schemata that narrow thinking and the rumination of past negative L2 learning experiences. Laughter promotes chemical changes in the body, promoting well-being and the openness necessary for learning. Finally, as pointed out by Gregersen, exercising is the typical activity that puts the mind and body in unison to promote well-being. Gregersen's study is informative for teachers as it provides evidence that activities grounded in PP, but focused on teaching an L2, are associated with learners' well-being, a pre-condition associated with better learning in a large body of research. For Gregersen, the long journey of learning a language is relieved by positive emotions, as they are a source of learners' resilience.

Foreign language enjoyment (FLE) and foreign language classroom anxiety (FLCA) have also been widely investigated by PP in SLA, such as in the study of Dewaele and MacIntyre (2014), reviewed in Chapter II. Expanding on Fredrickson's theory, Dewaele and Alfawzan (2018) carried out two studies on the topic, following a predominantly quantitative approach. The researchers aimed to search for correlational clues to tentative generalizations of the effects of these emotions on foreign language (FL) learning. They also collected some qualitative data to triangulate evidence for the generalizations. Participants in Study 1 were 189 students retrieved from two secondary schools in Greater London, ranging in age between 12-18, and studying different foreign languages. They were allocated into three age subgroups, and data collection materials were adapted accordingly. Measures of the independent variables (i.e., FLE and FLCA) were obtained through online questionnaires designed according to the research tools of the area. Participants' final grades in their FL test were taken as measures of the dependent variable (i.e., FL proficiency). Participants' scores ranged from 49% to 100%, with an average mean of 87.7% ($SD = 10$), meaning that the sample comprised proficient L2 language users. Participants in Study 2 were 152 Saudi learners and users of English, ranging in age from 18 to 40 ($M = 26$, $SD = 6$). Among them, 60% had recently finished college, while the others were studying English as an L2. Measures of the independent variables (i.e., FLE and FLCA) were the same of Study 1. Measures of the dependent variable were assessed through a standard English proficiency test. As stated before, qualitative data was obtained to establish links between FL proficiency, FLE, and FLCA. This data was gathered

through participants' subjective and detailed answers to questions concerning their enjoyment and anxiety experiences in FL classes. Results showed that FLE positively correlated with FL proficiency irrespective of contexts, whereas FLCA negatively correlated with it.

To put it another way, higher levels of enjoyment and lower levels of anxiety in the FL class were associated with better FL proficiency, as measured through FL tests. Despite the small to medium effect size and the correlational design not predicting direct causality, the existing literature in the area corroborates the association: learners under the effect of positive emotions, as stated earlier, more broadly notice classroom stimuli and language input (DEWAELE; ALFAWZAN, 2018). Results of the qualitative analysis reinforced this association as participants' range of achievement and persistence, in agreement with Guz and Tetiurka (2016), and Shirvan, Taherian, and Yazdanmehr (2020) reviewed in Chapter II, oscillated according to the teaching practices and teachers' mindsets. Practices and mindsets that generated anxiety were associated with participants' dropouts, traumas, and discouragement. In contrast, practices related to their contentment generated experiences of learning achievement and satisfaction. Thus, as widely cited by participants, teachers' positive mindset and feedback may have driven out negative arousal, supporting the undoing hypothesis (FREDRICKSON, 1998; FREDRICKSON; LEVENSON, 1998).

Due to its focus on learning anxiety, a study from Chapter II is worthy of being readdressed: Jin, Dewaele, and MacIntyre (2021). The researchers found that bringing up positive memories about positive experiences inherent to learning English (i.e., reminiscing) attenuates L2 learning anxiety. It is bearable to conjecture that manipulating these memories in real-time in working memory (WM) may be a way of unweaving and reshaping higher-order negative L2 emotion schemata. Those changes may alter how learners filter their present reality when found in L2 learning situations. It is as if reminiscing helped undo the effects of anxiety in L2 learners, leaving them at ease and in a state of cognitive openness for better L2 language absorption. The practice may be a source of energy for the emergence of the positive upward spirals hypothesis proposed by Fredrickson's theory (FREDRICKSON, 2001, 2004, 2009; FREDRICKSON; JOINER 2002).

Having finished the review of studies in this subsection, let us readdress the effect of positive emotions on learners' cognition and whether or not it may have uniquely beneficial effects on L2 reading. It is generally possible to assert its benefits,

mainly for social and intellectual reasons, such as interaction with peers and teachers and broadened exploration interests. Besides that, to be explained next, the effect of positive emotions during distinct reading comprehension phases may also be considered beneficial under the tenets of Positive Psychology (PP) and the Broaden-and-Build Theory of Positive Emotions.

As Tomitch (2009) explains, the first phase, pre-reading, precedes readers' complete contact with the text. It involves the presentation of its topic to motivate them to read, raise their prior knowledge, and activate relevant schemata. In other words, in the pre-reading phase, readers become familiar with the text content, make predictions, and have initial contact with some words to be seen later in their full context (RONDON; TOMITCH, 2020). In the case of a song, that could be done, among other possibilities, (a) through the presentation of illustrations conducive to the main ideas found in the lyrics; (b) through the prediction of meanings in some of the song verses containing familiar words; and (c) also through the mapping of conceptual links across words found in different parts of the lyrics. The second phase, while reading, is the phase in which readers explore the text through different tasks (TOMITCH, 2009). Tomitch explains that in this phase, readers go back and forth to the text, being always previously informed of the to-be-accomplished goal. That way, the reader explores the text in cycles through different tasks and with a reduced WM workload. The third phase, post-reading, is the phase in which readers establish associations between what they know and the ideas of the text to develop personal and situated new ideas.

Bringing Tomitch's operationalizations to this discussion, it is conceivable to propose that cognitive and attentional openness to reading begins in the pre-reading phase, mainly if the teacher conducts activities to activate learners' prior knowledge and awaken their topic interest, promote enjoyment, and reduce anxiety. The variety of activities in the while-reading phase may maintain readers' focus mainly if the text is approached utilizing student-centered tasks (DEWAELE; MACINTYRE, 2014). Finally, post-reading may allow students to generate and make personal and meaningful use of their broadened thought-action repertoires. However, what if the L2 learner, influenced by highly positive emotions, incarnates Pollyanna and loses the focus and the objectives of an L2 lesson?

For instance, the study of Gasper (2003) on sadness and its effects on cognition mentioned earlier corroborates the idea that positivity may distract learners. Komoroswska (2016) also emphasizes that positive emotions are associated with

superficial information processing and bias to mental shortcuts. In order to leave Pollyana far from the class, it is necessary to recap once again that Fredrickson's research advocates for the beneficial outcomes associated with *mild positive emotions*. Her research also acknowledges findings proposing that

[...] positive emotions lead to creative, unusual, or integrative thinking, but it differs in predicting a concomitant reduction in attention to details and negative feedback, sometimes leading to an overreliance on heuristics or stereotypes. (FREDRICKSON; COHN, 2008).

Let us take happiness as an example. Even though this concept is multidimensional, for this discussion, let us adopt the operationalization of “[...] an experience that involves the presence of pleasure or positive emotion and the absence of displeasure or negative emotion.” (GRUBER; MAUSS; TAMIR, 2011, p. 223). The researchers point out that in more critical cases, extreme states of happiness (i.e., heightened positive emotions) may lead individuals to lose track of risk-taking and be involved in threatening situations. Regarding cognitive processing, Gruber, Mauss, and Tamir, consonant with Fredrickson and Cohn (2008) above, conclude that intense happiness may lead individuals to be less analytic, easily tricked, and influenced by heuristics.

Bringing the discussion above to L2 reading comprehension, let us consider the phenomenon of the *illusion of knowing*. According to Epstein, Glenberg, and Bradley (1984),

Discrepancies between self-assessed and objectively assessed levels of understanding are not uncommon. When the discrepancy involves subjective overassessment of understanding, we designate the mismatch as an illusion of knowing. (p. 355).

Epstein and colleagues explain the phenomenon from a cognitive perspective, attributing it to the reader's difficulty in identifying text deficiencies and excessive positivism in self-assessment. Tomitch (2003a), in a study about the perception of distorted texts, added to Epstein's group that low reading proficiency and working memory capacity (WMC) also contribute to this phenomenon. According to Tomitch, participants who demonstrated the illusion of knowing evaluated their reading comprehension performance as effective despite their failures in understanding the

microstructure and macrostructure of a text. As already mentioned, the reasons given by Epstein, Glenberg, and Bradley (1984) and Tomitch (2003a) for the illusion of knowing are fundamentally cognitive.

Considering the discussion presented throughout this chapter, it is possible to conjecture that readers' emotional states may also yield the illusion of knowing. For instance, Forgas, Vargas, and Laham (2005) found that positive emotions magnified less accurate information processing and less systematic thinking, both associated with one's pathetic illusions. The illusion of knowing phenomenon also shares conceptual similarities with the *self-serving bias* phenomenon (BLAINE; CROCKER, 1993). Following Blaine and Crocker, this phenomenon "[...] refers to the tendency of people to interpret and explain outcomes in ways that have favorable implications for the self." (1993, p. 55). According to the authors, individuals demonstrating this self-bias somehow reveal that excessive high self-esteem may be dangerous because it may overestimate the expectations of individuals' outcomes.

Simply put, strong positive emotions about oneself may cause extreme self-reliance, which produces shallow information processing and distorted self-perception. Fredrickson's Broaden-and-Build Theory of Positive Emotions (1998) proposes that mild positive emotions are associated with exploration, absence of fear, creativity, reliance, and openness. In that sense, teachers must strategically monitor learners' enjoyment, encouragement, and exploration in EFL reading through singing for vocabulary learning while keeping them cognitively attentive to the content taught. If not, the broadened focus of attention yielded by positive emotions may distract learners and cause them to lose the goal of the task.

Departing from that, it is critical to consider that effective EFL reading requires attention to textually based information and openness to the whole landscape derived from inference-making. Such assertion calls for a brief review of the *Interactive Reading Model* (RUMELHART; MCCLELLAND, 1981). The model postulates that reading comprises a combination of bottom-up (i.e., textually driven) and top-down (i.e., inferentially driven) subprocesses that, in close interaction, allow readers to interpret a text more appropriately. The model constitutes an alternative to the *Bottom-up Reading Model* (GOUGH, 1972) and the *Top-down Reading Model* (GOODMAN, 1967) as it places equal importance on the role of both low-level (i.e., decoding and literal comprehension) and high-level reading subprocesses (i.e., inferential comprehension and comprehension monitoring) (GAGNÉ; YEKOVICH; YEKOVICH,

1993). According to the Interactive Model, information processing from these distinct levels may occur alternately or simultaneously whenever needed to implement comprehension (AEBERSOLD; FIELD, 1997; WOELFER; TOMITCH, 2019). Based on that, and especially when working with singing and adolescents, EFL teachers have to remain attentive to learners' experiences of mild positive emotions in activities that require a fluctuation between the details of the lyrics, inference-making, explorations, and imagination. In sum, it is conceivable to conclude that simply feeling positive does not guarantee effective EFL reading comprehension and vocabulary learning, topic to be explored in detail in the next section.

To this point, this chapter has described the Broaden-and-Build Theory of Positive Emotions (FREDRICKSON, 1998; FREDRICKSON; BRANIGAN, 2005) and its relationships with individuals' well-being and SLA. It highlighted that positive emotions bring about emotional and cognitive openness to sociability and broadened cognitive processing, respectively. The chapter, however, does not neglect or omit studies suggesting that positive emotions are not always entirely positive and that negative emotions are not always entirely negative regarding the outcomes they yield. Despite that, it insists on the value of positive emotions based on the emerging picture derived from the large body of studies described so far. On top of that, it is common sense that in practice, nobody wants to strengthen people's pessimism or low self-esteem but to build positivity from learners' negative and positive emotions. Nobody should evoke reactivity or fear in the school context. Opposedly, and as put before, everyone should help see the school as a place of peace and love. Next, the discussion on the sufficiency of positive emotions for EFL vocabulary learning is more fully elaborated based on neuroscientific findings.

3.3 IS FEELING POSITIVE ENOUGH FOR EFFECTIVE EFL VOCABULARY LEARNING?

All the studies described so far present a commonality: individuals under positive emotions tend to zoom out their vision of the world. It is not only about seeing the world through pink-colored glasses but through glasses that open up individuals' minds to complex forms of thinking. Immordino-Yang and Damásio (2016, p. 28) also propose that "Emotions are, in essence, the rudder that steers thinking." They used

the statement to refer to the results of Damasio's twenty years of investigation on brain-damaged people. Damasio's research has shown that thinking may be insufficient and even dangerous when emotionless. Without the rudder of emotion, it is as if thought were a bewildered ship with an uncertain destination. The researcher's studies on patients with damage to brain areas associated with the processing of social emotion, social conduct, and ethical behavior demonstrated that they had no problems in terms of rationality. However, they had problems using the knowledge in society, making good decisions for themselves, and learning from social feedback. Immordino-Yang and Damasio (2016), thus, propose that an emotional know-how repertoire influences the applicability of conceptual knowledge. A naïve interpretation of these ideas, considering the studies of PP in SLA earlier described, would be that feeling positive while learning is enough to enable an individual to apply knowledge appropriately and effectively. That interpretation would represent just part of the story. To elaborate on that, let us start with an analogy.

Charles Darwin, in *The power of movement in plants*, defines the term positive heliotropism as "[...] bending towards the light" (DARWIN, 1880, p. 5). Poetically, we can describe this movement as the dance of plants toward the sun. In the search for light, flowers, and leaves, rejoice in this energy that allows them to open up and grow fully. Alternatively, as illustrated by Fredrickson (2010):

[...] imagine that you are this water lily. It's very early in the morning and your petals are drawn up around your face. And if you can see out at all from that vantage point, it's just a small stream of light in front of you. Your [...] world is actually quite small. As the sun rises in the sky [...] with more sunlight your petals start to pull back from your face that kind of removing those delicate blinders, and your world, your experience of the world, quite literally expands [...].

PP, similarly, aims to evoke a positive heliotropic effect on people. It aims to enable them to learn from the lessons of periods of shadow and find the light, the positivity needed for flourishing. Nevertheless, when it comes to education, feeling positive and yielding complex conceptual thinking may not be enough. The beauty of heliotropism does not uniquely confine to the movement of plants towards the light, nor their opening. Its beauty is that this light feeds the plants with the energy necessary to grow up, feed on the mud and reach their plenitude *by themselves*. This self-achieved plenitude generates seeds that spread the absorbed light over vast and faraway fields.

In this sense, plants pull in the sunlight deep inside them, process, and turn it into something that is multiplied and shared; it is the actual applicability of knowledge in the world.

Having that in mind, it is possible to assert that solely planning classes and setting up the environment to trigger learners' positive emotions and build intellectual resources may not be sufficient to consider the educational process a means for one's flourishing. Today's world needs much more than people being recipients of conceptual knowledge, including a rich lexicon in a foreign language. The world lacks people able to pull in conceptual knowledge, recognize its personally meaningful value, manipulate it, intertwine it with tags of emotional and moral values, and grow *by themselves*. One's seeds of knowledge cannot simply spread rationality given that pure rationality may even be dangerous to oneself and others, as shown by Damasio's studies abovementioned; pure conceptual knowledge enables one to create destructive tools, as already mentioned. The type of seeds and how they are spread must be controlled by the emotional rudder that enables individuals to use knowledge appropriately in society. The studies of Pfattheicher *et al.* (2020) and West *et al.* (2021) on positive emotions and prosocial behaviors during the COVID-19 pandemic, reviewed in Chapter II, are evidence for that.

In agreement, Immordino-Yang (2021), in a lecture delivered to the *Programa de Pós-Graduação em Inglês of Universidade Federal de Santa Catarina*, addressed this issue and stated that:

[...] You have, as the teacher, a bunch of words that you need your students to remember. And then, you're going to find ways to present those [words] to them in ways that they can [...] assimilate, [...] digest, [...] and build from positive emotions and openness into engaging with those words so that they can [...] store them in semantic memory and recall them later. That's really important [...], but I also think that in tandem with that, we need to think hard about how it is that young people engage not just in ingesting what you send at them, but how they [...] come to the space disposed to search for and pull into themselves the information that they need to be able to think about things they care about. It's kind of balancing out the seesaw¹⁵ [...].

¹⁵ Statement presented by Mary Helen Immordino-Yang (University of Southern California) during the lecture entitled *Building meaning builds teen's brains: teens' narratives predict neural development and young adult wellbeing*, delivered on November 22, 2021, via Youtube (60:39 – 61:37). The lecture was part of the *Ciclo de Palestras "Leitura e(m) Interfaces: Teorias, Métodos e Aplicações"*, an event that celebrated the 50th anniversary of the Postgraduate Programme in English: Linguistic and Literary Studies at UFSC, with monthly lectures on themes related to reading. Link: <https://www.youtube.com/watch?v=oTIF1ynq8z8&feature=youtu.be> .

Inferring from Immordino- Yang's statement, creating ideal conditions to broaden learners' scope of cognition and attention through positive emotions would represent just halfway toward effective and meaningful learning. It would be like irradiating light to open up the flowers in heliotropism. However, the balance of the seesaw proposed by the neuroscientist comprises setting up the environment and carrying out activities that allow learners to interweave rationality and emotions to be enabled to build and apply knowledge in personally meaningful ways, caring about the next. In heliotropism, that would be represented by the *self-generating growth* of plants that, fed by light and mud, would spread the seeds of knowledge where life is needed. In that sense, learning EFL vocabulary effectively through singing and feeling emotionally positive about it would be just the initial steps into the kind of learning we currently need in the face of many adversities in today's world. The final steps would be unveiling the songs' main ideas emotionally and cognitively through elaboration (i.e., inference-making reading processes), a topic to be further explored in Chapter IV, during the description of Mathewson's (1985) *Comprehensive Model of Affect in the Reading Process*. Immordino Yang (2021), in the same lecture previously mentioned, also stated that

[...] In education, we usually think about the teacher having the knowledge and the student not, [...] the teacher has to give the student the knowledge, and then the student needs to be able to ingest it, assimilate it and recall it. But what our work is also showing is that [...] some kinds of learning are [...] the kinds of learning that potentially really grow young people's dispositions of mind and their stance toward the process [...] ¹⁶.

Here, Immordino-Yang proposes that *certain kinds of learning* are more effective than others. This finding of Social-Affective Neuroscience is supported by analyses based on brain and physical measures obtained, among others, through functional magnetic resonance imaging (fMRI) and cardiovascular responses, respectively. These measures are used to address questions "[...] about how people process social and self-relevant information in their cognitive, emotional, and cultural contexts." (IMMORDINO-YANG, 2016, p. 3). However, a deeper understanding of

¹⁶ Ibid., from 61:41 to 62:10.

neuroscience and its methods is beyond the scope of this doctoral dissertation. Thus, findings from this field will be broadly tapped with a focus on their learning implications and also to continue on the answer to the question that is also the title of this section: *Is feeling positive enough for effective EFL vocabulary learning?*

Following Immordino-Yang (2016), attention has to be devoted to the functioning of brain networks that support the full development of learners' cognitive and emotional skills. The functioning of these brain networks is the opening move to find a probable answer to the target question. According to the neuroscientist, a basal tenet of social and affective neuroscience is that these skills are supported by interdependent brain networks that are shaped according to contextual factors. At the educational level, it can be inferred that the development of learners' emotional and cognitive skills is subordinate to environmental, pedagogical, and socio-interactional factors. Social and affective neuroscience has accumulated a large body of research on a specific neural network cited earlier, namely, the Default Mode Network (DMN), which is considered critical for effective learning. The DMN, according to Immordino-Yang, is

[...] the most metabolically expensive core brain areas [...] organized into a grand network whose activity and connectivity (coordinated "cross talk" between the component networks) [that] are broadly associated with neural and mental health, intelligence, and memory ability.¹⁷ (IMMORDINO-YANG, 2016, p. 3, emphasis given by the author).

Immordino-Yang explains that high activation in the DMN has been associated with better cognitive performances, including reading comprehension. The DMN has been found highly activated when individuals experience admiration and compassion for others (IMMORDINO-YANG *et al.*, 2009). Interestingly, Immordino-Yang (2016) also explains that DMN connectivity and activation occur when learners are in a state of rest, introspection, daydreaming, or, in other words, when attention is not task-oriented. Based on that, one could mistakenly conjecture that directing the focus of attention away from the learning task would be better than toward it. However, the back-and-forth transition between task-directed and non-task-directed attention underlies the association between conceptual knowledge and emotions. Immordino-

¹⁷ For a detailed description of the DMN, check Immordino-Yang, Christodoulou and Singh (2016).

Yang posit that learners need both attentional movements of the seesaw because task-directed attention manipulates knowledge rationally, and non-task-directed attention allows for learners' deep reflection and inference-making processes on the socio and emotional value of that knowledge and its appropriate current and future applicability. The inward attention (i.e., non-task-directed attention), according to Immordino-Yang (2016), also allows for the learners' more profound comprehension of the value of the task at hand for themselves, for self-decision-making concerning their current contexts and futures, recall of personal memories, and for being empathic about the impact of social situations on people. This inward, non-task-oriented attention also characterizes the state of flow through thought that may occur when the seesaw movement is student-centered. As stated by Csikszentmihalyi (2008),

The important thing is to recognize here is that you should not feel that you *have to* absorb a string of facts, that there is a right list you must memorize. If *you* decide what you would like to have in memory, the information will be under your control. (CSIKSZENTMIHALYI, 2008, p. 124, author's emphasis).

Csikszentmihalyi seems to suggest that the empowerment given to learners to manipulate knowledge on their own is critical for them to be fully immersed in and aware of what they are doing.

The functioning of the DMN, thus, provides an answer to the title of this section: merely feeling positive is not enough for effective EFL vocabulary learning. The DMN functioning does not exclusively involve the induction of positive emotions to broaden attention and cognition to foster online information processing. That would be restricted to the traditional view of intelligence measured through a domain of purely conceptual knowledge. Social and affective neuroscience has shown that effective learning also involves calming down and inferring the personal value of learning tasks and the value of knowledge built for oneself and others with empathy. A question arises: Would learners get engaged in this intimate and personal non-task-directed information processing in the English class? To illustrate that, let us consider the target learning focus of this doctoral dissertation, EFL vocabulary and the textual genre used, songs' lyrics.

It is already established in the literature that the effectiveness of reading comprehension is associated with implementing activities divided into three phases

explained earlier in this chapter, namely, pre-reading while reading and post-reading, each having distinct objectives (TOMITCH, 2009). The third phase, post-reading, seems to this doctoral researcher the adequate phase for letting students engage in the deeper self-reflection and construction of personal, social, and situated meanings, as Immordino-Yang (2016) advises. It may be the moment for the generation of offline inferences. As stated by Tomitch (2009), “[...] post-reading aims to consolidate what has been learned, [and] to get students to use what has been learned in situations that are relevant to them, such as projects, new discussions, research on the subject, etc.” (p. 197, my translation ¹⁸). On the one hand, post-reading may allow for the initial dive that social and affective neuroscience recommends for effective learning. On the other hand, post-reading, as well as pre-reading, and while-reading, demand task-oriented attention. In other words, the inferences are generated because the teacher directs the learners’ attention to *doing something*. Immordino-Yang (2016), however, points out that DMN activation is not observed when attention is outwardly directed to external stimuli and demands of this kind. Here one can understand the need to balance rational and emotional processes. To permit this movement, a teacher may give readers the time needed to generate offline inferences outside the classroom before reassessing the texts (i.e., texts can be songs) and demanding task-oriented attention again. This inward movement would be the resting time for learners to build knowledge structures encompassing the value of the content learned in the song, and its current and future applicability involving responsibility and compassion to oneself and others.

If the reader allows me, I will dare again to bring the text to the first person. I would conjecture that emotions, when mildly positive, in addition to steering thinking, also widen the horizon of possibilities towards which the individual can navigate. It amplifies the horizon so flowers can spread their seeds! The amplified horizon, in terms of EFLvocabulary learning, may explain why positive emotions are associated with learners’ ability to establish unusual and more varied conceptual interconnections among words found in different parts of texts (ISEN *et al.*, 1985; ROWE; HIRSH; ANDERSON, 2007). Like a flower, learners are illuminated, open at their maximum, and can see where and how they should spread their seeds of knowledge.

¹⁸ In the original: O objetivo da pós leitura é consolidar o que foi aprendido, fazer com que os alunos utilizem o que foi aprendido em situações que lhes sejam relevantes.” (TOMITCH, 2009, p. 197).

Speaking of flowers, the following section presents an alternative analysis of the core concepts of the Broaden-and-Build Theory of Positive Emotions. The analysis generated a beautiful theoretical flower; some of its petals will be opened next.

3.4 CONCEPTS CENTRALITY ANALYSIS BASED ON SEMANTIC NETWORKS OF CLIQUES

By tying the fields of Applied Linguistics and Positive Psychology, The Broaden-and-Build Theory of Positive Emotions (FREDRICKSON; BRANIGAN, 2005) defines the dissertation's research niche: Second Language Acquisition from the Perspective of Positive Psychology (PP in SLA). For this reason and its significant influence on the dissertation's theoretical thread, an alternative analysis of the theory's core concepts was conducted, *a concepts centrality analysis based on semantic networks of cliques* (DRIEGER; 2013; FADIGAS; PEREIRA, 2013; PEREIRA *et al.*, 2022; TEIXEIRA *et al.*, 2010). The analysis comprises quantitative methods for extracting data and building the network and a qualitative discussion on its outcomes. The objective of the analysis is twofold: (1) to elaborate on the network configuration of the core concepts of Fredrickson's theory; and (2) to discuss relationships between the theory's core concepts, findings, reflections, and proposals made in Chapters II, III, and IV. That way, the discussion anticipates some information to be thoroughly presented in Chapter IV.

3.5 METHOD OF NETWORK CONSTRUCTION AND ANALYSIS

The network analysis comprised constructing a semantic network of cliques from seven texts describing the Broaden-and-Build Theory of Positive Emotions (FREDRICKSON, 1998, 2001, 2003, 2004, 2013; FREDRICKSON; BRANIGAN, 2005; TUGADE; DEVLIN; FREDRICKSON, 2021). Networks, represented by graphs, comprise entities and their interrelations. Specifically, a graph $G = (V, E)$ is a mathematical object with two finite sets, vertices (V) and edges (E) connecting pairs of vertices (GROSS; YELLEN; ANDERSON, 2019, p. 2). In a semantic network, vertices usually represent concepts and objects, and edges or arcs usually represent some semantic relation (PEREIRA *et al.*, 2022, p. 16). A network of cliques, in turn, is

constructed by the consecutive addition of cliques, which are structures formed by vertices that are mutually interconnected (i.e., complete subgraphs, FADIGAS; PEREIRA, 2013; GRILO *et al.*, 2017).

The semantic network of cliques was constructed by cliques representing the sentences of the abovementioned texts that elaborate on the Broaden and Build Theory, with each clique formed by vertices representing unique lexemes of each sentence. Edges represent co-occurrence in sentences, and cliques were connected if they shared a common vertex or vertices and edges (i.e., juxtaposition or superposition processes, as described in FADIGAS; PEREIRA, 2013). The network construction was performed in the R statistical environment (R CORE TEAM, 2022) with the following steps. First, the paragraphs of each of the seven texts were saved in a text file. Pre-textual information (e.g., titles, abstracts), paratextual information (e.g., section headers, figure captions), and post-textual information (e.g., references) were removed. Then, the texts were cleaned: numbered references (e.g., [1]), information between parenthesis, 's, symbols (e.g., colons, percent signs, hyphens), section references (e.g., 1.1, 1.1.1), and standard abbreviations (i.e., e.g., *et al.*) were removed; some abbreviations were replaced by their full words (e.g., fig. by figure) and all characters were converted to lowercase. Then, the sentences were split considering the delimiters period (.), exclamation (!), and question marks (?), followed by space. Then, stopwords from the default English list of the R package stopwords (BENOIT; MUHR; WATANABE, 2021) and some additional stopwords (APPENDIX A) were filtered out, and words were lemmatized with the R package textstem. Then, repeated lemmas were removed from each sentence. The result was a text file with the unique lexemes of the texts' sentences, each sentence represented in a line. This file was then converted to a network file (Pajek format) using the program criar.Net (BORGES; MONTEIRO; PEREIRA, 2021). Figure 4 illustrates the constructing process of a semantic network of cliques from a text, and Figure 5 shows the resulting network of the seven texts processed. Table 1 shows some of the network's metrics.

The analysis of the resulting network involved the identification of the most important vertices and their most strongly connected pairs of vertices. Betweenness centrality was used to measure vertices' importance in connecting the other vertices of

the network (NEWMAN, 2010, p. 185)¹⁹, and the Incidence-Fidelity (*IF*) index (TEIXEIRA *et al.*, 2010), which considers the “[...] frequency occurrence of a pair of words [...]” and “[...] their probability of occurring together [...]” (TEIXEIRA *et al.*, 2010, p. 336), was used to measure the strength of the connection between pairs of vertices. Vertices with betweenness centrality values greater than or equal to two standard deviations above the mean of the distribution in the network were selected for analysis (this cutoff value was based on ROSÁRIO *et al.*, 2015). Since this resulted in only 20 words, vertices with betweenness centrality greater than or equal to one standard deviation above the mean were also selected. Finally, pairs of vertices with $IF > 0.001$ (based on TEIXEIRA *et al.*, 2010) were selected for analysis (detailed data is accessible at <https://github.com/davi-ao/semantic-network-of-the-broaden-and-build-theory-of-positive-emotions>).

¹⁹ The betweenness centrality is mathematically defined by Newman (2010, p. 187) as $c_i = \sum_{s,t} \frac{n_{st}(i)}{n_{st}}$ for vertex i , being, n_{st} the number of shortest paths from a vertex s to a vertex t that pass through vertex i and n_{st} the total number of shortest paths from s to t .

Table 1 - Network metrics

Metric	Value
Number of Vertices	3387
Number of Edges	120866
Betweenness Centrality Mean	.000368
Betweenness Centrality Standard Deviation	.0037
Incidence-Fidelity Mean	.0000526
Incidence-Fidelity Standard Deviation	.000793

Source: Created by the author of the dissertation.

Figure 4 - The process of constructing a semantic network of cliques from a text

Even though research on emotions has flourished in recent years, investigations that expressly target positive emotions remain few and far between. Any review of the psychological literature on emotions will show that psychologists have typically favored negative emotions in theory building and hypothesis testing.

Text Cleaning

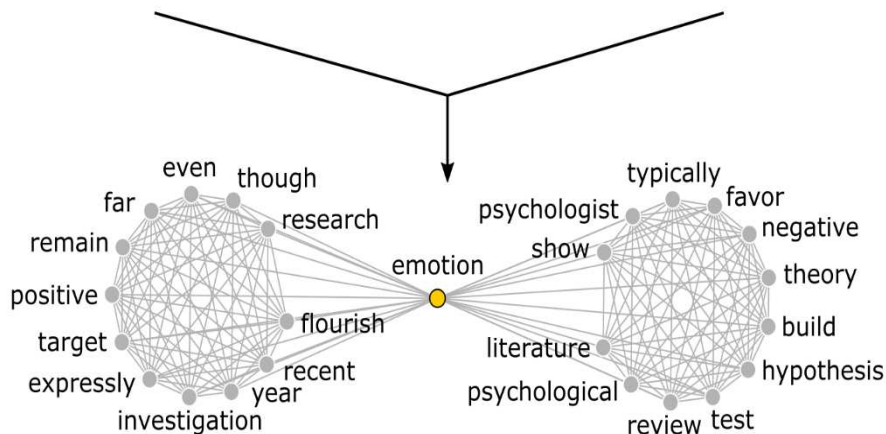
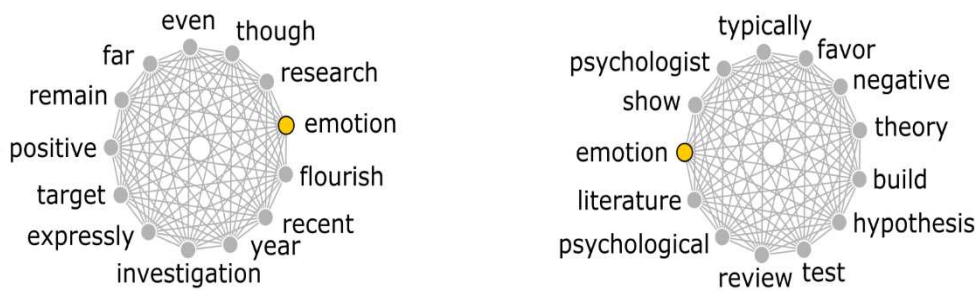
Sentences are split, words are lemmatized, stopwords are removed and only unique words are kept.

even though research on emotions has flourished in recent years investigations that expressly target positive emotions remain few and far between

any review of the psychological literature on emotions will show that psychologists have typically favored negative emotions in theory building and hypothesis testing

Construction of cliques

From each sentence a clique is constructed, with vertices representing its lemmas.

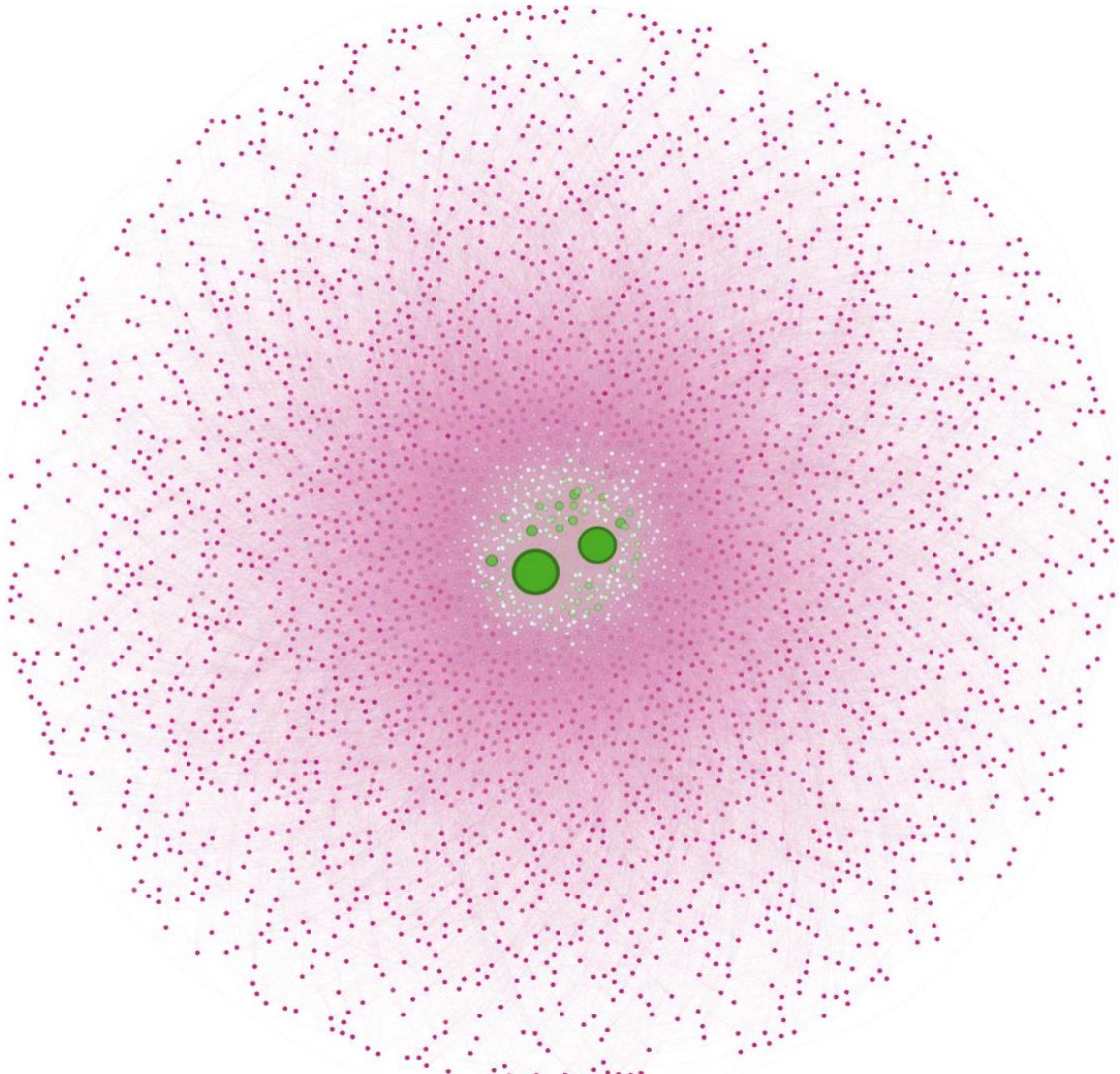


Construction of the network

The cliques are connected by their common vertices, forming a network of cliques.

Source: Created by the author of the dissertation.

Figure 5 - The resulting network



Source: Created by the author of the dissertation.

3.6 DESCRIPTIVE ANALYSIS OF THE NETWORK

Figure 5 above depicts the network's total amount of vertices (represented by dots) (3.387) and edges (represented by the connecting arcs) (120.866) with pairs of vertices with $IF > 0.001$. As put before, the vertices represent concepts, and the edges represent semantic relationships among pairs of vertices.

The vertices' position roughly represents their importance in connecting the other vertices of the network and their strength in connecting pairs of vertices. Vertices in central areas roughly present higher betweenness centrality degrees (i.e., the theory's main concepts). They also show higher incidence fidelity indexes (i.e., they more strongly semantically connect the theory's pairs of concepts). The opposite

specific network (e.g., it is not a standard feature of the Network's Theory but a choice for this dissertation). The same applies to the vertices' sizes, varying from bigger to smaller. For instance, the betweenness centrality of the *emotion vertex* is 0,153915, and its incidence fidelity index with the vertex *positive* is 0,260899. It is a core theory concept for its higher importance in connecting the other concepts of the whole network and its considerable strength in being semantically connected to the other vertex (i.e., *positive*).

On the other hand, the betweenness centrality of the vertex *tumble* (positioned in the extreme left peripheral area) is 0,00004, and its incidence fidelity index with the vertex *rough* is 0,002957. It is a supporting concept of the theory for its lower importance in connecting the other concepts of the whole network and its weaker strength in being semantically connected to the other vertex (i.e., *rough*).

At last, the thickness of the vertices' edges, as mentioned earlier, represents the vertices' incidence fidelity indexes. They lose semantic connection strength with other vertices varying from thicker to thinner.

3.7 DISCUSSION

An extensive discussion could be performed if all network vertices were accounted for. This would be an informative work. However, to fulfill the twofold objective described at the beginning of this section: (1) to elaborate on the network configuration of the core concepts of Fredrickson's theory; and (2) to discuss relationships between the theory's core concepts, findings, reflections, and proposals made in Chapters II, III, and IV, the discussion will confine itself to some of the vertices and edges of the network's central area, Figures 7 and 8.

The concepts *positive* and *emotion* are at the roots of Positive Psychology in Second Language Acquisition's (PP in SLA) objective: to improve learners' achievement, well-being, intrinsic motivation, and creativity (LI; XU, 2019), as mentioned in Chapter II. Without focusing on positive emotions, the tie between Applied Linguistics and PP would be broken in the dissertation. Consequently, its research niche could not be set (i.e., Applied Linguistics research's data devoid of triangulation with emotional data would not fit within PP in SLA; research conclusions would be solely built on linguistic outcomes).

On the top left of the network is set the concept *negative*, with considerable importance and presenting a strong semantic relationship with the concept *emotion* and many semantic relationships with the concept *positive*. As highlighted in Chapters II and earlier in this chapter, PP and PP in SLA research have a clear higher focus on positive emotions without neglecting that negative ones may nurture them (KOMOROWSKA, 2016; MACINTYRE, GREGERSEN; MERCER, 2020; LI; XU, 2019). The researchers point out that individuals' positive emotions may sprout and feed off of negative emotions.

In some cases, it is as if suffering were necessary to awaken people's inner strength, as if they were saying to themselves: *I see my situation, and I need to seek the power to get out of it*. The power comes from subsequent positive emotions built up. The same applies to Fredrickson's theory; her studies show that individuals' positive emotions, in many situations, arise in dark times (FREDRICKSON; COHN, 2008; FREDRICKSON; JOINER, 2002). According to Fredrickson and Cohn (2008), negative emotions are detrimental "[...] when extreme, prolonged, or contextually inappropriate [...]" since they "[...]are implicated in many grave problems, including anxiety disorders, aggression and violence, eating disorders and self-injury, and depression and suicide." (p.780). The strength and significant semantic relationship between the concepts *emotion*, *positive* and *negative*, in Fredrickson's theory also provide a basis for reasoning inherent to EFL reading comprehension processes. As explained earlier, EFL readers may be affected by the *illusion of knowing* phenomenon (TOMITCH, 2003a). According to Tomitch, these readers tend to delusionally think they have understood the text very well due to excessive self-confidence. It shows that positive emotions, when extreme and contextually inappropriate, are also detrimental. Following the researcher, excessive self-confidence leads them to overlook basic details of the text prematurely. In this case, as stated in the dissertation, mild negative

emotions, such as mild anxiety stemming from the desire to understand the text well, can make EFL readers more attentive to details, thus improving their reading comprehension. They are not extreme, are manageable, and are contextually appropriate.

At last, the network's interconnection configuration of these three concepts somehow goes against Revord, Sweeny, and Lyubomirsky (2021), who posit that Fredrickson's theory does not explain when or why negative emotions may be more appropriate than positive emotions. From a semantic perspective, what occurs is that the theory reinforces the concepts *positive* and *emotion* but mentions the concept *negative* less frequently. However, from a practical empirical perspective, the theory applies experiments comparing and contrasting the effects of positive and negative emotions (and also neutral as control) on human functioning. In sum, the importance and the connection's strength between the three concepts mirror (i) the main focus of Fredrickson's research group on the role of positive emotions in broadening the scopes of cognition and emotions for building individuals' long-lasting personal resources; (ii) the solid semantic relationship between the three concepts throughout the seven texts processed (iii) and the relationship of the theory with the theoretical thread of the dissertation. The latter will be resumed in detail later.

Overall, the theory's network concepts of *positive*, *negative*, and *emotion* form a semantic web indicating that PP in SLA constitutes promising future research avenues. However, harmonious with Dewaele *et al.* (2020), the reviews of studies of the dissertation also point to the lack of studies of PP in SLA that triangulate linguistic and emotional data. May this doctoral dissertation be inspirational for future implementation of such studies, especially in EFL reading.

The Broaden-and-Build Theory network configuration also reflects the empirical robustness that Positive Psychology has sought to build over the past years. Its empirical building weakens propagandistic and unsubstantiated assumptions of mass media publications on positivity, which, unfortunately, influence many researchers to look at Positive Psychology with some resistance. As Chapters II and V mentioned, PP and PP in SLA have tried to change this scenario. In PP in SLA, this attempt was inaugurated in MacIntyre and Gregersen's (2012) and Lake's (2013) publications. These two and subsequent publications began incorporating literature reviews based on empirical studies. Moreover, they have implemented their ones.

Concerning that, note that the concepts *study*, *research*, *theory*, *suggest*, *find*, *show*, *test*, *participant*, and *individual* are important in supporting the interconnectedness of the central part of the theory's network and that their semantic relations are multiple with other concepts.

Based on previous research, Fredrickson's group has developed various empirical methods to process data in triangulation through statistical tests, as reviewed in Chapter II and will be done in Chapter V. The methods include diverse materials and tools such as film clips, open-ended statement tests, inventories, scales, schedules, reports, and physiological assessments. They have served to measure participants with different ages and backgrounds' scopes of attention and cognition, self-reported affect and coping, psychological resilience, positive and negative mood, emotions, cognitive appraisal, cardiovascular activity, life satisfaction, self-reported problems, stress, and positive meaning (FREDRICKSON *et al.*, 2003; FREDRICKSON; BRANIGAN, 2005; FREDRICKSON; JOINER, 2002; TUGADE; FREDRICKSON, 2004). In a nutshell, Fredrickson's research, as suggested by the theory's network, has been critical in strengthening Positive Psychology's (PP) empirical robustness.

Other studies, shed by the light of the Broaden-and-Build Theory, have also implemented additional methods in both PP and PP in SLA with different populations. In PP, for instance, Kok *et al.* (2003), mentioned in Chapter II, triangulated measures from daily assessments of meditation practice, emotions, and social connection and vagal tone assessment to examine participants' emotional and cardiovascular autonomic regulation.

In studies of PP in SLA, also reviewed in Chapter II and earlier in this chapter, studies used materials and tools such as foreign language questionnaires and essays, psychometric scales, self-narrated reminiscing records, English proficiency tests, momentary assessments, scales, online surveys and questionnaires, open-ended questionnaires, videotaped lessons, PP interventions, positive thinking, emotions self-reports, and others.

These materials and tools have assessed measures of EFL learners' language classroom anxiety and foreign language enjoyment (FLE), trait emotional intelligence, actual English learning achievement, FLE fluctuations across time, self-narrated reminiscing qualitative data, teachers' self-appraisal, prior knowledge, knowledge gains, expectations, and goals, teachers' periods of heightened engagement, teachers' engagement, orientation, and overall mindset, positive thinking and emotions self-

reports (DEWAELE; ALFAWSAN, 2018; DEWAELE; MACINTYRE, 2014; GALLO, 2016; GUZ; GREGERSEN, 2016; JIN; DEWAELE; MACINTYRE, 2021; GUZ; TETIURKA, 2016; LI, 2019; SHIRVAN; TAHERIAN; YAZDANMEHR, 2020; TALARICO; BERNTSEN; RUBIN, 2009).

The network also outlines the key concepts related to the theory's five basal hypotheses: the *broaden hypothesis*, the *narrow hypothesis*, the *undoing hypothesis*, the *build hypothesis*, and the *upward spirals of positive emotions hypothesis*. The concepts are *people, broaden, build, resource, increase, new, think, interest, feel, affect, work, play, change, social, physical, experience, and process*. These concepts are also important in maintaining the interconnectedness of the central part of the theory's network and establishing semantic relations with other pairs of concepts.

Regarding the theory's hypotheses, it is possible to paraphrase what has been explained earlier in this chapter with a look at the network concepts and connections. Positive emotions broaden the focus of people's attention and cognition by changing the way they process external input and the knowledge they own about it. This broadening effect increases the possibility for people to build new resources that last for a long time, such as social, physical, intellectual, and psychological resources. By having more resources, people enter an upward spiral process in which positive emotions help undo negative emotions and amplify the construction of the previously mentioned resources through broadened attention and cognition, resulting in life satisfaction and new positive emotions. Now resuming the relationship of the theory's network with the theoretical thread of the dissertation mentioned above, let us focus on Chapter IV.

In that chapter, close theoretical consonances will be identified between what proposes *The Comprehensive Model of Affect in the Reading Process* (MATHEWSON, 1985) and The Broaden-and-Build Theory. Some of them, and considerations on the studies there, will be paraphrased now with an eye to the network.

The concepts *positive* and *emotions* are the starting point that gives rise to, strengthen, and maintain the theory's network. Not by coincidence, positive emotions are part of the affective factors, which according to Mathewson's model, make up the starting point and maintenance of reading comprehension.

It is worth noting that the concept *affect* appears in the central area of the network, among others, interconnected with the concepts *emotional, emotions, positive, and negative*. The configuration indicates that Fredrickson and Mathewson

are in tune when incorporating positive emotions as an affective subtype and a model subcomponent, respectively (MATHEWSON, 1985; FREDRICKSON, 2001; FREDRICKSON; COHN, 2008). Being a subtype and subcomponent, one could naively predict that the concept *emotion* should be less important than the concept *affect*. From a semantic perspective, however, it is necessary to highlight that *affect* is less mentioned in the seven texts. From a practical empirical perspective, Fredrickson's research focuses on bodily and mental changes, which are fleeting and derived from "[...] an individual's assessment of the personal meaning of some antecedent event." (FREDRICKSON; COHN, 2008). These features are inherent to emotions and not affect. As differentiated by Fredrickson (2001), affect is a broader concept that "[...] refers to consciously accessible feelings." (p. 218). The researcher also points out that affect is objectless, whereas some emotions are not. Fredrickson (2001) adds that "Although affect is present within emotions (as the component of subjective experience), it is present within many other affective phenomena including physical sensations, attitudes, mood, and even affective traits." (p. 218). The affective phenomena defined by Fredrickson match Mathewson's model in that the object that evokes emotions is *the text*. Chapter IV gathers studies on the specific type of text called *EFL song* and why it constitutes a text type associated with vocabulary learning. The discussion follows on it.

The concepts *construct*, *increase*, *human*, *resource*, *interest*, *action*, *social*, *physical*, *play*, *think*, *work*, and *feel* serve to draw associations between the theory's network (and hence, the theory itself) and the body of studies reviewed in Chapter IV. However, the concept *intellectual* that would directly refer to EFL vocabulary does not appear in the central area of the network. From a semantic perspective, this was due to the lowest citation of the concept among the texts processed. Nevertheless, the concept can be considered imbued in the concepts *resource* and *think*. The only fact is that it is not directly elaborated on. From a practical empirical perspective, this might have occurred because Fredrickson's research is mainly concerned with individuals' well-being and not learning.

In the same chapter, however, EFL reading through singing was associated with vocabulary learning (i.e., *think* and *resource* concepts) in studies conducted with different populations and places of the world (CHOU, 2014; COYLE; GRACIA, 2014; DAVIS; FAN, 2016; GOOD; RUSSO; SULLIVAN, 2015; LI; BRAND, 2009). These and

other studies also mirror the interconnections among the network's concepts *action*, *social*, *physical*, *play* and *feel*.

Several of the reviewed studies pointed out that adolescents connect socially with other adolescents through music, which also helps them define their social self-image, feel better about it, get engaged in action, and care about their physical health (CAMPBELL; CONNELL; BEEGLE, 2007; FINGER; SOUZA; HAAG, 2016; MIRANDA, 2013; NORTH; HARGREAVES; O'NEILL, 2000; TER BOGT; SOITOS; DELSING, 2011).

Not by coincidence again, the concepts *interest*, *increase*, and *think* appear next to each other in the theory's network (central left area), showing vast semantic relationships among themselves and other concepts. Paraphrasing Mathewson (1985), when readers are interested in the text, it is because they have motives for reading, and this precondition improves the execution of cognitive reading processes. Also, as Fredrickson (2009) puts it, interest increases individuals' willingness to explore and take in knowledge. In many studies reviewed, motivation (i.e., imbued in the concept *interest*) is strongly associated with knowledge building (CHEN; CHEN, 2009; DŽANIĆ; PEJIĆ, 2016; ROMERO; BERNAL; OLIVARES, 2012; YAMAMI, 2016).

Finally, acknowledgment has to be made that some concepts could have been eliminated from the theory's network by adding them to the stopwords list. (e.g., the concepts *although*, *within*, and *even*). They undoubtedly play a semantic role in the texts but do not refer to core concepts.

As announced earlier, some petals of the theoretical flower were opened up in this section. Nevertheless, the discussion does not exhaust all possible network structure analyses. It represents an initial interpretation to be improved in future studies, and curiosity is left to see the flower in its plenitude.

3.8 CHAPTER III SUMMARY

The present chapter contained three main parts to strengthen this doctoral dissertation's theoretical basis. Specifically, the chapter intended to solidify the reason for the proposal that EFL reading through singing may be a powerful tool to support vocabulary learning. In detail, part I presented the Broaden-and-Build Theory of

Positive Emotions (FREDRICKSON, 1998; FREDRICKSON; BRANIGAN, 2005). It described its four main hypotheses, the narrow hypothesis, the broaden hypothesis, the build hypothesis, the undoing effect hypothesis, and the upward spirals of positive emotions hypothesis. The chapter followed by reviewing studies of PP in SLA, connecting Fredrickson's theory tenets to the discussions. In part II, studies on neuroscience questioned the sufficiency of positive emotions for effective EFL vocabulary learning. Neuroimaging studies propose a brain network, the Default Mode Network (IMMORDINO-YANG, 2016), considered critical for that. Finally, the concept centrality analysis based on semantic networks of cliques offered an alternative depiction of the Broaden den-and-Build theory, the theory's network, followed by a discussion on the association among the network's main concepts and the theoretical thread of the dissertation. Having prepared and solidified the theoretical terrain for the central thesis of this doctoral dissertation, the subsequent chapter traces relationships between Fredrickson's (1998) Broaden-and-Build Theory and Mathewson's (1985) Comprehensive Model of Affect in the Reading Process. Empirical evidence to support those relationships is brought for through a review of a series of studies on EFL reading through singing and their effects on adolescents' general development and, ultimately, on EFL vocabulary learning.

4 THE ROLE OF AFFECTIVE FACTORS IN ENGLISH AS FOREIGN LANGUAGE READING: SINGING AS A PRACTICE TO ENHANCE VOCABULARY LEARNING

Teenagers, who swing from one threat to their fragile evolving personhood to another in quick succession throughout the day, especially depend on the soothing patterns of sound to restore order in their consciousness.

(CSIKSZENTMIHALYI, 2008, p. 109).

4.1 INTRODUCTION

This chapter initially presents a brief contextualization. Next, it reviews *The Comprehensive Model of Affect in the Reading Process* (MATHEWSON, 1985) to establish the doctoral dissertation's view of reading. Subsequently, it discusses some interplays among body, mind, and learning. After that, the chapter reviews studies, departing from a broader to a narrowed scope, directly informing the dissertation's primary objective: to raise bibliographical support to claim that the practice of EFL reading through singing, for its yielding positive emotions and broadening of WM focus of attention and cognition, enhances vocabulary learning among adolescents. The review encompasses sets of studies on (i) the role of music in adolescents' general development; (ii) singing and motivation in EFL learning; (iii) the relationships between singing and reading development in general; and (iv) singing and vocabulary learning in EFL reading. Subsequently, it reviews studies proposing the integration of songs' melody and text in memory. Then, the chapter discusses the role of involuntary rehearsal phenomena in EFL vocabulary learning. Finally, it presents a summary.

Music is a medium that accompanies adolescents in a wide range of life situations, and it has several functions in their general development (CAMPBELL; CONNELL; BEEGLE; 2007; FINGER; SOUZA; HAAG, 2016. Following Csikszentmihalyi (2008), it reduces anxiety and are inducive to flow. At schools, it can be considered a means for the acquisition of knowledge, transmission of relevant messages, emotional regulation, and establishment of social bonds (NORTH; HARGREAVES; O'NEILL, 2000; FONSECA-MORA; MACHANCOSES, 2019; MIRANDA, 2013; TER BOGT; SOITOS; DELSING, 2011. Inferred from Fredrickson's

(2003) study, musical experiences can spark learners' positive emotions, which may undo the lingering effects of school-related negative emotions. When it comes to English as a Foreign Language (EFL) learning, music can also improve learners' memorability of grammar, lexicon, pronunciation and fluency (FONSECA-MORA; MACHANCOSES, 2019).

Having tapped into this topic, practicing EFL reading through singing can help teachers create all-embracing learning atmospheres that may stimulate social interactions and support diverse students to experience learning in meaningful ways (PAQUETTE; RIEG, 2008; MOELLER, 2021). At last, singing consists of a pedagogical practice that teachers may implement to direct learners' attention to relevant information (SCHÖN *et al.*, 2008) while keeping them motivated during the process of EFL vocabulary learning (CHEN; CHEN, 2009; DŽANIĆ; PEJIĆ; 2016; YAMAMI, 2016).

Departing from the above, the objective of this chapter is to review Mathewson's (1985) Comprehensive Model of Affect in the Reading Process and draw theoretical consonances between the model and the Broaden-and-build Theory of Positive Emotions (FREDRICKSON, 1998, 2004; FREDRICKSON; BRANIGAN 2005) through a review of studies on EFL reading through singing. The selection of studies in this chapter, as in the preceding ones, followed an unsystematic approach to *Narrative Review* (PARÉ; KITSIOU, 2016).

4.2 THE COMPREHENSIVE MODEL OF AFFECT IN THE READING PROCESS - THE VIEW OF READING

According to Mathewson (1985), successful reading has an essential starting point that precedes the act of fixating eyes on the words of the text. As briefly summarized in Chapter III, the researcher proposes that successful reading begins with the reader's willingness to start or continue reading. The model seeks to explain how reading proceeds with an eye that transcends the boundaries of cognition. It can be considered an interactive reading model that encompasses cognitive factors common to information-processing reading models, with the addition of affective factors, including motivation and emotion: this is the view of reading in this dissertation.

As described by Mathewson (1985), the factors seen as the initial input of the decision-making process for reading are four: (1) *attitude*; (2) *motivation*; (3) *affect*; and (4) *physical feelings*, each of them discussed below.

The model proposes that *attitude* is its central affective component, influencing the attention and the whole reading process. The model also establishes that the attitude to start reading varies according to the material's content, form, and format. Additionally, it postulates that readers' general view of the reading act influences their attitude to start it. In this case, the individual can develop an "[...] abstract attitude object called reading." (MATHEWSON, 1985, p. 846) that, if favorable, may influence them to see reading as a universal good. Put another way, individuals who possess this favorable attitude more easily decide to venture among the lines of the text; they do not doubt the worthiness of reading. Finally, the model posits that the source of the reading material also determines readers' attitudes toward reading (i.e., a specific author, a teacher, or a friend). In other words, the indication of specific reading materials by someone with whom readers have a relationship of trust or by someone they admire influences their attitudes. EFL teachers' indication of songs may be an example of that. They may captivate readers to explore meanings in the target foreign language; songs' multimodal format, including beat, melody, rhythm, and other musical elements, may awaken their attitude to explore lyrics. Songs may more entirely involve readers, in the case of adolescents, due to their age and favorite singers or bands. Thus, the indication of songs from an EFL teacher with whom readers have an affective relationship (or with whom they can develop such a relationship) may influence their attitude toward reading, making them decide to search for the meanings of words.

According to Mathewson, *motivation* is another crucial component of the model; it is an energizing force that accompanies attitude (i.e., motives feed a positive attitude to start or continue reading). As pointed out by the researcher, motivational psychology has listed, among others, the following motives that may influence readers' attitude to start reading: *belongingness and love*, *curiosity*, *desire to know and understand*, and *aesthetic motivation*. The first congruency between Mathewson's model and The Broaden-and-Build Theory this chapter proposes concerns the motive *interest* (i.e., *curiosity*, *desire to know and understand*), which, for Fredrickson (2009), is critical for one's building intellectual resources. According to Fredrickson (2004) and Tugade, Dvlin, and Fredrickson (2021), interest is underneath the willingness to learn, explore, and expand the self; its resulting resource is intellectual complexity. Fredrickson (2004)

adopts Izard's (1977) working definition of the construct of interest. For Izard (1977), it can be defined as "[...] the feeling of being engaged, caught-up, fascinated, curious." (p. 216). In agreement with Fredrickson (1988), Izard adds, "There is a feeling of wanting to investigate, become involved, or extend or expand the self by incorporating new information and having new experiences with the person or object has stimulated the interest." (1977, p. 216). It harmonizes with Fredrickson (1998) in that interest leads to the desire for exploration that requires effort and attention, resulting in knowledge building.

To enhance the congruency between Mathewson's model and Fredrickson's theory, interest shares conceptual space with *intrinsic motivation*. Intrinsic motivation, according to Deci and Ryan (1985), "[...] is based in the innate, organismic needs for competence and self-determination. It energizes a wide variety of behaviors and psychological processes for which the primary rewards are the experiences of effectance and autonomy." (p. 32). Still, learning for intrinsic interest is directly associated with complex conceptual thinking and academic achievement (FREDRICKSON, 1998; 2004). In short, intrinsic motivation is the inner willingness that pushes individuals to get engaged in actions and pursue goals driven by their own decisions and whose aim is to achieve efficacy in something; it is an internal gratification. This rationale thus proposes that one of the subcomponents of motivation is interest (i.e., a type of motive). Interest, mainly intrinsic interest, constitutes a resource-building positive emotion that precedes the act of reading, maintains it, and fuels cognition (i.e., broadens readers' scope of attention for the processing information needed for EFL vocabulary learning).

Mathewson conceives *affect* as in continual interaction with attitude and motivation. He explains affect in terms of moods, sentiments, and emotions. As for mood, Mathewson (1985, p. 843) refers to "[...] extended feeling states [...]", to sentiment, as "[...] feelings focused upon some ideal [...]", or "[...] as a feeling associated with something highly valued or sacred to the person.". Examples are patriotic, aesthetic, and religious sentiments.". Lastly, the researcher conceptualizes emotion as a "[...] strong feeling, usually of a fundamental nature, tending to have a disruptive effect upon ongoing behavior." Mathewson puts it that research has shown that mood affects audience receptiveness, thus influencing reading behavior. Sentiments encourage readers to start or continue reading if the contents of the reading materials reflect the sentiments held by them (i.e., one may think of

adolescents' sentiments inherent to their ages, such as social bonding and first dates, for instance). Finally, the researcher proposes that emotions, when strongly experienced, may be disruptive to reading.

At this point, a theoretical discussion is necessary to avoid a possible conflict between the tenets of Mathewson's (1985) model and Fredrickson's (1998; 2004) theory: it regards the abovementioned disruption that emotions cause to reading. The discussion will start with a quotation mentioned in Chapter II, purposely repeated in this part of the text. The Broaden-and-Build Theory of Positive Emotions proposes that

“[...] *momentary experiences of mild, everyday positive emotions* broaden people's awareness in ways that, over time and with frequent recurrence, build consequential personal resources that contribute to their overall emotional and physical well-being.” (FREDRICKSON; JOINER, 2018, p. 194, my emphasis).

As per the quotation, the theory talks about fleeting positive emotions such as joy, gratitude, serenity, interest, hope, pride, amusement, inspiration, and love experienced in balanced dosages (FREDRICKSON, 2009). It is not about strong emotions that may lead readers to the *illusion of knowing* (EPSTEIN; GLENBERG; BRADLEY, 1984; TOMITCH, 2003a) or the *self-serving bias* (BLAINE; CROCKER, 1993) phenomena discussed in Chapter III, for instance. As an object of scientific investigation, positivity is not about masking people with forced clown smiles while falling from an airplane without a parachute! (FREDRICKSON, 2022). Additionally, Mathewson endorses Fredrickson's theory by acknowledging that emotion, when in balanced dosages and when purposely induced by the author of the text, can make reading even more intense. In his words, “If however moderate levels of anger and fear were to be stimulated by the content of a story, the emotion might play an energizing role such that reading will continue even more strongly than before the emotion has aroused.” (MATHEWSON, 1985, P. 844).

One could inquire about the types of emotions in Mathewson's quotation (i.e., anger and fear), which are negative emotions. Two considerations are essential to avoid again an interpretation that Mathewson's model and Fredrickson's theory are conflicting. The first consideration is that anger and fear may energize reading by narrowing the reader's focus of attention to details (i.e., the narrow hypothesis). For instance, the passage of thrilling narratives may make readers *interested* in (i.e.,

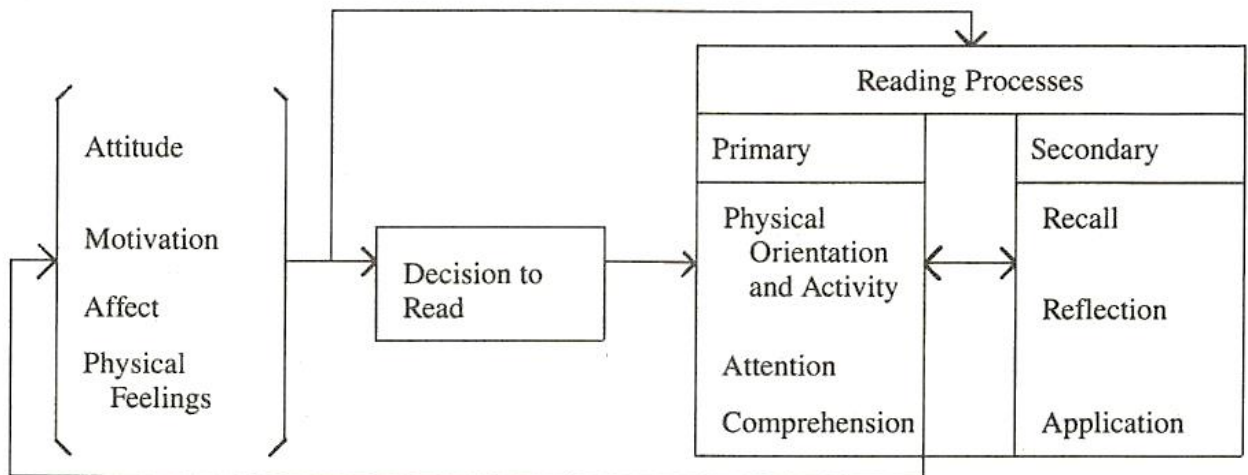
motivated to get to know) what is to come in the following lines. They may enter into a more analytical reading of the details of the text, which is led by mild negative emotions (i.e., mild anxiety or fear), narrowing the scope of their attention. In such texts, attention to the *trees rather than the forest* guarantees survival; a vampire may be hidden behind a tree, so attention to the tree is critical! Openness for exploration of the forest (i.e., the broaden hypothesis) would put one's neck in danger! Also, this doctoral researcher would add that mild negative emotion evoked by reading expository texts on one's areas of interest may have a similar effect. These emotions, such as mild irritation due to miscomprehension, may instigate the reader to keep more attentive to the text content and reread it as many times as necessary; the willingness to fully comprehend complex elaborations may explain such behavior. The second consideration regarding the non-conflicting relationship between Mathewson's model and Fredrickson's theory is of historical basis. When Mathewson designed his model in 1985, psychology was primarily concerned with negative emotions' effects on human behavior. Chapter II mentioned that higher interest in research on positive emotions started with Martin E. P. Seligman after the 1998 APA Convention in San Francisco. Thus, more than a decade separated Mathewson's initial model design from the beginning of more intense research on Positive Psychology. At last, neuroscience has demonstrated that emotions, when experienced in equilibrium, act directly in information consolidation and recall. As illustrated by Izquierdo (2018), one may not be able to recall what happened the day before precisely; however, they may be able to recall events accompanied by emotional alertness that occurred many years ago. According to the neuroscientist, the state of emotional alertness is the differential that acts in information processing and consolidation, making it memorable. In sum, *mild positive emotions* arise when a given circumstance represents something good for the self (FREDRICKSON, 2013), and in EFL reading, this matters since positive emotions, as implied by Mathewson's (1985) reading model, come to the forefront of the reading process.

Physical feelings, another affective factor of Mathewson's model, as the researcher explains, can arise from external sources or the meaning of the reading material. According to him, they come into readers' consciousness triggering feelings that might influence their decision to continue reading. One can feel butterflies in the stomach depending on the narrative passage or even changes in heart rate, for instance. The model, however, only incorporates physical feelings "[...] carrying

pleasure or pain [...]” (MATHEWSON, 1985, p. 845). Thus, the model does not embody physical feelings of no affective nature to the reader (i.e., the feel of an uncomfortable chair where one sits while reading).

The model described here, depicted in Figure 9, predicts that the four aforementioned affective factors, attitude, motivation, affect, and physical feelings, besides influencing individuals’ decision to read or continue reading, also influence primary and secondary cognitive reading processes.

Figure 9 - The Comprehensive Model of Affect in the Reading Process



Source: Mathewson (1985, p. 846)

Mathewson postulates that the influence of the four affective factors (i.e., the left-hand component of the figure) in the *decision* to read is cognitively mediated (i.e., the following component). The term *decision*, according to Mathewson, in the context the model is explained, “[...] refers to a process in which the reader uses coherent, cognitive data gathering strategies for the purpose of evaluating the desirability of beginning or continuing reading or reading-related behavior.” (1985, p. 848). In agreement, Fredrickson (2004) proposes that positive emotions open up cognition to consider possibilities of exploration and savoring of new experiences. In other words, the model predicts that readers, influenced by affective factors, are aware and systematically evaluate whether they will start or continue reading. It is worth mentioning that studies point to decision-making as an inherent function of working memory (WM) (BADDELEY; LOGIE, 1999). To perform decision-making, the system simultaneously coordinates and considers incoming information from the current

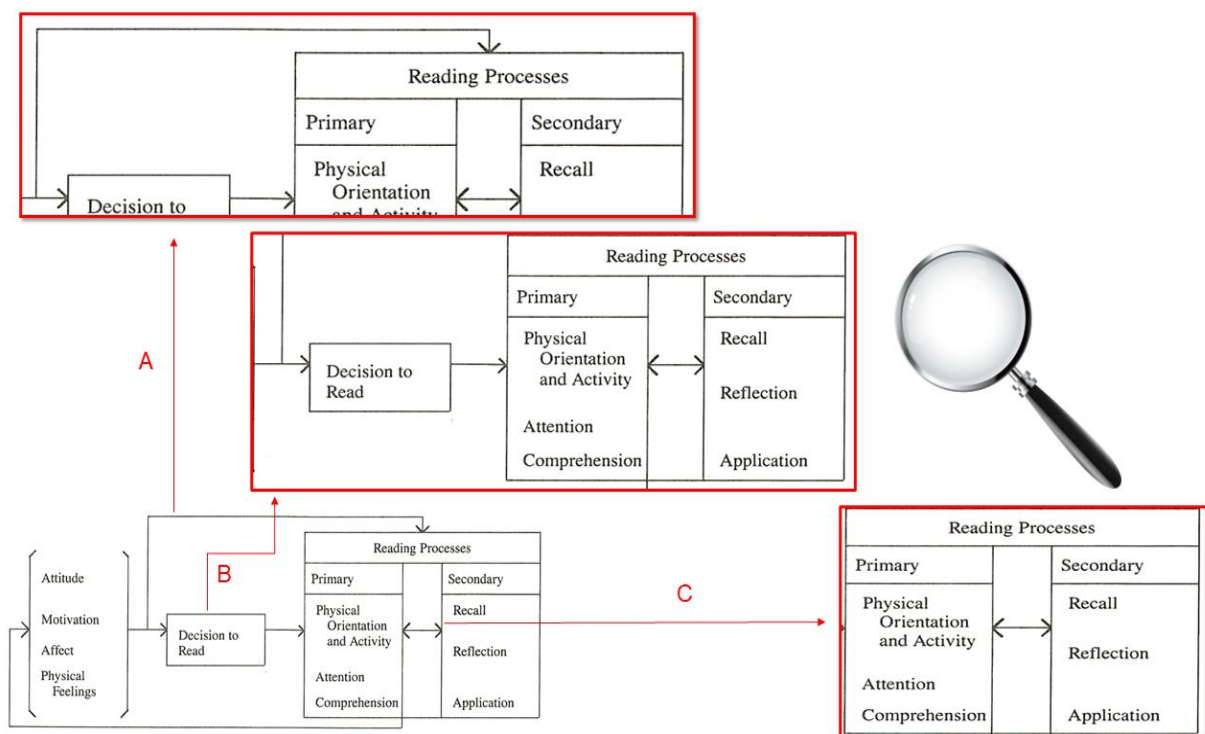
experience, information retrieved from past experiences, and prospective information. By consent, Baddeley and Logie (1999, p. 53) state that “[...] working memory allows the organism to reflect on the available options and choose a particular action or strategy, rather than being driven by the sheer weight of past experience.” (p. 53). Based on that, one can hypothesize that the functioning of the decision-to-read component proposed in Mathewson’s model and endorsed by Fredrickson’s theory could be attributed to WM focus of attention and is biased by positive or negative emotions. WM focus of attention is influenced by affective factors shaped by past reading experiences (i.e., shame for difficulties with decoding while performing EFL reading out loud, for instance) and prospections (i.e., elaborations on whether or not reading will be pleasurable). Based on both, it evaluates the degree of possible pleasantness to be experienced in the current reading situation. The assertion is consistent with the study of Positive Psychology in Second Language Acquisition (PP in SLA) by Jin, Dewaele, and MacIntyre (2021), mentioned in Chapter III. In that study, the researchers found that reminiscing about past language achievements assists EFL learners in reshaping higher-order negative emotion schemata (i.e., the undoing hypothesis). Reminiscing positive or negative memories may influence the affective variables influencing readers’ behavior. The same assertion can also be discussed, taking into account Talarico, Bernsten, and Rubin’s (2009) study. Reviewed in Chapter II, Talarico and colleagues’ study suggests that autobiographical memories built in positive emotional contexts are recalled with more details in the future. Then, a coherent reflection is that: acts of reading loaded with positive emotions may make up easily recallable autobiographical memories. Besides containing conceptual knowledge, these memories also contain the emotions evoked in the past; these emotions influence the execution of the current reading experience.

This interplay between affect and cognition appears to guarantee the conscious free choice of the individual to read or not a text. At this point, it is up to the teacher to identify whether EFL readers are affected by reading experiences that may have been frustrating in the past or by dejected future projections and try to persuade them to experience reading under different forms. In that sense, EFL teachers have the power to help leverage learners’ affect for reading with its practice through singing. Every class may be an opportunity to help them build what Mathewson’s (1985) model refers to reading as a universal good: the subjective value the individual attributes to the act

of reading. Songs explicitly presented as musicalized texts to EFL readers constitute a promising tool for achieving a favorable consideration for reading.

Despite the cognitive mediation proposed by Mathewson, his model also predicts that in some situations, the affective factors can straightforwardly affect the primary and secondary cognitive reading processes (i.e., the upper arrow along the top of the model), as zoomed in, in letter A in Figure 10.

Figure 10 - The Comprehensive Model of Affect in the Reading Process with processes A, B, and C zoomed in



Source: Adapted by the author of the dissertation, based on Mathewson (1985, p. 846).

It means that in these situations, there is no interference with conscious decision-making, that is, no cognitive mediation. For Mathewson, this is possible because, in some situations, negative affect is subtle, not identified by the reader's strategic control, and, thus, not changeable. In these circumstances, the researcher states that negative affect is likely to cumulatively depress attention, reading comprehension, recall, reflection, and application of knowledge, thus influencing the effectiveness of reading.

Back to the effects of a conscious decision to read or continue reading, the model also predicts that affective factors may influence primary and secondary reading

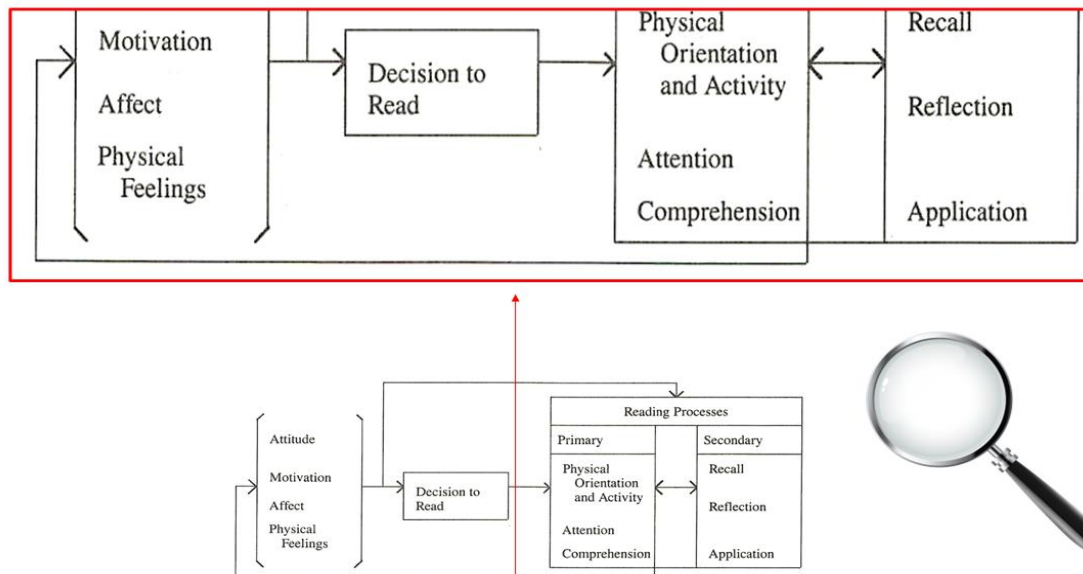
processes (i.e., the arrow linking the decision to read component to the two right-hand groups of processes), as zoomed in, in letter *B*, Figure 10.

As for primary reading processes, the model refers to physical orientation and activity (i.e., physical stance, eye movement, muscle, and tension), attention, and initial comprehension. As explained by Mathewson, these processes interact with the secondary reading processes, namely, recall, reflection (i.e., elaboration), and application (i.e., use of the knowledge acquired). Primary and secondary processes interact with each other (i.e., the doubled arrow between the primary and secondary reading processes), as zoomed in, in letter *C*, Figure 10.

Based on that, recall, elaboration, and application continuously feed the initial products of reading comprehension and vice versa. Regarding recall, Mathewson (1985, p. 847) proposes that “[...] the reconstruction of information following preliminary reading may enhance future ability to remember.” Regarding reflection, the researcher explains that this process connects prior knowledge (i.e., the reader’s relevant schemata) with incoming information. By the same token, Mathewson (1985, p. 847) theorizes that application constitutes “[...] a valuable product, either intellectual or physical [...]”, that is, the meaningful use of what was learned in new contexts and for new purposes. Concerning that, research shows that “[...] meaningful learning is actually about helping students to connect their isolated algorithmic skills to abstract, intrinsically emotional, subjective and meaningful experiences.” (IMMORDINO-YANG, 2016, p. 20). That is, for one to use knowledge in a wide variety of contexts, it must become abstract enough to be molded to different situations. To turn it abstract enough, Immordino-Yang’s research shows that it is necessary to strategically help learners use emotions to weave what they learn with knowledge from prior experiences.

At last, the model predicts that all reading processes can alter the affective factors via feedback (i.e., the arrow at the bottom of the model depiction), as depicted in Figure 11.

Figure 11 - The Comprehensive Model of Affect in the Reading Process with reading processes feedback to cognitive factors zoomed in



Source: Adapted by the author of the dissertation, based on Mathewson (1985, p. 846).

In other words, the execution of the primary and secondary cognitive reading processes, depending on their effectiveness, may alter the reader's attitude, motivation, affect, and physical feelings. Readers' perception of the effectiveness may hamper or enhance the reader's decision to continue reading.

Two additional proposals based on the Broaden-and-Build Theory can further shed light on understanding the reciprocal relationship between affective and cognitive factors proposed in Matthewson's model. The proposals specifically refer to the upward spiral of positive emotions hypothesis. To remind the reader, the hypothesis proposes, in a simple way, that "[...] any positive emotion you experience today not only feels good now, but also increases the likelihood you will feel good in the future." (FREDRICKSON, 2001, p. 1).

Thus, the first proposal has as its inspirational source the results of Gregersen's (2016) study reported in Chapter III and is concerned with EFL reading experiences. The study by Gregersen demonstrated that the positive emotions experienced in specific EFL learning environments arouse learners' desire to undergo those experiences again for the well-being they bring about. Consistent with the upward spiral hypothesis, positive emotions generated by the singing practice may augment readers' urges to read because their prospection will possibly be that they will be subjected to well-being sensations again. In other words, positive emotions broaden

cognition, which broadens thought-action repertoires (i.e., urges to read through singing, to socialize with classmates and teacher, and to learn from the lyrics) that results in positive emotions, that broaden cognition, and the cycle continues. Besides current and prospective well-being, the upward spiral hypothesis postulates that positive emotions broaden cognition, building long-lasting intellectual resources and giving the individual a sense of fulfillment (FREDRICKSON; COHN, 2008).

Consonant with that, the second proposal is directly related to implementing the reading model proposed by Mathewson. As discussed earlier, positive emotions fall within the model's affective component. Accordingly, they precede the act of reading, and, more than this, they may determine its continuity. Once the decision to read is made, and in this case, one can conjecture reading through singing, positive emotions may enhance the primary and secondary reading processes (i.e., attention, recall, reflection, and application), resulting in better EFL vocabulary learning. The feedback of effectiveness given by the cognitive processes to the affective factors may constitute the driving force of an upward spiral within the model, which we could consider an *emotional-cognitive upward spiral of reading comprehension*.

All told, Mathewson's hypothesis that cognitive reading processes (i.e., attention, comprehension, recall, reflection, and application) are influenced by affective factors and that, similarly, cognitive reading processes influence affective factors via feedback is pedagogically relevant. As put before, by identifying students who demonstrate low desirability to read due to the influence of affective factors, teachers may use remediation strategies to design their classes to help these students start building more positive affect toward reading.

Having described the model and made some initial elaborations, a brief discussion will follow to go deeper into the relationship between the practice of reading through singing and vocabulary learning.

Mathewson (1985) proposes that motivation encompasses the positive emotion of interest and that the same influences readers' decision to read and the primary and secondary reading processes. According to him, and as already stated, motivation is the energizing process that sustains readers' attitudes toward reading. Put another way, one's cognitive activity is maintained according to motivational fulfillment (GUTHRIE *et al.*, 2007). Attuned with this prediction, studies have shown that: (i) the supply of enjoyment and the provision of non-threatening learning atmospheres using songs may promote learners' mutual trust and respect (PAQUETTE; RIEG, 2008),

reduce their affective filter, make them feel more relaxed and in better conditions for better EFL learning (JAVADI-SAFA, 2018; LIEB, 2005; SHEN, 2009); (ii) singing helps create these atmospheres, reducing learners' anxiety, and promoting motivation to learn the target foreign language (CHEN; CHEN, 2009; MILLINGTON, 2011; NADERA, 2015); (iii) the reduction of anxiety is intrinsically related to better input processing (i.e. the less readers gets engaged in focusing attention on self-preoccupations, the higher the chances they will succeed in the resolution of reading demands which are taxing) (MACINTYRE; GARDNER, 1989); (iv) attention, a primary process in Mathewson's model, can be enhanced by the emotional aspects of songs (SCHÖN *et al.*, 2008), that as well described by Shen (2009, p. 88), "[...] are abundant in themes and expressions which will echo in the learner's heart"; and likewise, (v) emotion can guide the selectivity of attention and modulate motivation and behavior: their effects on these cognitive processes enhance the encoding of information and its retrieval from long-term memory (TYNG *et al.*, 2017).

Mathewson's predictions, as put before, can also be endorsed by recent neuroscientific findings. These findings suggest that emotions triggered by particular school contexts may determine whether learners will construct personal and significant meanings (IMMORDINO-YANG, 2016). As put in Chapter III, Immordino-Yang advocates that when school contents are emotionally involving to learners, their thinking engagement increases because they start valuing the contents from a personal perspective. After all, they start to relate them to their previous experiences and, thus, to what composes them as human beings. A conjecture based on Immordino-Yang's rationale is that EFL vocabulary learning may also be improved through singing if the songs present topics of interest to adolescents. The conjecture may be extended to proposing that attentive thinking triggered by meaningful topics may directly influence their vocabulary learning once it brings relevant information to online processing, that is, to WM focus of attention. The conjecture is still endorsed by Izquierdo (2018) in that: the amount and type of information maintained in short-term memory (STM) and also the amount and type of information consolidated in long-term memory (LTM) are dependent and, more importantly, *determined* by WM processing. The researcher explains that WM analyses the connections and usefulness of incoming information to the individual. According to him, WM verifies "[...] relationships of the current experience with similar ones of which there may be a record."

(IZQUIERDO, 2018, p. 15, my translation)²⁰. Applying this principle to language learning, experiences of EFL reading through singing containing topics of *interest* may motivate adolescent EFL readers to get more cognitively and emotionally tuned to what is taught, and higher attunement may be related to increased EFL vocabulary learning.

All in all, it is assertable that EFL reading through singing may influence readers' desirability to go beyond the mere melodic and rhythmic rendition of unknown strings of words to the rendition of meaningful ideas with an emotional tone.

The present chapter subsequently presents additional findings from neuroscience on the interplays among body, mind, and learning, which are informative to EFL reading.

4.3 BODY, MIND, AND LEARNING

Emotions, according to Izquierdo (2018), play a crucial role in the consolidation and retrieval of memories. The neuroscientist emphasizes that unemotional moments do not exist; thus, everything is tagged with the specific emotions they feel in the learning moment. He goes further by saying that certain emotions, such as stress, inhibit memories' consolidation and retrieval, whereas others, such as happiness and enthusiasm, have the opposite effect, fostering learning. Life constitutes unceasing moments accompanied by a plethora of emotions that attribute nonlinearity and individual differences in learning. This idea amounts to what is described by Immordino-Yang (2016): "[...] learning is dynamic, social and context-dependent because *emotions* are, and emotions form a critical piece of how, what, and why people think, remember and learn." (p. 17, emphasis given by the author).

Consonantly, neuroscience has provided data showing that information processing involved in learning, despite primarily activating high-level and complex cortex networks, also feeds itself into the brain stem mechanisms that keep humans alive (IMMORDINO-YANG; DAMÁSIO, 2016): complex thinking has effects that cross the boundaries of the mind, permeates the field of emotions, and involves the whole body of an individual, a standpoint that goes against the cartesian view of a disembodied mind.

²⁰ In the original: "[...] relações da experiência atual com outras semelhantes das quais possa haver registro." (IZQUIERDO, 2018, P. 15)

Damásio (2019) states that the cartesian view of a disembodied mind explicitly proposed in Descartes' famous *Cogito ergo sum*, translated into English as *I think, therefore, I am*, has shaped western Medicine research and practice. Nevertheless, neuroscience, through neuroimaging techniques, shows that thinking and feeling co-occur and perpetuate together throughout the whole body. Immordino-Yang and Damásio (2016) emphasize that the human brain would not have evolved to its current stage without the demands of a body that needed constant and progressively more complex regulation. Put another way, the continuous evolution of the human being demanded the simultaneous evolution of the biological operations needed for its regulation. In agreement with the evolutionary and functional view of emotions adopted in this doctoral dissertation (FREDRICKSON; BRANIGAN, 2005), these regulations, in their most primitive forms, focused on guaranteeing the human's survival through emotions (i.e., negative emotions with respective narrowed scopes of attention and cognition evoking reactivity). However, the continuous human evolution demanded that such regulations should meet more refined needs involving the need for affection and socialization (i.e., positive emotions with broadened scopes of attention and cognition evoking exploration, savoring, and flourishing). Damásio (2019), in his argument against Descartes' view, also elaborates that initially, there was only the being. Then, from the moment a basal consciousness emerged and became complex enough, a simple mind also emerged, creating conditions for some form of thinking that became better organized only millions of years later through language. Thus, as concluded by Damasio, in opposition to Descartes' assumptions, *humble beings preceded thinking*, and a separation between the most refined operations of their minds, emotions, and the structure and operation of their biological organisms can no longer be maintained. Considering these things, like in Medicine, research in Applied Linguistics must be cautious not to treat the mind as a disembodied entity and learning as a purely cognitive activity.

When individuals learn in situations marked by the arousal of emotions, perception, attention, memory, and reasoning are deeply influenced (IZQUIERDO, 2018). Emotions, as emphasized by Tyng *et al.* (2017), steer the selectivity of attention and modulate motivation and behavior: the effects of that are enhanced information encoding and retrieval from LTM. Emotions also narrow the individual's focus of attention to something considered interesting for them (IMMORDINO-YANG, 2016) (i.e., the narrow hypothesis). In the school context, "[...] students' accumulation of

subtle emotional signals guides their meaningful learning, helping them to build a set of academic ‘intuitions’ about how, when, and why to use their new knowledge.” (IMMORDINO-YANG; FAETH, 2016, p. 21). In other words, emotions color incoming information so it can become attractive to learners. As stated earlier in the dissertation, these colors will guide learners to identify how and what knowledge to use in specific real-life situations more efficiently and adequately.

Considering that, the use of stimuli and the conduction of practices aimed to promote students’ simultaneous cognitive and positive emotional engagement in the classroom can be seen as beneficial to EFL learning. The use of songs, and more specifically, the practice of reading through singing in the classroom, is an example that may put the body and mind together in a state of open receptiveness. Consonant to the narration in Chapter I, singing is a universal practice that resonates in the body and mind during gestation and in early childhood when children vocally manifest thoughts and emotions using elements such as beat, pitch, form, and tempo (NILAND, 2009). It also involves emotional and cognitive processes inherent to adolescents’ development (TER BOGT; SOITOS; DELSING, 2011) and can be regarded as a supporting aid in promoting cross-talk between emotion plus cognition in learning. As claimed by Džanić and Pejić (2016, p. 42), songs, in fact, “[...] represent a flexible resource which allows teachers to use and adapt them in a variety of ways to suit the needs of their learners.” They can help teachers design EFL reading classes strategically to conquer students to learn via emotions positively associated with effective learning (IMMORDINO-YANG, 2016).

Building on the above non-cartesian view of learning, studies that classify music as one of the main mediums accessed in adolescence and elaborate on its social, emotional, and cognitive functions in adolescents’ general development are worth special consideration in this dissertation. The chapter reviews some of them in the following sections.

4.4 STUDIES ON THE ROLE OF MUSIC IN ADOLESCENCE

The appreciation of music among adolescents is undeniable. According to Ter Bogt, Soitos, and Delsing (2011), adolescents, overall, listen to an average of two to five hours of music daily. As described in their study, this impressive listening time has

been dramatically increased due to the current easy accessibility to songs. From the early twentieth century to today, it has evolved from the radio to thousands of downloadable song files that can be stored on laptops and smartphones. Not mentioned in the study, it has evolved to streaming music that does not even require downloading. As put by Ter Bogt and colleagues, besides being art for appreciation and soundtrack in adolescents' routines, research has shown that music plays a vital role in this stage of development in which human beings pass through intense changes.

North, Hargreaves, and O'Neill (2000), for instance, investigated the importance of music in adolescence in a study conducted in England involving 2465 adolescents between the ages of 13-14. The study showed a high involvement of the participants with music and demonstrated their particular liking for popular musical styles. Emotional and social reasons were outstanding when asking why students listened to music. Regarding emotional reasons, the respondents, especially females, revealed listening to music to overcome difficult times and reduce anxiety and stress. Regarding social reasons, participants, in this case, mainly males, reported listening to music to build up their social images, follow trends, and please the people with whom they lived.

Based on the study above, popular music repertoire looks pretty suitable for adolescents. As advocated by Domoney and Harris (1993), this style brings adolescents' knowledge and language to the classroom. That is critical for learning because, drawing on Mathewson (1985), the format of texts as lyrics accompanied by melody may instigate adolescents' positive attitude towards reading. Additionally, Džanić and Pejić (2016) claim that songs help satisfy characteristics peculiar to the learners' age and, as predicted in Mathewson's model, may turn adolescents' moods into a positive state and stir up their sentiments. Also, adolescents' sympathy for songs may awaken their willingness to seek out the songs outside the school environment, thus augmenting their exposure to the target foreign language (LIEB, 2005). Additionally, the power that the vagueness of popular songs has in inducing people to interpret their messages as if they were making references to what they think and feel, as proposed by Murphey (1992), makes the case that singing may indeed enhance adolescents' motivation to learn the vocabulary items from the lyrics.

In another study, Campbell, Connell, and Beegle (2007) collected essays from 1155 American adolescents aged 13-18 to examine their position concerning the banishment of music classes in the United States. The essayists revealed much more

than what the adolescents thought to be the value of music in the school curriculum. They extended their writings to talk about music's emotional and social benefits for human growth in out-of-school contexts, a finding similar to those reported by North, Hargreaves, and O'Neill (2000) previously reviewed. Campbell and colleagues found that two out of three respondents invested expressive attention to write about emotional benefits they thought to be attributable to their contact with music. Among these benefits, they mentioned the importance of music for releasing and controlling emotions and coping with struggling situations involving the pressure of family and school.

Regarding social benefits, they reported that essential facets of their character, such as tolerance, responsibility, and patience, could partly result from their interaction with music. Besides, they also informed that music aided them to compassionately deal with individuals of different age groups and social and ethnic backgrounds. Participants also pointed out that music could help them construct their identities, develop a sense of belonging, discourage suicidal behaviors, handle depression, and prevent substance use.

Harmonious with the two previous studies, Ter Bogt, Soitos, and Delsing (2011) also listed some relevant music functions in adolescence. For them, music can serve as an external stimulus to aid mood management, social gathering, problem-solving, identity development, friendship formation, and improvement of self-esteem. Moreover, the researchers proposed that music can bolster adolescents' feelings of connectedness and encouragement to work through negative feelings and experiences, besides being a source of academic knowledge gain and worldview expansion.

A review of studies conducted in Australia, Canada, Netherlands, Sweden, the United States, and the United Kingdom published by Miranda (2013) also informs this discussion. The researcher states that music is the source that gives adolescents the strength to thrive during their biopsychosocial reorganization. Miranda lists at least seven areas of adolescents' development influenced by music: (1) sense of aesthetics; (2) construction of identity; (3) socialization; (4) emotion regulation and coping; (5) personality shaping and motivation; (6) gender differences; and (7) positive youth development. Regarding aesthetics, the researcher proposes that music helps adolescents develop their autonomous creativity and sense of what can be considered culturally and historically beautiful in specific contexts. As for identity, Miranda posits

that music allows adolescents to choose which type of *badge* can identify them in society, which themes are of interest, and which role models they wish to follow to define themselves. In terms of socialization, he proposes that adolescents' musical tastes may create a bond with other adolescents, thus promoting conditions for establishing friendships. Concerning emotion regulation and coping, Miranda postulates that music is a crucial resource for adolescents to remain resilient while facing the stressful dynamics of adolescence. Also, it works as a relief from tension and a distraction from worries.

Regarding personality and motivation, the review shows that musical preferences and personality traits have a reciprocal influence and that adolescents experience music listening primarily willing to reach emotional regulation. When it comes to gender differences, in agreement with North, Hargreaves, and O'Neill (2000), the review revealed that girls' reasons to listen to music are related to the search for emotional balance. In contrast, boys' reasons are linked to modeling their social identities.

Concerning this aspect, a negative side also emerged from data: lyrics many times can reinforce gender stereotyping and sexism, as well as represent problems in adolescents' psychosocial development. Among these problems are the possible arousal of antisocial thoughts and feelings, the development of depression, the arousal of interest in substance use, and, most alarming, the practice of self-harm. This finding is relevant for EFL teachers in selecting appropriate songs to work on in class. Despite that, the review, on the whole, demonstrates that contact with music, in most cases, positively contributes to adolescents' socialization, intellectual development, and emotional regulation.

A study by Finger, Souza, and Haag (2016) in Brazil also demonstrated how music could promote adolescents' health. Their study reports the results of an educational activity that counted on the participation of 45 choristers. All of them were members of a project named *Promovendo a saúde da criança e do adolescente através da música*, translated into English as *Promoting the health of children and adolescents through music*. The activity reported in the study consisted of discussions and interpretation of some verses of one of the songs of the choir's repertoire, *Sementes do Amanhã*, by the Brazilian composer Gonzaguinha. This activity, which included singing, aimed to trigger the manifestation of the adolescents' internal desires and subjectivities. Its underlying rationale was that externalizations of desires and

subjectivities would promote participants' self-care, covering their health's physical, emotional, and social aspects. The study found that music stimulates adolescents' engagement in reflecting on topics and subjects that will accompany them for the rest of their lives. In the reports presented by the participants, the researchers could notice that the song which was in focus helped encourage them to: (i) think about the relevance of the various forms of faith; (ii) reflect on the importance of doing good amidst so many adversities of society; (iii) believe in dreams; and (iv) be conscious about the effects of people's attitudes in the world. In short, the researchers could verify that music is beneficial in promoting adolescents' health by assisting them to cope with a high diversity of emotional states, establish affective bonds, stimulate self-care, and cultivate values and principles associated with a healthier life during their transition to adulthood.

In light of the Broaden-and-Build Theory (FREDRICKSON 2004; FREDRICKSON; BRANIGAN, 2005) reviewed in Chapter III, the studies above reviewed suggest that music sparks positive emotions that, in turn, broadens adolescents' scopes of attention, cognition, and action. The studies suggest that the scope of attention broadens in the sense of augmenting adolescents' capacity to notice and keep in mind a vast varied of percepts; of cognition, in the sense of broadening their capacity to establish relatedness among thoughts; and of action, in the sense of pushing them to get engaged into activities. Still following the theory, the broadening of adolescents' scopes of attention, cognition, and action underlies the process of resource building, which can be social, intellectual, physical, and psychological (FREDRICKSON; COHN, 2008). According to the theory, they are "[...] stable resources one builds as durable tools we use for dealing with ups and downs of life." (VALENZUELA, 2020, p. 8). In addition, adolescents' exposure to music anchors resource-building for present and future situations. Not exclusively, but social resources outstand in the studies of Miranda (2013) (i.e., construction of social identity); psychological resources in the studies of Campbell, Connell, and Beegle (2007) and Ter Bogt, Soitos, and Delsing (2011) (i.e., coping with the pressure of family); physical resources, in the study of Finger, Souza, and Haag (2016) (i.e., care with a healthier life); and intellectual resources in the study of Ter Bogt, Soitos, and Delsing (2011) (i.e., the building of academic knowledge). Furthermore, the studies reviewed in this section bring evidence for the undoing hypothesis, also proposed by Fredrickson's theory. As stated by the researcher, "[...] positive emotions serve as

useful resources for regulating negative emotional experiences in daily life.” (FREDRICKSON, 2013, p. 12). This regulation is apparent in the studies’ results of North, Hargreaves, and O’Neill (2000) (i.e., reduction of anxiety and stress), Campbell, Connell, and Beegle’s (2007) (i.e., discouraging of suicidal behaviors), and in the study by Miranda (2013) (i.e., rebound from stressful daily situations). Music, in a word, is a critical ingredient that acts upon diverse aspects of adolescents’ functioning.

Bearing in mind all the benefits of music in adolescents’ development here reviewed and considering their high availability of songs in the English language, its use in English classes can be expected to be of great value. Besides being based on empirical evidence, the value of music is widely defended by most teachers. Results from a survey conducted by Garton, Copland, and Burns (2013) showed that, from a sample of 4.696 teachers of English who work with young learners from 144 countries, 66.9% of them reported using songs very often or even in every class. Brazil was the second country with more responses to the interview (293), being only behind Italy (559). One of the reasons underlying the use of music, according to Butzlaff (2000), is that besides music giving opportunities for adolescents to reflect, debate, and learn from the songs’ lyrics, the practice of singing also constitutes an up-and-coming alternative for teachers to assist the development of their reading skills. By learning lyrics, EFL learners get engaged in reading written texts and conveying meanings (HILLIAHO, 2015). Also, by involving readers in a kinesthetic, aural, oral, visual, and emotional exploration of written texts, songs can bring texts to life (HANSEN; BERNSTORE, 2002). Besides, songs aggregate components that are essential for successful reading to take place. Content, for instance, may determine whether readers will remain intrinsically motivated to explore the text (WIGFIELD; GUTHRIE, 1997). The format may awaken readers’ aesthetic sentiment that, if mirrored in the text, may excite their desirability to read (MATHEWSON, 1985). Finally, according to Mathewson, content, format, and form may influence readers to keep a positive attitude toward the text, thus increasing their attention, comprehension, and the positive emotion of interest, a subcomponent of motivation.

Having touched on the topic motivation, the chapter now moves on to reviewing studies on the relationship between singing and motivation in EFL learning in general.

4.5 STUDIES ON SINGING AND MOTIVATION TO LEARN ENGLISH AS A FOREIGN LANGUAGE

There is broad agreement among educators that high motivation is intimately associated with effective EFL learning. Research corroborates this position and has shown that using materials that keep learners motivated and alert during school time is crucial (CHOU, 2014; COYLE; GÓMEZ GRACIA, 2014; IMMORDINO-YANG, 2016; AJIBADE; NDUBUBA, 2008). Songs are one of these materials because their emotional load increases learners' engagement and attention to their verbal content (FONSECA-MORA; MACHANCOSES, 2019; SCHÖN *et al.*, 2008). Even being primarily used to convey messages and teach content in EFL classes, songs' emotional effect on learners is undoubtful (MORA, 2000). Besides, research shows that information encoding, consolidation, and retrieval are better in emotional situations (CAVANAGH, 2016; IZQUIERDO, 2018). Singing can turn the classroom environment into a casual place, lowering learners' affective resistance to the content (PAQUETTE; RIEG, 2008). Furthermore,

[...] songs, in particular choral singing, can help to create a relaxed and informal atmosphere that makes the classroom a non-threatening environment. By reducing anxiety, songs can help increase students' interest and motivate them to learn the target language. Students often think of songs as entertainment rather than study and therefore find learning English through songs fun and enjoyable. (NADERA, 2015, p. 370).

Chen and Chen's (2009) investigated the effect of popular English songs on learning motivation and learning performance among adolescents in Taiwan. Participants were students from 5 already-formed sixth-grade groups of a public elementary school ($N= 131$), aged around 12. They intermittently sang four popular English songs while studying their textbooks' contents during one semester. Reading was directly involved in the participants' revision of sight vocabulary²¹ learned in the fifth grade. Statistical analyses of participants' survey answers showed that their interest in learning English through singing was high, especially concerning their

²¹ A set of "[...] words that are identified and comprehended automatically, even when they appear in isolation or in a clueless context." (LAUFER; AVIAD-LEVITZKY, 2017, p. 737).

interest in improving their listening skills. The analysis also showed participants' positive impressions of the role of popular songs in language learning and their role in learning foreign cultures. The correlation between the two variables of the study, learning motivation and learning performance, was also significant.

Romero, Bernal, and Olivares (2012) conducted another relevant study in Colombia. Eighty-four sixth graders aged 11 – 13 participated in activities to develop their English-speaking skills through singing. Reading was involved in filling-in-the-gap activities, studying written expressions found in the songs' lyrics, and identifying words' spelling mistakes. Throughout the activities conducted in the action stage of the study, participants also studied the lyrics and sang them with the whole class and in groups. They performed the songs by playing instruments, dressing up, and dancing while singing. Participants' survey answers showed that working together in the activities made them feel more confident during the English classes. The topic of teamwork to overcome fears stood out among participants' commentaries. The researchers' field notes also revealed that participants constantly encouraged each other to sing and participate in the activities. The research showed clear evidence that singing enhanced participants' pronunciation accuracy due to increased motivation.

Yamami (2016) carried out an additional study to examine how songs could improve EFL college students' learning in EFL speaking classes in Japan. Participants from two groups, intermediate and advanced, were provided with explicit pronunciation instruction and, in terms of reading, with the study of words' spelling and meaning. The researcher implemented the activities throughout one semester (15 classes, one song per class) and instructed participants to remain attentive to written vocabulary items and sound connections while listening to songs or singing. Additionally, Yamami applied a learning motivation questionnaire to explore participants' impressions about how enjoyable and effective learning through songs was. They were also required to examine what changes, if any, were being noticed regarding language learning. Results showed that intermediate students, compared to advanced, were more motivated about learning. Regarding the effectiveness and changes in language learning, students reported that the activities with songs helped them gain vocabulary and rhythm, improve pronunciation and listening skills, and better understand the meaning of the lyrics. Students also reported that the activities made them attentive to the emotions conveyed by the lyrics.

Lastly, Džanić and Pejić (2016) implemented a study with primary schoolers aged 7-8 from Bosnia and Herzegovina. They were to learn vocabulary from songs presented in two different conditions: in the control condition, songs were aurally presented, and in the experimental condition in which reading was involved, they were aurally and visually presented (i.e., through videos including lyrics). The aim of the study was twofold: first, the researchers wanted to investigate the extent to which the audio and/or audio and video would enhance vocabulary retention; and second, to examine whether songs would influence learning motivation. For that, two types of instruments for data collection were used: (1) retention tests (i.e., a pre-test, a post-test, and a delayed test) to check possible increases in terms of vocabulary knowledge; and (2) a questionnaire to check whether songs were considered a motivator to learn English. Even though the researchers hypothesized that retention would be worst among controls, results showed no between-groups significant differences. Džanić and Pejić reason that visuals possibly caused some distraction among controls who might have deviated their attention from language to other details depicted in the videos. It is essential to realize that the retention of new vocabulary was high in both conditions. By comparing pre-tests and delayed tests, it is possible to note that the percentage of vocabulary knowledge practically doubled for each of the songs taught. In the case of song 1, for instance, vocabulary knowledge in the experimental condition increased from 54.16% to 98.95%. This increase was from 66.66% to 100% in the control condition. Thus, even though one of the hypotheses raised by the researchers was not confirmed, it was possible to verify that songs positively impacted participants' vocabulary retention. Concerning motivation to learn, participants' answers to the questionnaires showed that their likeliness to learn English was motivated mainly by coloring, drawing, and singing. Most participants reported enjoying listening to and singing songs and described songs as fun and exciting. Their questionnaire answers also acknowledged that songs helped them retain new vocabulary. Likewise, they reported that they could easily remember the songs and kept singing them out of school. In conclusion, the study's central finding was that songs positively affected vocabulary retention, regardless of whether being only aurally or visually and aurally presented. Besides these positive outcomes, the study showed that the songs helped awaken learners' love for EFL learning.

Taking into consideration assumptions from Positive Psychology in Second Language Acquisition (PP in SLA), the studies above reviewed suggest that feeling

motivated to learn English through singing weakens affective learning barriers, making students more prone to absorb the language input (DEWAELE *et al.*, 2020; SCHÖN *et al.*, 2008). They are also tuned with the broaden hypothesis (FREDRICKSON, 2013) in that the scopes of attention and cognition broaden when individuals are interested in exploring and are not at risk. In the study of Romero, Bernal, and Olivares (2012), this interest in exploration resulted in better pronunciation accuracy. Gains in vocabulary were findings in the studies of Yamami (2016) and Džanić and Pejić (2016). Finally, openness to learning more about foreign cultures was among Chen and Chen's (2009) findings. Concisely, one commonality is remarkable in the studies reviewed in this section: "[...] the emotion that songs evoke in students may transfer to motivation, making a stronger bond with the language and the desire to learn." (DŽANIĆ; PEJIĆ, 2016, p. 45). The studies indicate that learners of different ages and contexts reveal positive emotions when learning English involves singing.

Having described studies on the relationship between singing and motivation in EFL learning, the following section gets narrowed to reviewing studies on singing and general reading development.

4.6 STUDIES ON SINGING AND GENERAL READING DEVELOPMENT

As earlier said, this section describes the role of singing in *general* reading development. However, it elaborates on processes that also inform EFL reading.

For instance, Iwasaki *et al.* (2013) propose that when students keep track of lyrics while singing, they try to read melodiously and rhythmically. According to them, elements that are inherent to songs, namely (i) assonance (i.e., repetition of vowel sounds in a verse or phrase, especially the tonic syllables); (ii) alliteration (i.e., when identical or similar sounds repeatedly appear at the beginning of words or in stressed syllables); (iii) prosody, rhythm, and melody can aid the improvement of some specific language skills that may lead to the construction of meanings in reading. Assonance and alliteration can contribute to developing phonemic awareness, that is, the ability to discriminate and manipulate the individual phonemes of spoken words (ALLINGTON *et al.*, 1998). Gromko (2005) states that phonemic awareness is reinforced when individual phonemes are associated with their corresponding graphemes. Based on that, it is possible to assume that listening to songs and following their lyrics contributes

to establishing sound-symbol correspondence (i.e., mapping phonemes into graphemes) in EFL reading.

As Iwasaki *et al.* (2013) also remark, songs' prosody (i.e., duration, pitch, and stress of sounds) aids reading development because of its beneficial effects on fluency. Consonant to Rasinski (2006), fluency is more easily acquired through interactive texts that incentivize repeated oral reading, such as song lyrics. According to him, fluency, a combination of accurate word decoding, automatic word recognition, and prosodic reading, is the gateway to comprehension. For Rasinski, poor comprehension results from poor fluency because readers exhaust their cognitive resources by placing much effort into decoding and recognizing words, leaving little remaining to be devoted to the execution of high-level reading processes. Thus, methods that help automatize low-level reading processes are essential to reading development. This topic will be readdressed in detail in Chapter V. Following this rationale, reading through singing can be regarded as an effective tool for low-level reading processes automatization. Songs' repeated, melodious and rhythmic structure might act in establishing letter-sound relationships, which in turn, can help automatize word decoding and recognition. Likewise, the context provided by lyrics might trigger top-down processes that facilitate matching written words with meanings stored in long-term memory (LTM). Similarly, the context presented in lyrics might form the basis for the reader to assign meaning more accurately to the text.

In like manner, Rasinski (2012) emphasizes that prosody is crucial to inferential comprehension. The oral emphasis given to specific words attribute particular meanings to sentences that cannot be implied solely by their written forms (i.e., you *can* change the world, that is, you *do have the capacity* to accomplish that, or you can change the *world*, that is, you can cause changes that *can affect everyone and everything*). Finally, as Rasinski (2006) concludes, text genres that demand repetitive and interpretive reading, such as lyrics, can help increase reading rate, expressive reading, and reading comprehension.

Furthermore, Iwasaki *et al.*'s (2013) study also expounds that melody and rhythm facilitate learning and improve the memorability of the words sung. For them, memorability can help in acquiring and expanding sight vocabulary. In the same way, the researchers propose that the effort made by individuals in repeating songs to recall their words can also enhance the memorability of chunks of language, which per se, is

advantageous to vocabulary learning (JAVADI-SAFA, 2018). The topic of memorability of chunks will also be explored in detail in Chapter V.

Also, phonological awareness (i.e., the aural ability within which phonemic awareness is a subcomponent, which refers to the broader ability to discriminate and manipulate the units of oral language) can benefit from reading through singing. According to Hansen and Bernstorf (2002), this aural ability can be strengthened, for instance, through studying rhymes and singing songs with appealing rhythmic and sound patterns. Moreover, the researchers state that phonological awareness is improved among fluent readers by studying the sounds of words' roots. Based on this study's suggestions, it is possible to conjecture that, even though phonological awareness is an aural ability primarily related to the discrimination and manipulation of sounds, teachers, by establishing associations between combinations of sounds and their inherent orthographic representations, may assist learners to build connections that might be beneficial to general reading development.

In the same vein, Hansen and Bernstorf (2002) also propose that singing aids strengthen readers' orthographic awareness (i.e., the ability to comprehend how letters and other symbols) are appropriately used in a specific writing system). According to them, by visualizing lyrics, students can (i) recognize patterns of letter combinations; (ii) revise rules of spelling; (iii) identify word families; and (iv) comprehend the variations of forms from changes in terms of word length done to obtain casual speech vocabulary. Some instances are *because*, changed to *cuz*, *am not*, changed to *ain't*, *got to*, changed to *gotta*, among others.

Research has shown that word decoding development is another reading skill positively associated with music practices. Standley (2008) conducted a meta-analysis comprising 30 experimental studies demonstrating that. The researcher investigated whether music activities, including singing practices, would enhance reading skills, especially word decoding. Correlational results indicated that teaching reading skills can be positively affected by interventions in which students are purposely led to establishing relationships between musical and linguistic elements. As stated by Standley, "[...] information does not transfer from music participation without specific training for transfer." (2008, p. 29). That is, readers, while keeping track of melody, rhythm, and prosody, for instance, must be instructed to simultaneously remain attentive to the specific linguistic elements of the song if the singing activity intends to enhance their reading skills.

The effect size reported in Standley's meta-analysis regarding studies whose participants were English to Speakers of Other Languages (ESOL) students is inspirational to this dissertation. To understand that, a comparison of the effect sizes of distinct groups is necessary. They were: (i) typically developing children ($d = .14$); (ii) at-risk ($d = .55$); (iii) special education ($d = .81$); and (iii) ESOL students ($d = .96$). The effect size for ESOL students indicates that singing indeed improved word decoding in the reading of English as a second language. In the final analysis, Standley, consonantly with Register *et al.* (2007), positions herself in favor of the inclusion of music activities into the school curriculum or, depending on the school context, in favor of the implementation of remedial interventions using music strategies aimed at improving students' reading skills.

The gains for improved reading performance yielded by EFL reading through singing are noteworthy in the findings of the studies reviewed in this section. As such, singing appears to catalyze the attentional resources required for the real-time storage and processing of information necessary to attain these gains (i.e., intellectual resources). Indeed, the working memory (WM) literature has well established that attention plays a direct role in the selection of perceptual information and the transition of information in and out from the focus of attention (BADDELEY; HITCH; ALLEN, 2021; COWAN; MOREY; NAVEH BENJAMIN, 2021). Consistent with the discussion proposed so far, positive emotions via singing may act as the catalytic force of attentional resources by broadening the cognitive ability to bring learning-relevant information into the WM spotlight. Chapter V will explore this topic thoroughly.

Following this discussion, the follow-up section will narrow the literature review and tap into studies on the relationships between EFL reading through singing for the ultimate purpose of vocabulary learning.

4.7 STUDIES ON EFL VOCABULARY LEARNING AND THE PRACTICE OF READING THROUGH SINGING

Vocabulary knowledge can be considered at the heart of EFL learning; it supports the development of the four basic language skills: listening, speaking, reading, and writing (JAVADI-SAFA, 2018). However, while natives are immersed in the context where English is an L1 and, as such, count on vast support to learn

vocabulary, the same does not apply concerning vocabulary learning as a foreign language. In Brazil, for instance, most EFL learners only have contact with the target language at school. Under these conditions, learning English sometimes becomes meaningless (ROMERO; BERNAL; OLIVARES, 2012); learners see no reason to learn something they do not or rarely use. For this reason, investigating effective ways to simultaneously enhance vocabulary learning and turn English into a meaningful school subject is worthwhile. It is up to this section to elaborate on the practice of reading through singing to enhance vocabulary learning in EFL classes. The effectiveness of this practice has the support of empirical evidence provided by a considerable body of studies.

For instance, a literature review conducted by Davis (2017) showed that using songs for vocabulary learning among young students is positive, especially when combined with supplemental resources such as visuals and gestures. Consistent with that, Paquete, and Rieg (2008) proposed that it is possible to help learners develop or expand vocabulary and comprehension skills through reading and singing techniques. Still, Lee and Lin (2015) put it that singing, as a response to previous auditory input, is associated with EFL learning because it “[...] takes advantage of the strong links between music and memory [...]” (p. 14). In other words, as explained by Salcedo (2010), “[...] when music and text are encoded together, some components of the melody will cue or echo the parallel component of the text.” (p. 22). Consistent with that, Džanić and Pejić (2016) state that “[...] songs can have a great impact on learners because of their multi-modal characteristics and may connect with the language in many different ways.” (p. 51).

Additionally, Nadera (2015) poses that the themes and topics of songs provide the context necessary to facilitate this process, or in other words, as elaborated by Abbot (2002), songs “[...] provide meaningful contexts for teaching vocabulary because they deal with relevant topics and include forms and actions that can reinforce common themes and structures that are being covered in the language program.” (p. 10). The studies reviewed hereafter will discuss some investigations on the relationships between reading through singing and EFL vocabulary learning.

Davis and Fan (2016), in a study with young children in China, demonstrated that both song and choral reading (i.e., having students read in unison) repetition conditions produced statistically significant higher effects than the control condition in terms of EFL vocabulary learning. In that study, participants in the song condition

learned and sang the songs during a seven-week intervention. Participants in the choral condition learned the same vocabulary through unison reading after visualizing pictures. Controls just read the tested vocabulary during the pre and post-tests. Even though there was no significant statistical difference between the song and the choral reading conditions, the researchers, by considering the suitable learning outcomes obtained by participants, still emphasized that including songs alongside other methods in foreign language curricula is still advisable.

Li and Brand (2009), in a study in China, also investigated vocabulary learning and singing. Specifically, the researchers used a pretest-posttest experimental design and examined the relative effectiveness of varying the use of lyrics and music on three aspects of learning: vocabulary, language usage, and meaning. Participants were undergraduate students at the upper intermediate level. In the contextualization of the study, the researchers describe the English as a second language (ESL) classes in Asia as monotonous testing with an over-emphasis on the teaching of rigid grammatical rules. Aiming to suggest improvements, Li and Brand examined the effectiveness of songs and lyrics to provide empirical evidence for their use. After a treatment consisting of six 90-minute classes in which learning gains were assessed through multiple-choice, sentence completion, short answers, and meaning explanation questions, the study found statistically significant results showing that participants who were exposed to music the most, besides demonstrating higher levels of motivation, also obtained an outperformance in the three aspects tested.

Chou (2014), in another study conducted in Taiwan, also investigated the effectiveness of using alternative activities, including songs, to increase English vocabulary size. The study counted on the participation of primary school pupils aged 8-11. Besides the researcher's observation that the alternative activities encouraged participants to interact with the teacher, 87.5% of the lower and higher-grades groups reported learning the contents taught more quickly and easily through singing than other ways. Similarly, more than 80% of them reported that singing in English facilitated their vocabulary understanding. The quantitative analysis showed that all participants presented improved vocabulary size; however, higher-grade students' outcomes were superior.

Coyle and Gracia (2014) conducted a further study on the effects of singing on EFL vocabulary learning in Spain. In this study, a group of five-year-old preschool EFL learners was taught the target language vocabulary through the presentation and

practice of a sequence of song-based activities for seven weeks. The analyses of participants' scores in the vocabulary tests showed a statistically significant and steady increase in their receptive vocabulary (i.e., written words recognized by the participant after being read by the researcher). However, the same result did not hold with participants' productive vocabulary (i.e., written words directly read by the participants)²². The researchers justified this result by proposing that the input received was insufficient to help participants produce the target vocabulary within the study period. They recommended that the consolidation of the linguistic content of songs must be reinforced through additional activities.

Good, Russo, and Sullivan (2015) conducted another relevant study in Ecuador. Aligned with the studies above described, the researchers investigated whether songs (i.e., sang experimental condition), as compared to speech (i.e., spoken control condition), would better support foreign language learning in what concerns pronunciation, recall, and translation of words. Through a paired-associate learning method, the direct association of written words in the target foreign language with their corresponding translations in the native language, participants (9-13-year-olds) in each specific condition studied a four-line lyrical passage for two weeks. Regarding recall, the study showed that 100% of the participants in the experimental condition, even not being requested to, employed singing to recall the words of the passage studied. Moreover, participants in the experimental condition outperformed controls in recall word sequences. As pointed out by Good and colleagues, musical elements such as rhythm and melody possibly act as retrieval cues that facilitate information retrieval from memory. Concerning the translation of words, the study showed that the participants who studied the lyrical passage in the experimental condition obtained higher performances than controls in the test applied shortly after the study sessions. This difference, however, was not significantly marked when the same test was applied six months later. As reasoned by Good, Russo, and Sullivan, the context that the melody attributes to lyrics possibly contributes to constructing a mental representation of the words meaning. However, they also posit that the non-retention of words, as observed six months later, may indicate that besides singing, the consolidation of vocabulary knowledge in long-term memory (LTM) depends on continuous practice.

²² Based on Nations' (2001, 2013), receptive vocabulary refers to the vocabulary used in reading and listening, whereas productive vocabulary refers to the vocabulary used in speaking and writing.

The findings of the studies reviewed in this section amount to the build hypothesis of The Broaden-and-Build theory (FREDRICKSON; BRANIGAN, 2005). The studies found improved EFL vocabulary learning in Davis and Fan (2016) and Li and Brand (2009), better vocabulary recall in Good, Russo, and Sullivan (2015) (intellectual-resource building), and social interaction in Chou (2014) (social-resource building).

Subsequently, the chapter explores one proposition that repeatedly appeared throughout this chapter: EFL reading through singing facilitates vocabulary learning because verbal and musical elements cue each other in memory retrieval.

4.8 INTEGRATION OF MELODY AND TEXT IN MEMORY FOR SONGS

As proposed earlier, one reads while simultaneously following and singing lyrics since it involves oral and visual input (BUTZLAFF, 2000). Research has provided evidence that this dual-encoding process may turn melody into a cueing aid for further memory retrieval of the verbal information sang (GOOD; RUSSO; SULLIVAN, 2015; JAVADI-SAFA, 2018; LI; BRAND, 2009; MEDINA, 1993; MORA, 2000; MORI, 2011; SCHWARZ, 2013). Experimental results obtained by Serafine, Crowder, and Repp (1984) provide a theoretical basis to sustain that.

Serafine, Crowder, and Repp's (1984) study examined to what degree melody and text could be described as independent, integrated, or inseparable in memory for songs. The researchers departed from informal observations indicating that when individuals recite well-known songs, such as national anthems, they often have difficulty doing it without simultaneously singing the melody or, at least, rehearsing the melody subvocally. In like manner, they noticed that individuals also have some difficulty realizing that different songs contain the same melody. According to Serafine *et al.*, these difficulties could indicate that melody and text for songs are represented in an integrated fashion in memory. Though, as acknowledged by the researchers, when individuals, mainly adults, voluntarily draw attention to melody or text, they may differentiate between them through singing and text recognition. Thus, by conducting two different experiments, the authors tried to find empirical evidence that could indicate that melody and text for songs are integrated into memory, and if they were

right, use the experimental results to propose that the recall of one component facilitates the recognition of the other.

To check this hypothesis, the researchers initially had 32 undergraduate students listen to 24 excerpts of unfamiliar folksongs in L1. Posteriorly, they had them perform recognition tests to examine their ability to identify songs, melodies, and texts based on their hearing. Even after conducting a second experiment with 48 undergraduates to evaluate whether participants of experiment one had performed in such a way due to the influence of task instructions or due to influence of the vocalist performance, the researchers found that: (a) participants recognized 85% of the old songs (i.e. exact same text and melody) even having heard them only once; (b) new songs, that is, songs which received some type of change in terms of melody or text, generated high number of incorrect responses; (c) in the recognition task for tunes, melodies previously heard were more accurately recognized by participants in the context of old songs, than in the context of songs containing new words (i.e. same melody previously heard, but different words), or in the context of songs containing old words from other songs previously heard (same melody previously heard, but old words which had been previously sung to a different melody in the original presentation, namely, 'mismatch song'); (4) in the recognition task for text, words previously heard were more accurately recognized by participants in the context of old songs, than in the context of songs with new melodies (i.e. exact words previously heard, but sang with different melodies), or in the context of mismatch songs. In other words, the study's main finding was that when one component (i.e., melody or text) is accompanied by the simultaneous presence of the other with which it was encoded, its recognition is facilitated.

Serafine *et al.* (1986), in a further study, conducted three additional experiments to examine two interpretations of the integration of text and melody in memory for songs observed in the 1984 study: (1) the semantic hypothesis; and (2) the decrement hypothesis.

The semantic hypothesis, according to Serafine *et al.*, was that "[...] the integration effect could be caused by the semantic connotation that words impose on a melody." (1986, p. 124). Explained in another way, they hypothesized that the ideas implied by the texts of songs could make their accompanying melodies or fragments of melodies more salient in terms of specific meanings. For instance, a textual reference to a distant church may make weak and slow beats of a triangle seem to

suggest jingling bells, even when this is not the purpose of the composition. Serafine's group acknowledged that some melodies mirror the meaning of song texts, but they wanted to check whether this was occurring in their experiment, even in songs not aimed to produce such an effect. Put another way, the idea was that the semantic relationship between imbued in melody by text functions as a recognition cue. If the semantic hypothesis were true, the semantic relationship between these two components would explain the melody-text integration. Participants' performance in the 1984 experiment would be explained by the fact that the exact accompanying texts functioned as cues for the melody recognition of the old songs used. Consequently, when the old songs previously heard by them were presented with new texts and used as the stimuli for melody recognition, the semantic relationship aforementioned was broken, thus causing a detrimental effect on the accuracy of melody recognition.

On the other hand, the decrement hypothesis postulated that the integration effect was a mere experimental artifact, that is, that it did not imply that melody and text representations are integrated into memory for songs. In other words, this hypothesis proposed that the manipulated song excerpts used in the recognition tasks of the 1984 study did not precisely mirror what happens under typical circumstances, distracted and, or confused participants, and depressed their ability to recognize melodies and words in the mismatch condition. Because of that, this hypothesis assumed that participants had a superior recognition performance in the context of old songs (i.e., the exact text and melody previously heard) than in the context of mismatched songs because they were not affected by possible deleterious and distracting effects of, say, *wrong melodies* and *wrong words*. According to Serafine *et al.* (1986), "[...] perhaps the melody by itself could be recognized well without the original words, but adding new or mismatched words somehow disguises the retained melodic information." (p. 129). Thus, the same would be applied to recognizing the texts to which mismatched melodies were added (i.e., words could be recognized well without the original melodies). In sum, the decrement hypothesis postulated that melody and text were separately represented in memory for songs and that participants' recognition performances were superior when they were prompted with unmodified songs because, in those circumstances, they were under experimental conditions that improved their performances.

In order to test the semantic hypothesis, the researchers implemented a paradigm similar to the one used in the 1984 study, however, having 37

undergraduates perform recognition tests after having heard folksongs whose lyrics were translated into nonsense text. If the experiment result were the same as the one obtained in the previous study (i.e., better recognition of melody and text previously heard in old songs), then the integration effect could not be pointed out as dependent on a semantic relationship. That was exactly what happened: data showed that even when individuals were asked to recognize melodies after hearing songs containing nonsense texts, they performed better when melodies were paired with their original texts (i.e., previously heard nonsense words). The evidence found was that participants in both the 1984 and the 1986 experiments did not recognize melodies better in the context of old songs because melodies were imbued with features implied by meanings of their accompanying texts, thus working as semantic recognition cues. That occurred possibly because the representation of text and melody in memory is integrated for reasons other than semantics. Despite the results, Serafine *et al.* (1986) did not completely rule out the semantic hypothesis, especially in those cases in which melodies contain elements that overtly mimic meanings implied in their accompanying texts, as said before (i.e., the sound produced from slow movements of a rain stick accompanying excerpts of lyrics referring to rain).

To test the decrement hypothesis, the researchers conducted two experiments, the first having 40 and the second 20 undergraduates. The first experiment tested whether the unfamiliar context of wrong words combined with previously heard melodies would account for the mismatch condition's poorer recognition. Similarly, they examined whether the unfamiliar context of "[...] wrong melodies combined to previously heard words" would account for the poorer word recognition in the mismatch condition. In the second experiment, the researchers used nonsense words because the recognition tests used in their previous studies observed ceiling effects for folksongs texts. To test the decrement hypothesis, Serafine *et al.* (1986) compared the recognition of melodies and texts in old and mismatched songs to the recognition of melodies and texts presented alone (i.e., in hummed and spoken versions, respectively). In experiment 1, participants were to disregard the words and respond whether the recognition test excerpts were presenting any of the melodies they had previously heard. In experiment 2, as expected, they were to disregard the melodies and respond to whether the recognition test excerpts presented any of the texts they had heard before. The results showed that the decrement hypothesis was disconfirmed in both experiments. In experiment 1, melodies were more accurately recognized when

paired with their original old words than when presented alone (i.e., hummed form). In experiment 2, texts were more accurately recognized when paired with their original old melodies than when presented alone (i.e., in spoken form).

As emphasized by Serafine *et al.* (1986), even though both studies presented evidence for the integrated representation of melody and text in memory for songs, further research is needed to offer full accounts of this result considered by them as just experimental. Despite that, the findings of the two studies support the hypothesis that melody and text may be represented in an integrated way in memory for songs and that one component may trigger the recognition of the other. This hypothesis aligns with findings from prior studies indicating that learning English as a foreign language was enhanced when musical components were combined with verbal content (SCHWARZ, 2013; LEE; LIN, 2015; JAVADI-SAFA, 2018). Based on that, it is plausible to assert that singing, when practiced with simultaneous attention to melody and lyrics, possibly helps EFL learners consolidate new vocabulary in LTM so that it can be posteriorly accessed via different routes and, thus, be more easily retrieved.

4.9 INVOLUNTARY REHEARSAL PHENOMENA AND EFL VOCABULARY LEARNING

Congruent with the proposition that melody and text in memory for songs are possibly integrated in memory for songs (SERAFINE; CROWDER; REEP, 1984; SERAFINE *et al.*, 1986), research has suggested that musical elements such as rhythm and melody can serve as a supporting aid in the encoding, rehearsal, and retrieval of the EFL verbal material (GOOD; RUSSO; SULLIVAN, 2015; IWASAKI, *et al.* 2013; JAVADI-SAFA, 2018; LI; BRAND, 2009; MEDINA, 1993; MORA, 2000; MORI, 2011; SCHWARZ, 2013; WALLACE *et al.*, 1994). Even though this might be true, it has been acknowledged that, due to different processing demands, these three processes may differ in terms of automaticity when the verbal material is presented in a foreign language.

As pointed out by Ludke, Ferreira, and Overy (2013), the learning of song lyrics in a foreign language, especially at the beginning stages, will demand much more cognitive effort from learners because they do not count on the same processing automaticity they take advantage from when performing the same task using their

native languages. Whereas in the native language, this learning process is automatized and allows for the construction of meanings directly based on the chunking of entire sentences, in the foreign language, the same construction tends to be slower because chunking is limited to syllables and words. This construction, however, may be improved by posterior song rehearsals, as indicated by previous studies (LI; BRAND, 2009; MORA, 2000; SALCEDO, 2010), and be associated with two involuntary rehearsal phenomena, namely the *Din-in-the-head* (KRASHEN, 1983) and the *Song-stuck-in-the-head* phenomena. (MURPHEY, 1990, 1992).

According to Krashen (1983), the Din-in-the-head phenomenon can be broadly described as an involuntary rehearsal processing of a second language's words, sounds, and phrases to which one is intensely exposed. According to Krashen, this phenomenon results from "[...] the stimulation of the Language Acquisition Device (LAD) and is set off when the acquirer receives significant amounts of comprehensive input." (1983, p. 41). Chomsky's LAD, as defined by Reed (2011), refers to "[...] a genetic device in the brain which makes language acquisition come naturally to human beings." (p.121). As posited by Krashen's Input Hypothesis (1983), second language acquisition occurs when the individual understands input containing structures that go beyond the ones of their current stages of development ($i + 1$), but only via sufficient comprehensible input processed during listening or reading focused on meaning. As reasoned by Lieb (2005), the context provided by songs in helping to turn unfamiliar vocabulary comprehensible enough to allow its acquisition is a good example of Krashen's Input Hypothesis.

Nevertheless, as explained by Krashen, comprehensible input, even though mandatory, is not sufficient: language acquisition may be hampered by the individuals' Affective Filter. The Affective Filter, as described by Liu (2015), refers to a "[...] mental block, that can control the access of comprehensible input to the Language Acquisition Device (LAD) for acquisition." (p.140). For instance, when there is no motivation, self-confidence, or much pressure, thus augmenting the learners' anxiety, the acquisition might deteriorate because the affective filter will be strong (SCHOEPP, 2001; LIU, 2005; SHEN, 2009). Krashen's proposition from the standpoint of the Broaden-and-Build Theory of Positive emotion (FREDRICKSON; BRANIGAN, 2005) seems to conform to the broaden and narrow hypotheses. Positive emotions broaden the cognitive processing of and the focus of attention on the input, while negative emotions produce the opposite effect. It also conforms to Mathewson's (1985) Comprehensive

Model of Affect in the Reading Process in that affective factors trigger and keep up one's willingness to read and feed the execution of cognitive processes. Finally, as explained by the researcher, the phenomenon will only occur among beginners since advanced ones experience less input containing $i + 1$.

A related phenomenon is the *Song stuck in my head* (SSIMH), proposed by Murphey (1990, 1992). In simple terms, the SSIMH refers to the involuntary rehearsal processing of songs sung in foreign languages.

As stated by Murphey, people commonly experience the *SSIMH* having melody memorized prior to lyrics. Murphey's SSIMH differs from Krashen's ideas on the *Din-in-the-head* phenomenon in the following ways: first, for the din to occur, there is no need for comprehensible input and content presenting $i+1$ since EFL learners sometimes rehearse songs they do not know the word meanings; second, the din effect not only occurs among beginners; it can be even stronger with advanced learners. Murphey (1990) concludes that both the *Din-in-the-head* and the *SSIMH* phenomena may be seen as online rehearsals, the latter stimulated by verbal and musical content.

It seems acceptable that the musical din proposed by Murphey (1990, 1992) may be triggered by the repeated melodic and rhythmic structure of songs that research shows to be associated with vocabulary learning (LI; BRAND, 2009; MORA, 2000). This repetition includes words, language structures, and rhythm that, as explained by Džanić and Pejić (2016), "[...] enhance learning and they stick easily in learners' minds." (p.42). It is also possible to assert that the relaxing and welcoming atmosphere that music can promote in the classroom can act in learners' positive emotions and motivation, thus lowering their affective filter and creating ideal conditions for the musical input to cause a posterior din effect. By practicing EFL reading through singing in a non-threatening and motivating environment, learners may broaden their WM focus of attention via positive emotions. Also, by optimizing the use of cognitive resources through an enhanced focus of attention, conditions can be created for the occurrence of posterior involuntary rehearsal phenomena in working memory.

4.10 CHAPTER IV SUMMARY

This chapter started by reviewing Mathewson's (1985) Comprehensive Model of Affect in the Reading Process, and settling commonalities between the model and The Broaden and Build Theory of Positive Emotions (FREDRICKSON; BRANIGAN 2005). The model, broadly speaking, predicts that affective factors are the basis of effective reading comprehension. They are described as cognitively mediated processes that sustain reading. The theory reinforces that by proposing that positive emotions boost cognition and broaden one's focus of attention. Subsequently, the chapter presented a series of recent neuroscientific findings advocating that emotions are highly influential in the consolidation and retrieval of memories (IZQUIERDO, 2018). The use of songs and the practice of reading through singing in EFL classes to promote learners' motivation and vocabulary learning was then proposed as a reply to this initial proposition. The underlying idea of this reply is that EFL reading through singing may help EFL learners develop conceptual knowledge while being socially, affectively, and cognitively engaged in the learning process (IMMORDINO-YANG, 2016; IMMORDINO-YANG; DAMÁSIO, 2016). In what followed, the chapter reviewed studies aimed to provide a more holistic view of the effects of music on adolescents' development. By presenting these studies, the chapter proposed that besides being used to meet educational purposes, adolescents' exposure to music can simultaneously impact their lives in out-of-school contexts (CAMPBELL; CONNELL; BEEGLE, 2007). It showed that music helps them reduce anxiety, build up their own social identities (NORTH; HARGREAVES; O'NEILL, 2000), develop resilience while facing stressful dynamics of adolescence (MIRANDA, 2013), aid the improvement of self-esteem (TER BOGT; SOITOS; DELSING, 2011), and promote their well-being (FINGER; SOUZA; HAAG, 2016). In the subsequent subsections, the chapter reviewed studies showing more specific relationships among the practice of singing, motivation in EFL learning, reading development in general, and EFL vocabulary learning. The studies reviewed pointed out that this practice can trigger phonemic and phonological awareness, memorability of chunks of language (IWASAKI *et al.*, 2013), fluency (RASINSKI, 2006), orthographic awareness (HANSEN; BERNSTORE, 2002), word decoding (STANDLEY, 2008), word knowledge gain and reading comprehension improvement (REGISTER *et al.*, 2007). Apart from this, the studies reviewed indicate that motivation to learn, as intensified by the practice of reading through singing, can increase learners' attention (SCHÖN *et al.*, 2008), reduce their affective filter (PAQUETTE; RIEG, 2008), and help develop their ability of team working to overcome

fears (ROMERO; BERNAL; OLIVARES, 2012). Besides, the chapter mentioned that motivation incentivizes learners to participate in the class actively, awakening their love for foreign language learning in non-threatening learning environments (AGUIRRE; BUSTINZA; GARVICH, 2016; NADERA, 2015; MOELLER, 2021). Further, studies suggested that vocabulary learning can be facilitated by musical elements such as melody and rhythm, which possibly function as retrieval cues (MEDINA, 1990; MORA, 2000; MORI, 2011), and also by the meaningful contexts provided by songs (ABBOT, 2002). At last, the chapter reviewed the behavioral studies conducted by Serafine, Crowder, and Repp (1984) and Serafine *et al.* (1986), which suggest that melody and text are integrated into memory for songs and that one element serves the other as a retrieval cue. It also discussed the effects of the Din-in-the-head phenomenon (KRASHEN, 1983) and the Song stuck-in-my-head phenomenon (MURPHEY, 1990, 1992) for consolidating EFL vocabulary from songs in memory.

The next chapter will elaborate on the concept of working memory, the model adopted in this doctoral dissertation, and the impact of positive emotions on its focus of attention. It also builds on a research gap derived from a question by Barbara Fredrickson in the proposal of the Broaden and Build Theory of Positive Emotions: “*Do they [positive emotions] increase working memory?*” (FREDRICKSON; BRANIGAN, 2005, p. 328), The reflections and proposals to answer the question will be contextualized concerning the impact of positive emotions on the online processing and storage of information in working memory triggered by EFL reading through singing for the ultimate purpose of EFL vocabulary learning.

5 WORKING MEMORY, POSITIVE EMOTIONS, AND THE EFFECTS OF ENGLISH AS A FOREIGN LANGUAGE READING THROUGH SINGING ON VOCABULARY LEARNING

5.1 INTRODUCTION

This chapter initially presents a contextualization that begins with a subjective viewpoint on individuals' real-time conception of reality, inspired by the opening words of the book *Positivity – Discover the Upward Spiral That Will Change Your Life* (FREDRICKSON, 2009). After that, it provides a historical overview and operational definition of working memory and working memory capacity constructs. Then, it reviews *The Embedded-Processes Model of Working Memory* (COWAN, 1988, 1999; COWAN; MOREY; NAVEH-BENJAMIN, 2021), adopted to compose the theoretical framework of this doctoral dissertation. Then, the chapter proposes three final arguments for the beneficial effects of EFL reading through singing for vocabulary learning, namely (i) Automatization of melody for vocabulary retrieval; (ii) Phoneme-grapheme-mapping automatization for fluent reading; and (iii) Versification chunking. At last, it elaborates on the effect of positive emotions on WM focus of attention.

Suppose it is early morning, far away from downtown. The sound of birds and the crowing of roosters slowly wake people from there, who insist on keeping their eyes closed for some more time. By paying attention to those sounds, they understand that the orchestra announces a new day; they already know that musical composition. People may wake up and open the room window to appreciate the wonders, full of positivity. Conversely, they may remain in bed stuck by memories loaded with negative emotions, part of their recorded memories, making them decide not to allow a ray of light to enter the room. In the case of affective disorders, such as depression, they may even enter severe rumination processes, that is, “[...] the inability to stop reflecting on particular past negative experiences [...]” (WILLIAMS; FORD; KENSINGER, 2022, p. 10-11). In other words, an uncontrollable repetitive retrieval and rehearsal of negative memories remain in real-time maintenance due to privileged processing resulting from insufficient inhibitory control (i.e., negative thoughts cannot be prevented from entering and remaining in WM rehearsal) (KORB, 2015; MIKELS; BEYER; FREDRICKSON, 2008; WILLIAMS; FORD; KENSINGER, 2022).

Of course, this division between being in a state of negativity and positivity is not discrete. Emotions manifest themselves on a continuum, and the sources that yield them are also subjectively interpreted by people. While the rooster's crowing may be interpreted as irritating and making people put their heads under the pillow (and decide to cook rooster soup for lunch), the birds' sounds may be interpreted as inspiring, making people prepare a nice cup of coffee. However, if the birds' sounds are interpreted as irritating, the birds are at risk of being at lunch, more precisely, of being *the lunch*.

Thus, people's emotions may mold two or more versions of reality. On one of them, for instance, emotions may narrow their scope of WM attention to details (i.e., to the irritating rooster's crowing, an external input, or/ and to bad memories), decreasing their willingness to engage in actions. On the other, emotions may broaden the scope of WM attention to the appreciation of the broader context for exploration and savoring (i.e., to the full view from the window or/and to good memories), increasing their willingness to engage in actions (FREDRICKSON; BRANIGAN, 2005; FREDRICKSON; COHN, 2008). To make this process even more complex, oscillations may also occur within people, and the types of soup may differ daily. The menu may gain more options! In sum, external stimuli and recorded knowledge in LTM may be more narrowly or broadly processed and maintained in WM depending on people's emotional states, which define their versions of reality.

These initial bucolic words narrate people's endowed ability to capture external stimuli through the senses (i.e., sensorial perception). Thus, even with their eyes closed, they understand what is happening in the environment through other senses. The understanding, however, depends on people's ability to process and simultaneously maintain sensorial perception. Finally, people rely on their knowledge about what is happening around them. All this engineering starts outside people and continues to run inside their memory: in this narrative, broadly speaking, in two types of memory, implied in Izquierdo's (2018) words:

Basically, there are two types of memory according to their function. A very brief and fleeting one, it serves to "manage reality" and determine the context in which various facts, events, or other kinds of information occur, whether or not it is worth making a new memory of that, or whether that kind of information is already in the records."

(IZQUIERDO, 2010, p. 13, my translation, emphasis given by the author)²³.

The type of memory that *manages reality* is defined as *working memory* (WM). As said before, it processes and maintains sensorially captured information and their inherent consolidated knowledge stored in another type of memory, *long-term memory* (LTM) (i.e., paraphrasing Izquierdo's words, the part of your memory *containing recorded information*). This simultaneous management of both sources of information allows people to conceive *a version of reality*. A version of reality because each individual has unique recorded information, and how they sensorially capture, process and maintain what is around and inside them is, *in part*, unique too. So, one might inquire, are not the external and internal information equally processed and maintained by everyone? Is reality not equally conceived by everyone? The answer from the perspective of Positive Psychology (PP) is *no*.

Besides influencing how people begin their days, WM plays a role in all complex cognitive activities, from deciding the day's organization to school learning. Regarding that, this doctoral dissertation has proposed that practicing English as a foreign language (EFL) reading through singing may be beneficial for vocabulary learning for its yielding positive emotions on cognitive processing, mainly for broadening learners' WM focus of attention. This beneficial role is attributed to scientific evidence suggesting that the use of songs in EFL classes, by helping create non-threatening and anxiety-free teaching environments (JAVADI-SAFA, 2018; LIEB, 2005; NADERA, 2015; SHEN, 2009;) influences readers to experience foreign language learning as a pleasurable activity (AJIBADE; NDUBUBA, 2008; DOMONEY; HARRIS, 1993; LI; BRAND, 2009; MORI, 2011; COYLE; GRACIA, 2014). Additionally, research suggests that the foundational structures of singing and reading are intrinsically related to increasing attention span (COOPER, 2010) and that the elements of songs aid the memorability of their verbal content (GOOD; RUSSO; SULLIVAN, 2015; IWASAKI *et al.*, 2013; LI; BRAND, 2009; MEDINA, 1993; MORA, 2000; MORI, 2011; SCHWARZ, 2013) thus favoring language processing and learning (MORI, 2011; SALCEDO, 2010). Also, studies point out that the enhancement of individuals' arousal and

²³ No original: "Basicamente, há dois tipos de memória de acordo com a sua função. Uma muito breve e fugaz, serve para "gerenciar a realidade" e determinar o contexto em que os diversos fatos, acontecimentos ou outro tipo de informação ocorrem, se vale a pena ou não fazer uma nova memória disso, ou se esse tipo de informação já consta dos arquivos." (IZQUIERDO, 2018, p. 13, emphasis of the author).

attention can be attributed to the emotional aspects of songs (SCHÖN *et al.*, 2008), which is in agreement with what is proposed by studies from neuroscience in that emotions potentially steer the selectivity of attention and modulate motivation and behavior (TYNG *et al.*, 2017). What more, involuntary rehearsal phenomena (KRASHEN, 1983; MURPHEY, 1990, 1992; SALCEDO, 2010; MORI, 2011), as triggered by continuous exposure to songs, are also said to bring musical and linguistic elements to constant online processing, thus enhancing consolidation of verbal knowledge in LTM. Finally, the Broaden-and-Build Theory of Positive Emotions (FREDRICKSON, 1998, 2004; FREDRICKSON; BRANIGAN, 2005) has revealed through several studies that positive emotions tend to broaden the scope of individuals' attention, allowing them to process information with more flexibility, openness, and expansiveness. Altogether, research predicts that crosstalks between emotion and cognition are essential for effective reading, an assumption also defended in Mathewson's Comprehensive Model of Affect in the Reading Process (1985), reviewed in Chapter IV. Emotions, which are encompassed in Mathewson's reading model within the component of affective factors, enter the process of reading by preceding both the reader's decision to read and the execution of posterior primary and secondary processes that more directly involves cognition. Attention is one of the primary processes influenced by affective factors, as Mathewson explains. Because attention is necessary for the online processing of linguistic elements in reading, it is assertable that affective factors are crucial to effective reading due to their enhancing force. Simply put, the literature suggests that singing broadens EFL readers' WM focus of attention to learning through enhanced positive affective factors, thus enhancing vocabulary learning.

Given this contextualization, the objective of this chapter is to operationalize the constructs of WM and working memory capacity (WMC) based on Cowan's (1988, 1999) Embedded-Processes Model of Working Memory and propose theoretical discussions on the role of positive emotions evoked by the practice of EFL reading through singing in WM focus of attention.

5.2 WORKING MEMORY AND WORKING MEMORY CAPACITY: CONSTRUCTS ORIGIN AND OPERATIONALIZATION

The official coinage of the construct of *working memory* (WM) dates back to the 1960s when the development of digital computers influenced psychology to understand human memory based on an information-processing approach (BADDELEY, 2010). The construct was first used in the book *Plans and the Structure of Behavior* by Miller, Galanter, and Pribram (1960), in which the authors attempted to elaborate on how individuals can execute plans in real time. The researchers proposed that humans need a *state* or a *place* where information can be simultaneously processed and maintained.

Building from Galanter and Pribram's initial assumption, several researchers have developed models to explain what WM and WMC are and how they function, and Baddeley and Hitch (1974) proposed the seminal model in the area (GABRIEL; MORAIS; KOLINSKY, 2016; RONDON; TOMITCH, 2022). For its proposal, Baddeley and Hitch submitted participants to perform three types of verbal tasks (i.e., a verbal reasoning task; a language comprehension task; and a free recall of unrelated words) with the addition of a memory load of six items, which ended up being detrimental to participants' performance. Based on that, the researchers proposed "[...] that the core of the working memory system consists of a limited capacity "workspace" which can be divided between storage and control processing demands." (BADDELEY; HITCH, 1974, p. 75-76, emphasis given by the authors). This assumption was the starting point of the idea that WM encompasses online processing and maintenance of information needed to accomplish complex tasks and that when the system's capacity is exceeded (i.e., WMC), there are detrimental effects on the individuals' task performance. Over the years, Baddeley's model has evolved and remains open to changes as research requires (BADDELEY; HITCH; ALLEN, 2021, p. 11).

Currently, their model, namely the *Multicomponent Model of Working Memory*²⁴ is operationalized as "A limited capacity system responsible for the temporary maintenance and processing of information in the support of cognition and action." (BADDELEY; HITCH; ALLEN, 2021, p. 11). Implied by its nomenclature, it is a nonunitary model since it encompasses distinct subsystems (i.e., a Central Executive, a Visuo-spatial Sketchpad, a Phonological Loop, and an Episodic Buffer). According

²⁴ For a full review of the Multicomponent Model of Working Memory see Baddeley, Camos and Allen, 2021, p. 10, in *Working Memory, State of the Science*, Edited by Robert H. Logie, Valérie Camos and Nelson Cowan.

to the model, the subsystems are interconnected with LTM through the Episodic Buffer; all subsystems, however, dealing with the task's demands in close cooperation. Consonant with the rationale of Miller, Galanter, and Pribram (1960) and Baddeley, Hitch, and Allen (2021), Izquierdo explains that WM is an

[...] "online" memory. It holds during acquisition and a few seconds, at most a few minutes, the information being processed. It helps to know where we are or what we are doing at any given moment and what we said or where we were at the previous moment. It thus gives continuity to our actions. (IZQUIERDO, 2018, p. 14, my translation, emphasis given by the author)²⁵.

Such as in this chapter's opening narrative, WM permits individuals to realize who and where they are and what to do or not. In other words, WM memory is the mental system that allows people to build conceptions of their reality, having as a reference the present moment, a point in time from which they recall past events and elaborate prospectations.

Other researchers have also conceptualized WM²⁶ following these same basic premises. Bailer and Tomitch (2017), for instance, in a study on individual differences in the neural processing of sentences in Portuguese-English bilinguals, define WM as "[...] a computational arena where the mental processes happen in real-time²⁷." (p. 17, my translation). The researchers also point out that this computational arena is limited to the amount of work that can be operated simultaneously (i.e., WMC). Their conclusion matches Cowan's (1999) *Embedded-Process Model of Working Memory*, to be fully described in the next section, by its conceiving WM as a workspace where "[...] information needed to do a task must be made especially accessible temporarily." (p. 88), given that:

²⁵ In the original: "é uma memória "on-line". Mantém durante a aquisição e mais alguns segundos, no máximo poucos minutos, a informação que está sendo processada no momento. Ajuda a saber onde estamos ou o que estamos fazendo a a cada momento, e o que dizemos ou onde estávamos no momento anterior. Dá continuidade assim, aos nossos atos". (IZQUIERDO, 2018, p. 14, ênfase do autor)

²⁶ Another view of WM is the *Capacity-Constrained View of WM for Language* (JUST; CARPENTER, 1992). It will be reviewed in Chapter VI.

²⁷ In the original: "[...] uma arena computacional onde os processos mentais acontecem em tempo real [...]." (BAILER; TOMITCH, 2017, p. 17.).

[...] some of the necessary information may be in the focus of attention; some may be in an especially active state, ready to enter the focus as needed; and some may simply have the appropriate contextual coding in long-term memory that allows it to be made available quickly (COWAN, 1999, p. 88).

This doctoral researcher chose Cowan's model as a theoretical pillar for his reasoning for three reasons. The first is that any multicomponent model adopted would have to accommodate the idea of a subsystem responsible for processing and maintaining emotions. Despite the ongoing research by Mikels *et al.* (2008) and Mikels and Reuter-Lorenz (2019) proposing multicomponent domain-specific modules for affect, to the knowledge of this doctoral researcher, no model fits emotion within a specific subsystem. Cowan's model provides openness, allowing inferences on emotions' influence in WM. According to the model, information stored in LTM can be grouped by specificity, but a simple taxonomy (i.e., phonological, visuospatial, and thus emotional) would not suffice to comprehend all categorical possibilities. According to Cowan, Morey, and Naveh-Benjamin (2021), information stored in LTM that goes in and out of WM can be grouped by similar characteristics (i.e., verbal, spatial, olfactory, among others) or by various combinations among them. Thus one inference lies in the possible combinations between types of information the model accepts, such as (i) a combination comprising phonological information and emotions originated during encoding processes; and (ii) the same type of combination already stored in higher-order schemata (i.e., LTM).

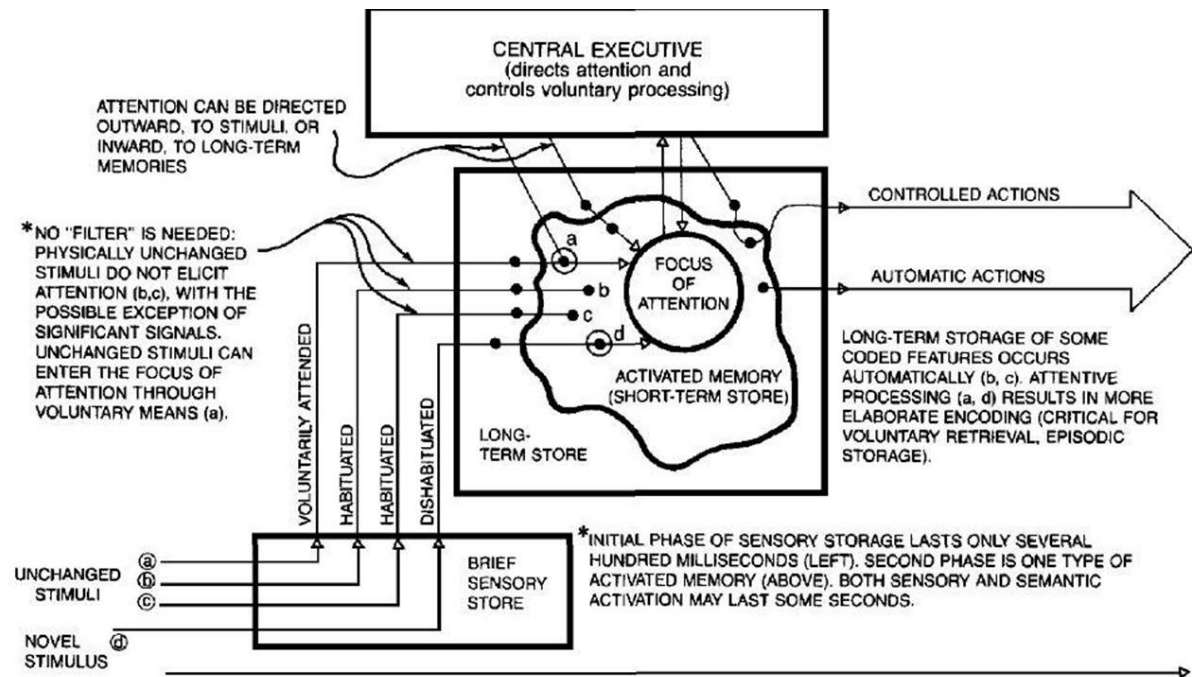
The second reason Cowan's model was chosen as a referential WM model in this dissertation is its emphasis on the role of WM focus of attention in concept building and vocabulary learning (COWAN, 2015; COWAN; MOREY; NAVEH-BENJAMIN, 2021). Inferential propositions are expanded based on research findings on the role of emotions on the scope of attention.

The third reason is that the model allows the establishment of theoretical consonances among it, the Comprehensive Model of Affect in the Reading Process (MATHEWSON, 1985), and the Broaden-and-Build Theory of Positive Emotions (FREDRICKSON, 1998, 2004; FREDRICKSON; BRANIGAN, 2005), concerning the influence of the type of stimuli in the sensorial capture of attention. The three reasons are explored in this chapter.

5.3 THE EMBEDDED-PROCESSES MODEL OF WORKING MEMORY

The current working definition given to Cowan's model is that working memory is "The ensemble of components of the mind that hold a limited amount of information temporarily in a heightened state of availability for use in ongoing information processing." (COWAN; MOREY; NAVEH-BENJAMIN, 2021, p. 54). The model postulates that three parts form the WM ensemble of components: (i) a small portion under a high focus of attention; (ii) a portion of the LTM in a state of activation; and (iii) features of the LTM in a latent state of activation. See Figure 12 below:

Figure 12 - The Embedded-Processes Model of Working Memory



Source: The Embedded-Processes Model of Working Memory. Retrieved from Cowan, N. (1988). Evolving conceptions of memory storage, selective attention, and their mutual constraints within the human information processing system. *Psychological Bulletin*, 104, 163-191.

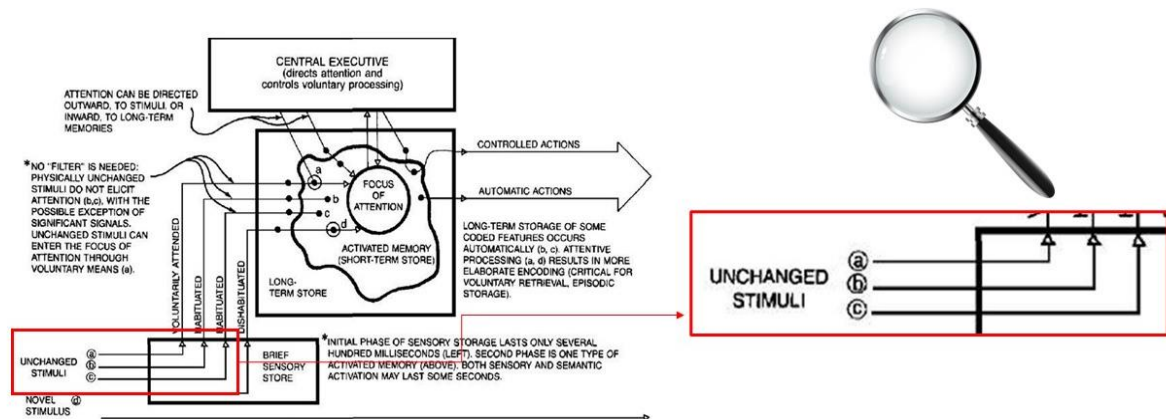
As explained by Cowan (1999), the central squared component of the depiction represents LTM. The irregular-shaped component within that square represents the portion of LTM under a currently heightened state of activation, namely activated memory or short-term store. In Cowan, Morey, and Naveh-Benjamin (2021), the term was updated to *activated long-term memory*. This terminology will be adopted from now on. The circled component embedded in *activated long-term memory* represents

the smaller portion of information receiving the highest activation in LTM, that is, the portion under the focus of attention and awareness. In other words, information within the focus of attention is the information one is aware of (i.e., thinking about). Consonant to Cowan (1999), LTM, activated long-term memory, and the focus of attention and awareness are the key components that give support to WM.

Just below the square, the small rectangle represents the initial sensory store in which, as depicted above, stimuli are processed for only several hundred milliseconds before activating related existing features in LTM, forming a neural model of the surrounding environment.

Finally, the rectangle on the top of the depiction represents the central executive (CE) responsible for voluntary attentional processes that regulate WM. Necessary to underscore that, according to this model, not only information in the focus of attention remains activated; information in activated long-term memory is also active but at a lower level. The arrow at the bottom of the depiction represents the real-time information processing and storage beginning in the initial sensory store. As explained by Cowan (1988), “[...] stimulus information can be present in more than one component at the same time.” (p. 180), which means that there is processing flexibility in terms of chronology and sequence. The four arrows identified as *a*, *b*, *c*, and *d* (left side of the depiction, just next to the smaller rectangle) represent the stimuli entering the brief sensory store and being posteriorly directed to their activating of inherent features already stored in LTM. The three arrows, *a*, *b*, and *c* depict coding into LTM after forming new memories within the focus of attention.

Figure 13 - The Embedded-Processes Model of Working Memory with emphasis on habituated stimuli

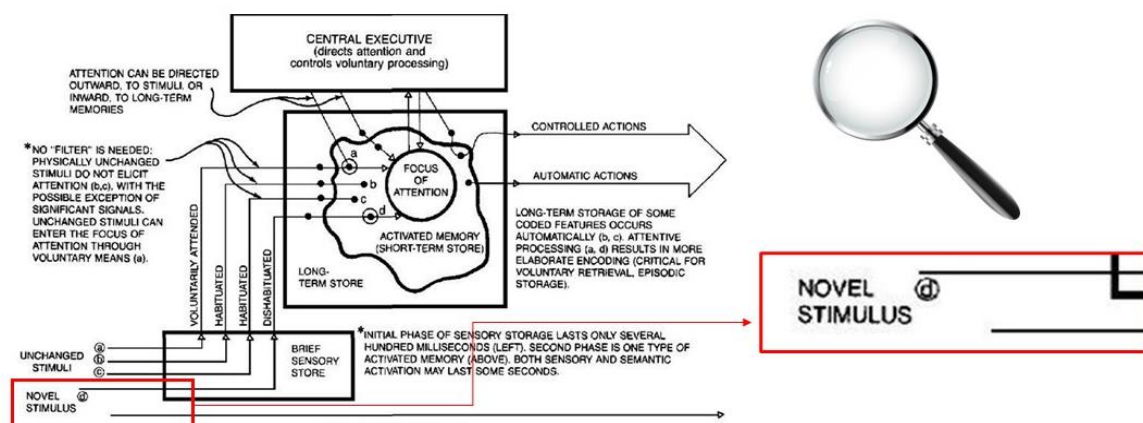


Source: Adapted by the author of the dissertation based on The Embedded-Processes Model of Working Memory. Retrieved from Cowan, N. (1988). Evolving conceptions of memory storage, selective attention, and their mutual constraints within the human information processing system. *Psychological Bulletin*, 104, 163-191.

These stimuli no longer elicit the individual's awareness to activate their corresponding features in LTM. Their activation becomes automatized by remaining unmodified during a period and having already structured neural models (i.e., a structured set of features) to which they are compared and matched (COWAN, 1988). In other words, they correspond to well-learned items to which the individual is already habituated, and they do not necessarily require high activation but some activation. One can think of automaticity in reading. For instance, it occurs during the execution of low-level processes such as automatized decoding and matching. However, this type of information may enter the focus of attention via Central Executive, as in the case of the circled *a* (within the irregular-shaped representation of activated long-term memory). This activation may happen because a habituated stimulus can become significant to the individual and thus enter the focus of attention to form a new memory. For instance, while reading, the reader may become confused with perfect homonyms (i.e., words with the same spelling and pronunciation but that differ in meaning) and direct the word to the focus of attention together with other textual pieces of evidence to grasp its actual meaning.

Additionally, when there is no habituation to a specific stimulus, as represented by *d* (i.e., novel stimulus), Figure 14, the *Attentional Orienting System* verifies that there is no exact equivalent neural model to which the novel stimulus can be matched.

Figure 14 - The Embedded-Processes Model of Working Memory with emphasis on novel stimulus

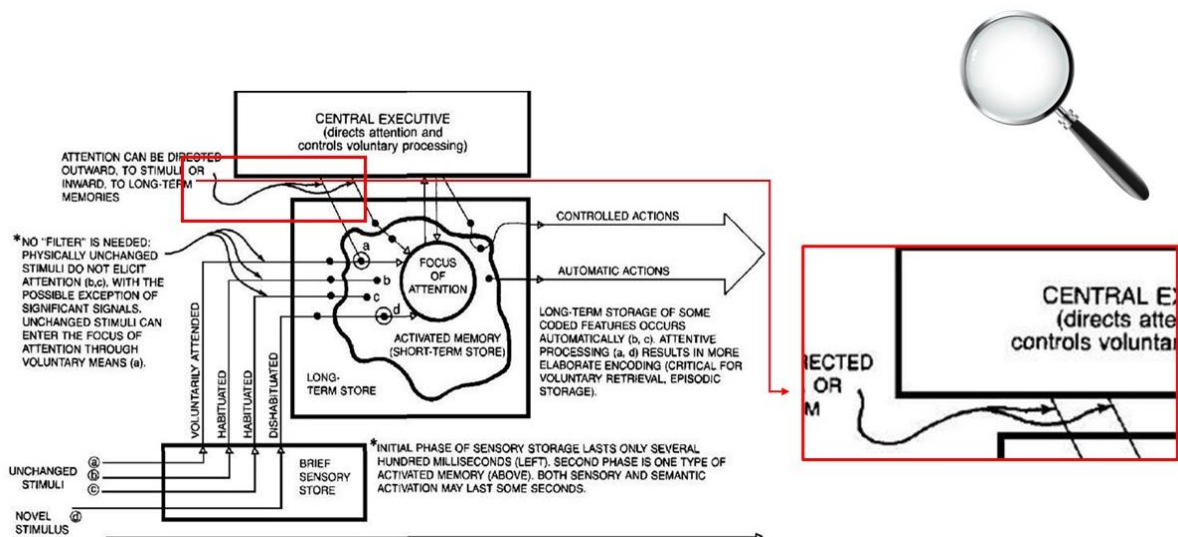


Source: Adapted by the author of the dissertation based on from The Embedded-Processes Model of Working Memory. Retrieved from Cowan, N. (1988). Evolving conceptions of memory storage, selective attention, and their mutual constraints within the human information processing system. *Psychological Bulletin*, 104, 163-191.

In that case, voluntary attention from the CE is required, and any composite of features that may help unveil its meaning is activated in activated long-term memory and is directed to the focus of attention for concept building and possible learning of the item. One can think of a new word found in lyrics, for instance. Even if the word is new, some relevant prior knowledge (i.e., topic or linguistic) is activated and brought to the focus of attention to unveil the word’s meaning. In this case, the reader enters into more effortful processing. Effortfulness thus will depend on the contextual topic and text features, and LTM features constraints.

The two arrows on the upper left side of the top rectangle, Figure 15, show that attention, according to this model, can be voluntarily drawn by the CE to information sensorially captured, represented by a, and also to information already stored in LTM, represented by the black dots connected to those arrows, respectively. Both types of information, as depicted below, can enter the focus of attention.

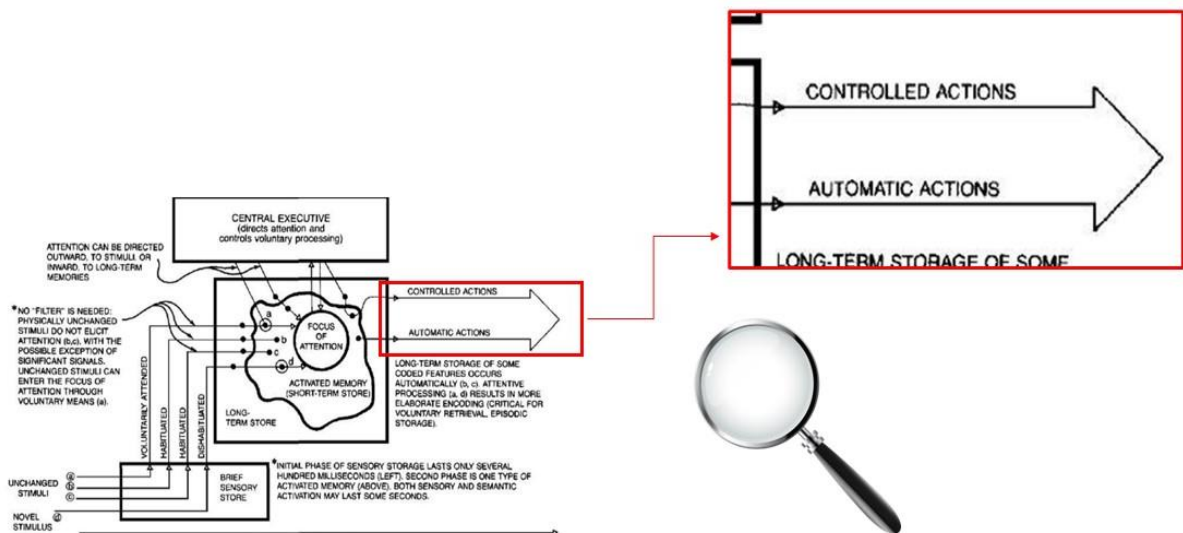
Figure 15 - The Embedded-Processes Model of Working Memory, with emphasis on the attention directed by the Central Executive outward or inward



Source: Adapted by the author of the dissertation based on The Embedded-Processes Model of Working Memory. Retrieved from Cowan, N. (1988). Evolving conceptions of memory storage, selective attention, and their mutual constraints within the human information processing system. *Psychological Bulletin*, 104, 163-191.

Additionally, the two arrows on the upper right of the square refer to controlled and automatic actions, as depicted in Figure 16.

Figure 16 - The Embedded-Processes Model of Working Memory, with emphasis on the controlled and automatic actions

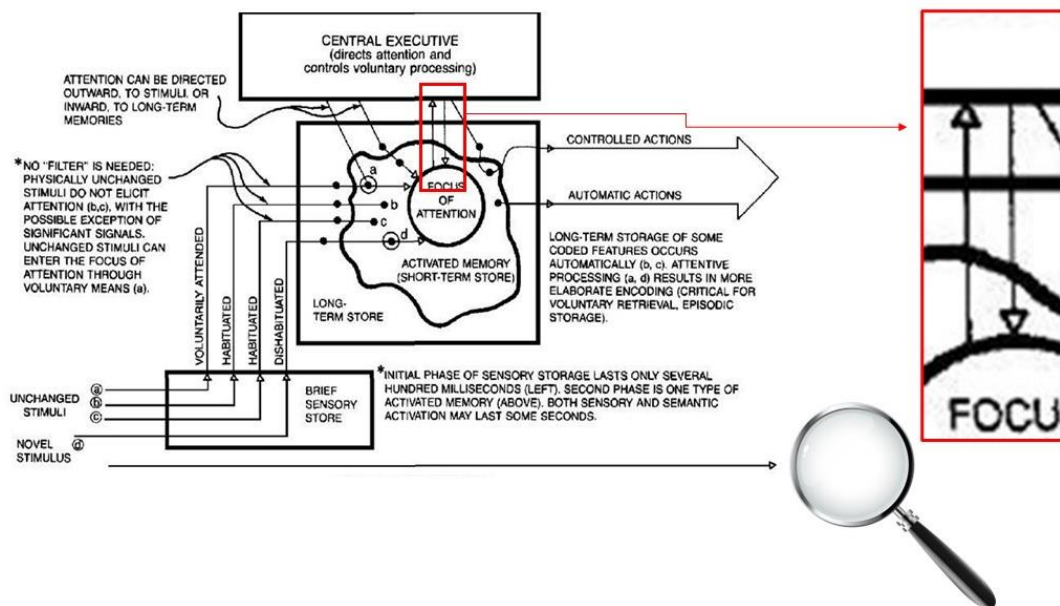


Source: Adapted by this researcher from The Embedded-Processes Model of Working Memory. Retrieved from Cowan, N. (1988). Evolving conceptions of memory storage, selective attention, and their mutual constraints within the human information processing system. *Psychological Bulletin*, 104, 163-191.

As can be seen, whereas voluntarily controlled actions are managed by the CE, automatic actions are involuntary. Nevertheless, as Cowan (1988) puts it, actions can also be derived from the simultaneous execution of controlled and spontaneous processes. As explained by the researcher, in that case, errors in terms of speech and action, for instance, can occur.

Finally, the two parallel arrows depicted between the CE and the focus of attention, as shown at the top of Figure 17, imply the existence of continuous interactions between these components and the refreshing of information in the focus of attention.

Figure 17 - The Embedded-Processes Model of Working Memory, with emphasis on the interactions among the CE, activated LTM, and WM focus



Source: Adapted by the author of the dissertation based on The Embedded-Processes Model of Working Memory. Retrieved from Cowan, N. (1988). Evolving conceptions of memory storage, selective attention, and their mutual constraints within the human information processing system. *Psychological Bulletin*, 104, 163-191.

In other words, for information to be or to remain in activated LTM or the focus of attention, it has to be reactivated by the CE. At the same time, this activation/reactivation is required from the CE by the task at hand to guarantee that the information needed for its accomplishment remains available.

Considering the previous description, Cowan's model can be seen as more unitary than Baddeley's because, as put earlier, it does not propose subsystems for specific types of information. As put before, for Cowan (1999), codes differ from each other, but following the researcher, "[...] different codes may be processed according to the same principles." (p. 79). As also posed by Cowan, Morey, and Naveh-Benjamin (2021), the different codes can be regarded as "[...] different types of activated long-term memory rather than concrete modules." (p. 64). Nevertheless, as emphasized, the model cannot be entirely seen as unitary since it presupposes that information from different parts of memory (i.e., LTM, activated long-term memory, and the focus of attention) interact for successful task performance. The following will briefly describe how basic mechanisms (i.e., encoding, representation, maintenance, and retrieval of information) are conceived according to Cowan's WM model.

According to Cowan (1999), *encoding* occurs through the initial activation of features in memory triggered by the stimulus processed, as exemplified in the narrative used at the beginning of this chapter. As explained by the researcher, “[...] the composite of activated features forms the encoding of the stimulus used in working memory.” (p. 66). According to Cowan, the quantity of features corresponding to the stimulus that will be activated depends on the individual’s level of attendance. Also, the stability of the memory representation, as argued by the researcher, will depend on how extensive the activation of the features will be. If the quantity of features corresponding to the stimulus that will be activated depends on the individual’s level of attendance, a theoretical consonance with the Broaden-and-Build Theory of Positive Emotions (FREDRICKSON; BRANIGAN, 2005) may be proposed. The level of attendance may vary according to the emotional state of individuals (i.e., more features in positive states characterized by a broadened focus of attention and the opposite in negative states).

Representation, in Cowan’s model (1999), is somehow simplified than in Baddeley’s (1999, 2012, 2021). As put before, the researcher does not neglect that information can be distinctively represented in WM across modalities; however, “The basic mechanisms of encoding, maintenance, and retrieval could be similar no matter what the form of the representation of an item.” (p. 71). Despite that, in agreement with Baddeley, the researcher admits that the parallel processing of similar representations in memory impairs performance.

Maintenance, as explained by Cowan (1999), “[...] may work together or in sequence.” (p. 75) depending on the task at hand. By maintenance, the researcher refers to processes executed by the CE that keep on reactivating items to maintain them in states of activation.

Retrieval, at last, in conformity with Cowan (1999), basically means “[...] entering the correct items into the focus of attention.” (p. 75). Consonant with him, the presence of an item within the focus of attention better guarantees its recall due to its higher activation. Moreover, the researcher states that there are differences in terms of time limitations between the retrieval of items from LTM and retrieval from activated long-term memory. When retrieving information from LTM, time limitations will matter to the individual only if the context imposes that on him (i.e., the need for immediate information recall due to time constraints). However, time limitations are a constant imposition when retrieving information from activated long-term memory because

information can go out of activated LTM if not reactivated. Having tapped into the topic *limitations*, Cowan's model (1999) predicts two types of WM limitations: temporal limitation for memory activation, as explained, and capacity limitation for the focus of attention.

In the researcher's words, "As time goes on, some of the activated features in memory cease to be activated, making the temporary representation of an item more and more vague until it disappears completely." (COWAN, 1999, p. 81). That is, information from activated long-term memory, which must be recirculated within the focus of attention to accomplish a task, will be boosted and consequently last longer. In what concerns capacity limitations, Cowan proposes that just a few *unrelated items* can be maintained in the focus of attention (i.e., from 3 to 5). Nevertheless, as pointed out by the researcher, this limit can be increased through chunking²⁸: Finally, Cowan (1999) underscores that the exact limitation of the activated LTM is unknown.

These are the basics of Cowan's WM Model. The following section proposes theoretical discussions on the role of positive emotions evoked by the practice of EFL reading through singing in WM focus of attention and its effect on vocabulary learning.

5.4 POSITIVE EMOTIONS, WORKING MEMORY FOCUS OF ATTENTION, AND EFL READING FOR VOCABULARY LEARNING

As regards the relationship between Cowan's WM model and vocabulary learning in foreign languages, special attention must be driven to the function of the focus of attention in concept building, given the highly complex rules that govern languages. According to Cowan (2015), language differs from other forms of communication because of a great deal of "[...] arbitrary relations between symbols – in the form of words – and the meanings symbolized." (p.29). According to the researcher, this distinction allows humans to convey a vast array of meanings through new combinations of symbols. However, as posed by Cowan, when learning new

²⁸ According to Gilchrist (2015, "chunking is a process through which one reorganizes or groups presented information to compress information; it is one of the best-known methods of increasing the amount of information stored in memory. Chunking can occur by two different means: either through strategic reorganization based on familiarity or prior knowledge or through grouping based on perceptual characteristics. An example of the former is using knowledge of acronyms to break a string of letters (e.g., *AWOLNASAMIA*) into smaller, separate groups (i.e., *AWOL*, *NASA*, *MIA*). In the case of the latter, more common with visual stimuli, one can form groups on the basis of similarity or proximity." (p.1).

words, such as in the case of a foreign language, memory has to manage much information, and “[...] the capacity of working memory will determine how complex can be the learned information.” (p. 29). Briefly speaking, Cowan (2015) proposes that through a constant shuttle of sensorial attendance to distinct sources of information (i.e., orthographic, phonological, semantic, and others), many kinds of features can be concurrently activated in WM, thus contributing to foreign language learning. As already described in Cowan’s model, the whole system contributes to WM through an interactive configuration. However, given its limitations, some memory features remain in a heightened activation state in activated long-term memory, whereas only a few enter the focus of attention and awareness. The features that enter the focus of attention, according to Cowan (2015), play an essential role in foreign language learning because concept building occurs within this workspace, where the foreign language words and their corresponding meanings are bound.

As exemplified by the researcher, while building the concept of a word such as *tiger*, the learner has to simultaneously maintain information such as “[...] *big + stripped + cat* in the focus of attention.” (p. 36, emphasis given by the author). Cowan (2015) even jokes by saying that the absence of this chunk of information pieces could confuse one between a zebra and a tiger! In a few words, according to this WM model, the central role attributed to the WM focus of attention is that it allows for the storage and processing necessary to construct new knowledge. Based on the examples given by Cowan (2015), it is predictable that this also applies to EFL vocabulary learning.

Considering the above, Mathewson (1985), in his *Comprehensive Model of Affect in the Reading Process*, Chapter IV, classifies attention as one of the primary cognitive components of reading comprehension. Additionally, Cowan (1999) states that the physical properties of a given stimulus determine the attention effortfulness driven to it. In the 1999 chapter, the researcher predicts that the more exciting the stimulation, the higher the odds that the individual will be focused on the target object of attention.

This statement matches Mathewson’s postulation that the attitude to start reading depends on the reading material’s content, form, and format. Reading through singing may add exciting properties to the reading material, such as musical elements and the topics they approach. Thus, EFL vocabulary learning can be facilitated by reading through singing because affective factors, as triggered by the songs’ properties, may contribute to keeping the learners’ focus on the given stimuli. Low WM

spans, in that case, would be greatly benefitted. If attention is “[...] an enhancement of the processing of some information to the exclusion of other, concurrently available information.” (COWAN, 1999, p. 63), and as low spans count on a lower capacity to process and maintain information in WM, the use of stimuli that better guarantees a higher state of attendance to relevant information to the exclusion of extraneous ones would possibly allow them to make the most from the WM resources they own.

The same rationale applies to the broaden hypothesis of the Broaden-and-Build Theory of Positive Emotions (FREDRICKSON; BRANIGAN, 2005). The theory proposes that the scope of attention broadens when individuals experience positive emotions. Building on all the literature reviewed so far, it is possible to envisage that positive emotions aid in keeping EFL readers’ broadened focus of attention on the object of study. They may perform better in complex cognitive tasks (i.e., reading to learn vocabulary in a foreign language) because their emotional states provide ideal conditions for efficiently using their total WM attentional capacity.

In addition to what has been presented, this chapter will propose three final arguments explaining how effective EFL reading through singing may be for vocabulary learning: (a) Automatization of melody for vocabulary retrieval; (b) Phoneme-grapheme-mapping automatization for fluent reading; and (c) Versification chunking.

5.4.1 Automatization of melody for vocabulary retrieval

Back in time, Cowan added that WM refers to cognitive processes that retain information in an unusually accessible state, suitable for carrying out any task with a mental component.” (1999, p. 63). Still, according to him, “[...] any processing mechanisms contributing to the desired outcome, which is the temporary availability of information, are said to participate in the working memory system.” (COWAN, 1999, p. 63). Expanding from that, it is reasonable that the retrieval of well-consolidated musical information inherent to the song sung in the classroom from LTM may cue the activation of its inherent verbal information. The retrieval of melody EFL learners previously practiced through singing may cue EFL readers’ recall of vocabulary: melody becomes an additional part of the verbal input stored in LTM.

Figure 13, page 156, The Embedded-Processes Model of Working Memory (COWAN, 1999) depicts that habituated stimuli (i.e., items *b* and *c*) automatically activate their representation in LTM with no considerable attentional effort. That is, the habituated stimuli become part of activated long-term memory with higher automaticity because their features already have a neural model. Thus, EFL readers may recognize and match melodies and words to which they are habituated to their representation in LTM, entering online processing. If the reader experiences a feeling of weirdness about some feature of the melody, attempted recoding of the feature takes place (i.e., item *a*, in the depiction). For instance, that may occur in the same song sung by a different interpreter who improvises the melody. In other words, these features pass LTM where there is weak or no representation of it, and effortful attention driven by the central executive imbue them into WM focus of attention for deeper processing and learning. A different instance is when the reader forgets some musical notes of the melody (i.e., this may vary among students due to individual differences in musical knowledge or aptitude). Then they must listen to the melody as often as necessary to add those melodic features and their inherent vocabulary to the neural model. Then, if this rationale holds, vocabulary recall depends on melody automatization in this EFL teaching context.

Speaking of automatization, Tomitch (2009), already mentioned on page 81, establishes that effective reading comprehension is better accomplished when it passes three phases: pre-reading, during reading, and post-reading. In teaching vocabulary through singing, reading may also pass through these phases. In the *pre-reading through singing phase*, for instance, EFL readers can appreciate the melody, get to know the composer of the song, the author of the lyrics, its date of composition, and make predictions about what the song may be about based on textual cues (i.e., the title, some words from the chorus, among others). The same can also be done based on musical cues (i.e., beat, tempo, and types of instruments used). In the *while-reading-through-singing phase*, EFL readers can listen and sing the melody repeatedly while carrying out activities with different purposes (i.e., learning a specific verbal tense, affixes, rhymes, assonances, and vocabulary). In the *post-reading-through singing phase*, EFL readers may discuss how meaningful the songs are for them and how the knowledge built from the songs may apply to other contexts. In this phase, singing will possibly be better automatized, given the verbal and musical automatization tendency reached by the repeated study of melody and lyrics. This

constant study of the song may help consolidate melodic features in LTM to serve as cues to the recall of its associated vocabulary, as advocated in the proposal of integration of melody and text in memory for songs proposed by Serafine, Crowder, and Repp (1984) and Serafine *et al.* (1986), reviewed in Chapter IV, page 139.

Notably, the teaching of vocabulary through songs divided into the three phases above described implies that the use of songs in English classes should not be limited to one study for translation or filling in the gaps, as it sometimes happens. As already pointed out, repeated meaningful singing is paramount for vocabulary learning (DŽANIĆ; PEJIĆ, 2016; LI; BRAND, 2009; MORA, 2000). In agreement, studies have shown that for vocabulary learning to be deeply consolidated in LTM, multiple encounters with the words in different contexts are needed (DE AZEVEDO; TOMITCH, 2019; KODA, 2005; LAUFER; AVIAD–LEVITZKY, 2017; LAUFER; RAVENHORST-KALOVSKI, 2010; NATION, 2006), which can occur mainly in the while-reading and post-reading through singing phases. The study of the song in different phases may also be beneficial to yield the involuntary rehearsal phenomena (i.e., *Din-in-the-head*, KRASHEN, 1983, and the *Song-stuck-in-the-head* phenomena, MURPHEY, 1990, 1992), described in Chapter IV, page 143.

Another aspect, the type of rehearsal, is also worth considering at this point. Following Sprenger's (2018) considerations on the role of rehearsal in learning, "To rehearse is to recite or repeat in private for experimenting and improvement." (SPRENGER, 2018, p. 27). Sprenger categorizes rehearsal as rote rehearsal and elaborative rehearsal. On the one hand, "Rote rehearsal is effective when the information will be used in the same way as it is rehearsed." (SPRENGER, 2018, p. 106). In other words, the rote rehearsal of a song helps recall its inherent vocabulary for singing it by the book. On the other hand, "Elaborative rehearsal is more useful for teaching semantic information because it relies on creating meaning, and meaningful information is more memorable." (SPRENGER, 2018, p. 106).

Based on Sprenger, rote rehearsal of melody and words is bound to be primarily triggered by the while-reading-through-singing phase because the tasks are more closely related to the verbatim information of the lyrics. Elaborative rehearsal, however, is bound to be triggered by the post-reading-through-singing phase that deals with the world of inferences and connections of the text-based information EFL readers' prior knowledge. In closing, Sprenger postulates that:

Rehearsal allows permanent changes to take place in the brain, solidifying neural connections to aid transfer. If information can be stored in all of the memory pathways, then, it can be accessed through various memory cues. (2018, p. 125)

Inferred from Fredrickson's Broaden-and-Build Theory of Positive Emotions (1998, 2004, 2005), the melody may also spark positive emotions such as joy and serenity (FREDRICKSON, 2013). According to the theory, joy may be associated with action urges to get involved with other learners and build skills through experiential learning. Serenity may be associated with action urges of savoring and integrating the group and building resources such as new priorities and a sense of the self. These action urges and accrued resources are critical during the process of melody habituation since activities will involve interaction among students, especially among those who are shier and need the openness needed to experience music and *sing!*

The conclusion is that songs' automatized melody may serve as a retrieval cue for their inherent vocabulary, the vocabulary used exclusively to sing the songs as they are, and the vocabulary used in various contexts for different purposes. The more automatized melody and words become, the less their demand for the heightened WM focus of attention during retrieval, and the higher the attentional resources freed-up for the processing of novel information. Also, appreciation of melody broadens and builds cognition and thought-action repertoires critical for meaningful learning in the classroom environment, strengthening social bonds among students.

5.4.2 Phoneme-grapheme mapping automatization for fluent reading

Automatized low-level reading skills, such as mapping phonemes to graphemes, are also crucial for fluent reading for their amenability to the demands on WM. As stated by Anderson,

Skill learning usually proceeds from an effortful stage, which requires careful attention and conscious remembering and monitoring of individual steps to more fluid, less effortful performance, exhibiting what is referred to as automaticity. When a skill gradually achieves automaticity, it can usually be done with minimal attention, which is then freed up to be devoted to *other endeavors*. (2020, p. 148, my emphasis).

Singing in English can be done without developing EFL orthographic skills. By repeating what they hear, EFL learners more or less accurately may reproduce the pronunciation of words understanding some of them based on prior knowledge or having no clue as to what they are singing. The advantage of systematized reading in EFL through singing in the classroom thus gives EFL readers access to the composers' ideas through a standard code, writing, which allows for a more elaborate phonological representation of these ideas in memory. In agreement,

[...] beginner readers need time and experience to build up the structures that enable predictive, top-down processing in long-term memory. During the learning of reading, bottom-up processing is predominant, characterized as bottom-up, in a hierarchy of building knowledge of graphemes, morphemes, orthographic patterns, words, and expressions in their written and visual version, which through experience leads to the rapid discrimination characteristic of fluent readers. (GABRIEL; MORAIS; KOLINSKY, 2016, p. 73-74, my translation²⁹)

In that regard, one of the significant contributions of the practice of EFL reading through singing is that it enables the learning of word orthography and the automatization of low-level processes such as decoding, which includes the subprocesses of matching and recoding, and of literal comprehension, which comprises the subprocesses of lexical access and parsing (GAGNÉ *et al.*, 1993; TOMITCH, 2012). Automatizing low-level reading processes matters in singing because it frees up attentional resources in WM for processing the connotative meanings of words and verses characteristic of songs, allowing EFL readers to do *other endeavors* through top-down reading. The automatization allows readers to go into a deeper understanding of the song over the multiple meanings of single words and verses. What more,

Learning to read creates a new way of acquiring, retrieving, and storing information in memory, through the orthographic representation of words that connects to the language, allowing the reader to count on

²⁹ In the original: “[...] leitores aprendizes necessitam de tempo e experiência para construir na memória de longo prazo as estruturas que possibilitarão o processamento preditivo, top-down. Durante a aprendizagem da leitura, predomina o processamento caracterizado como bottom-up, num processo hierárquico de construção do conhecimento de grafemas, morfemas, padrões ortográficos, palavras e expressões em sua versão escrita, visual, que por meio da experiência acarreta na discriminação rápida, característica dos leitores fluentes.” (GABRIEL; MORAIS; KOLINSKY, 2016, p. 73-74).

two keys to access knowledge, retrievable through language. (GABRIEL; MORAIS; KOLINSKY, 2016, p. 76, my translation³⁰).

Taking that into account and recognizing the phonemic and graphemic differences of words in the English language for Brazilian Portuguese users, the process of grapheme-phoneme mapping becomes even more fundamental for automatizing low-level reading processes. A simple example would be the phoneme-grapheme mapping of the grapheme “a.” The grapheme, to a low proficient EFL reader, would be possibly mapped to its most common phoneme in Brazilian Portuguese, /a/. Nevertheless, in the English language, it could be mapped to phonemes such as /æ/ (i.e., cat), /ə/ (i.e., again), and /eɪ/ (i.e., face), for instance. On top of that, the comprehension of words sung in different accents through shortened articulations, contractions, and linking sounds may be facilitated by phoneme-grapheme mapping. That is because singers’ pronunciation nuances can be unveiled through visual grapheme evidence.

Otherwise stated, automatized phoneme-grapheme mapping makes the difference between speaking in real-time and reading. Whereas speakers count on a broader context to negotiate meanings, readers depend on a formal writing system to establish communication with a writer distant in space and time (GABRIEL; MORAIS; KOLINSKY, 2016). In that case, the writing system also enables EFL readers to grasp the meaning of composers’ lyrics, which become even more complex by the singers’ pronunciation.

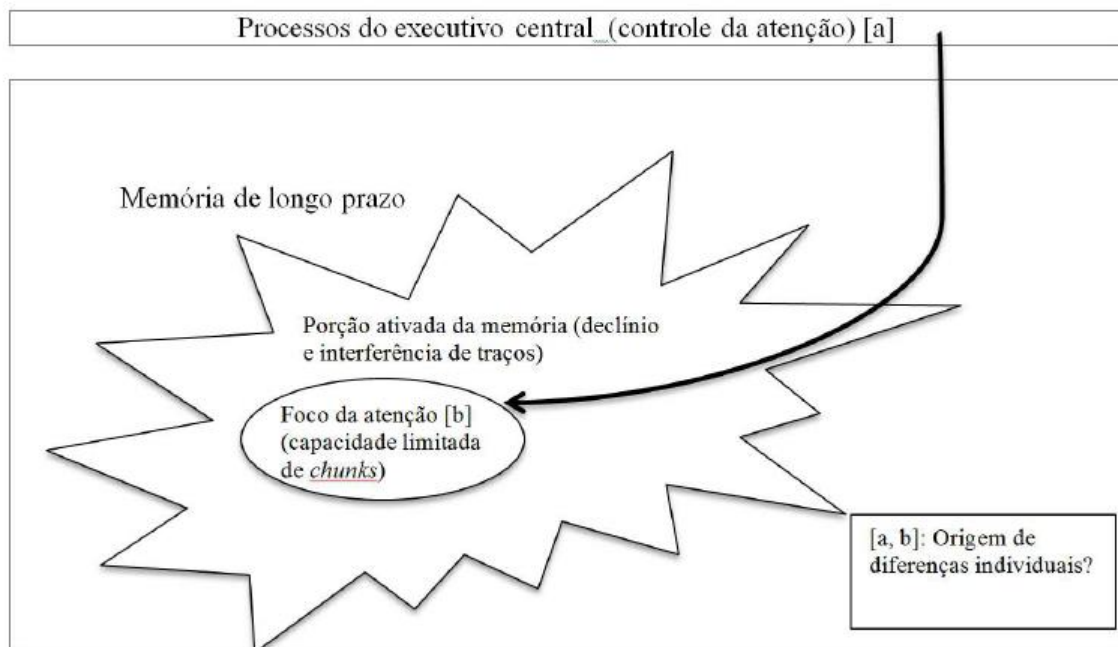
In conclusion, Gabriel, Morais, and Kolinsky (2016) state that it is through the automatization of low-level processes that memory can expand associations, build knowledge, and favor the formation of chunks that make all the difference in the amount of information that WM can retain or keep in an accessible state for quick access. The chapter discusses the topic of chunking in EFL reading through singing next.

5.4.3 Versification chunking

³⁰ In the original: “A aprendizagem da leitura cria uma nova forma de aquisição, recuperação e armazenamento de informações na memória, por meio da representação ortográfica das palavras que se conecta às redes da linguagem oral, permitindo que o leitor possa contar com duas chaves de acesso ao conhecimento recuperável por meio da linguagem.” (GABRIEL; MORAIS; KOLINSKY, 2016, p. 76).

As explained before, Cowan (1999) proposes that the focus of attention retains from 3 to 5 unrelated items at a time, a number that varies among researchers. However, chunks “[...] contain a larger set of information units, resulting from the (re)organization or (re) grouping of information into new units from familiar patterns stored in long-term memory.” (GABRIEL; MORAIS; KOLYNSKI, 2016, p. 75), as depicted in Figure 18:

Figure 18 - Adaptation of the representation of the theoretical model by Cowan to emphasize the chunking process (1988;1999)



Source: Gabriel, Morais, and Kolynski (2016, p. 75). Translation of the terms: (1) Memória de longo prazo: Long-term memory; (2) Porção ativada da memória (declínio e interferência de traços): Activated portion of memory (decline and interferences of traces); (3) Foco da atenção [b] (capacidade limitada de *chunks*): Focus of attention [b] (limited capacity of *chunks*); (4) [a,b]: Origem de diferenças individuais? : [a,b]: Origin of individual differences?

A classic example of chunking is that of one's ID number. It is more difficult to retrieve it by saying number by number; previous numbers may decay from WM, making the individual lose the sequence or forget where s/he stopped. Nevertheless, if the ID is retrieved into three sets of 3 numbers, there will be greater odds of succeeding in the task. The exact process may happen when a song is taught to EFL readers.

A song is a text with a beginning, middle, and end conveying a message. It is organized sequentially and even more helpful in verses containing a few words. This textual organization may facilitate teachers' EFL vocabulary teaching method.

On a past occasion, this doctoral researcher taught a group of adolescents the composition entitled Singing All Together by Thord Gummesson, Figure 19.

Figure 19 - Score of the piece Singing all together by Thord Gummesson

Singing all together

Thord Gummesson

① D E7 A7 D
Sing-ing all to-geth-er, sing-ing just for joy.
Sing-ing all to-geth-er, ev'-ry girl and boy.

②
Ev'-ry-bo-dy sing-ing a song, ev'-ry-bo-dy sing-ing a song,
ev'-ry-bo-dy sing all day long, ev'-ry-bo-dy sing all day long.

Ostinati D E7 A7 D

A La-la-la-la - la-la ...

B Pom po-pom pom ...

C Sing your song and sing it all day long. long.

D If you have a so-pran voice, you can just re-joice. joyce.

Source: <https://www.mariajesusmusica.com/inicio/singing-all-together-wix-con-partitura-y-acompanamiento>

The adapted composition lyrics contained short verses that the whole group studied. Afterward, distinct groups sang distinct parts separately and simultaneously following the composition arrangement. For the adolescents' adapted performance (available at <https://youtu.be/QzfcrcXNCK8>), group two started singing, group one continued, followed by groups three and four. The lyrics were:

Group 1:

Sing your song
And sing it all day long
Sing your song
And sing it long

Group 2:

Everybody is singing a song (2X)
Everybody sings all day long (2X)

Group 3:

Singing all together
Singing just for joy (2X)
Singing all together
Every girl and boy

Group 4

If you have a sopran voice
You can just rejoice (2X)

(GUMMESSON, THORD)

During the rehearsals, the three phases of reading pointed out above by Tomitch (2009) were similarly applied to allow for versification chunking. This process occurred before the song rehearsal, (i) in the pre-reading-through-singing phase, when essential elements of the lyrics meaning and melody were presented to arouse adolescents' curiosity; (ii) in the while-reading-through-singing phase, when the song was rehearsed several times to allow lyrics learning (i.e., versification chunking) and also tuning; and (iii) in the post-reading-through-singing phase, when it was discussed how valuable was having adolescents from different contexts, with their peculiarities, singing altogether in harmony to make art and to convey messages of hope to people.

Despite the most refined singing techniques used in this performance, compared to those used in the classroom, versification chunking was critical for the adolescents. It permitted them to reserve attentional resources to execute body movements and learn the composition's dynamics. This reserve allowed those adolescents to devote resources to other endeavors in that specific situation.

Building on Fredrickson's (1998, 2004, 2005) Broaden-and-Build Theory of Positive Emotions, two points will be underscored. To do that, let us first recap the study conducted by Rowe, Hirsh, and Anderson (2007), reviewed in Chapter II, page

44. The study found that participants in positive emotional states, relative to neutral, performed better at establishing conceptual links among lexical items in memory. Also, the study of Isen *et al.* (1985), page 44, found that participants feeling positive emotions, relative to neutral and negative ones, presented a more remarkable ability to perceive unusual, creative, and unique linguistic connections. The results match the Broaden hypothesis of Fredrickson that predicts more flexible and creative thinking under positive emotions. From this rationale, the following subsection proposes an attempted answer to Fredrickson and Branigan's question: "*Do they [positive emotions] increase working memory?*" (2005, p. 328).

5.4.4 The effect of positive emotions on WM focus of attention – a theoretically-based rationale

This chapter now proposes a theoretically-based answer to Fredrickson and Branigan's (2005) question: "*Do they [positive emotions] increase working memory?*" (p. 328). The proposed answer, however, is confined to the context of EFL reading through singing for teaching vocabulary learning. A better-informed and more comprehensive answer would derive from experimental studies using various triangulations testing hypotheses with various populations.

Based on the literature reviewed, the proposal is that mild positive emotions cause WM focus of attention to more broadly (i) capture external stimuli; (ii) retrieve information from LTM; and (iii) process and maintain information from both stimuli sources in real-time (i.e., the broaden-hypothesis, focus on the whole, *seeing the forest and connecting the relationship among its trees*). This conclusion, however, does not allow this doctoral researcher to propose that positive emotions increase WMC. It allows him to propose that EFL reading through singing triggers adolescent readers' WM focus of attention to more amply process and maintain exogenous and endogenous information needed for effective EFL vocabulary learning.

The corollary hypothesis this doctoral researcher proposes is that strong negative emotions cause WM focus of attention to more narrowly (i) capture external stimuli; (ii) retrieve information from LTM; and (iii) process and maintain information from both stimuli sources in real-time. (i.e., the narrow hypothesis, focus on details, *seeing some of the trees*). This conclusion also does not allow this doctoral researcher

to propose that negative emotions decrease WMC theoretically. It allows him to propose that strong negative emotions trigger adolescents' WM focus to more limitedly process and maintain exogenous and endogenous information needed for effective EFL vocabulary learning.

Both proposed answers to Fredrickson and Branigan also have emotional consequences. Chapter VII, Conclusions, Final Remarks, Limitations and Suggestions for Further Research and Pedagogical Implications, will report them.

5.5 CHAPTER V SUMMARY

The present chapter started by comparing WM as a window through which people can contemplate and create *a version of reality*. It adds that positive emotions, on the one hand, may broaden one's view of reality, increasing the focus of attention for exploring and building various types of resources, including intellectual resources. Negative emotions, on the other hand, may narrow the focus of attention to detail and poorer resource building. The chapter also uses the comparison to explain how positive emotions, as triggered by the practice of EFL reading through singing, possibly affect EFL vocabulary learning. Broadened WM focus of attention would be related to better EFL vocabulary learning for its broadened capture of sensorial information and better chunking of information. Narrowed WM focus of attention, as opposed to that, would be related to poorer vocabulary learning for its decreased capture of external stimuli and impoverished chunking. The chapter also reviewed the history behind the construct of WM and WMC, emphasizing the research of Miller, Galanter, and Pribram (1960), Baddeley and Hitch (1974), and more recently, Baddeley, Hitch, and Allen (2021). It was also incumbent on this chapter to justify why Cowan's (1988, 1999) Embedded Processes Model of Working Memory is among the theoretical pillars of this dissertation. Afterward, three final arguments were presented favoring the role of EFL reading through singing in vocabulary learning, which were: (a) Automatization of melody for vocabulary retrieval; (b) Phoneme-grapheme mapping automatization for fluent reading; and (c) Versification chunking. Having proposed reflections on the relationships among WM, positive emotions, and the effects of English as a foreign language reading through singing on vocabulary learning, the chapter proposed that positive and negative emotions increase and decrease the WM focus of attention to

broadened and narrowed functioning, respectively. The conclusions, however, were theoretical and confined to the context of EFL reading through singing for vocabulary learning. The next chapter will present the result of a quasi-experimental study devoted to designing a particular WM span test for adolescents: *The Reading Span Test For Adolescent Speakers of Brazilian Portuguese*.

6 MEASURING ADOLESCENTS' WORKING MEMORY CAPACITY: A VERSION OF THE READING SPAN TEST FOR SPEAKERS OF BRAZILIAN PORTUGUESE

[...] A arte de esquecer é parte fundamental de nossa sobrevivência, e talvez de nossa própria vida. Só ela nos permite seguir adiante no meio de tantas adversidades e perigos. Só ela nos permite voltar a sorrir depois da perda de um ser querido, sacudir a poeira, dar a volta por cima e sair caminhando de frente ao mundo. Só ela nos permite esquecer o efeito inebriante de uma vitória ou de uma conquista e voltar a ser o mesmo de todos os dias depois que passar a euforia correspondente, acreditar que somos Deus é um erro que se paga dolorosamente com o primeiro fracasso. Por último, há coisas que não podemos esquecer por mais que tentemos: aprendamos a conviver com elas, ou a extingui-las se forem penosas.³¹

(IZQUIERDO, 2010)

6.1 INTRODUCTION

This chapter first presents a brief introduction. It then outlines the constructs of working memory (WM) and working memory capacity (WMC) adopted for this study. Subsequently, it reviews studies on the assessment of WMC in experimental research in reading comprehension. Afterward, it raises the study's hypotheses and details its

³¹ “[...] The art of forgetting is a crucial part of our survival, and perhaps of our very life. Only it allows us to move forward in the midst of so many adversities and dangers. Only it allows us to smile again after the loss of a loved one, to shake off the dust, to turn things around, and to walk away facing the world. Only it allows us to forget the inebriating effect of a victory or an achievement and go back to being the same as every day after the corresponding euphoria has passed; believing that we are God is a mistake that is paid painfully with the first failure. Finally, there are things that we cannot forget no matter how hard we try: let us learn to live with them, or to extinguish them if they are painful.” (IZQUIERDO, 2010, my translation).

method. After that, the chapter presents the study's results, proposes a discussion on them, and elaborates on its pedagogical implications, limitations, and suggestions for further research. At last, a chapter summary closes the chapter.

Previous studies have extensively investigated the nature of individual differences in both L1 and L2³² reading comprehension. They have suggested that readers' ability to abstract ideas from texts is associated with (i) topic prior knowledge (BORGES; PEREIRA, 2018; GERHARDT; LEESER, 2007); (ii) the use of strategies and skills (DANIA, 2018; DO AMARAL; TORRES; TOMITCH, 2018; HAGEN; BRAASCH; BRÅTEN, 2014; MELLO, 2017); (iii) inferential processes (BARETTA; PEREIRA, 2018; BARTH *et al.*, 2015; NAHATAME, 2014; SEGERS; VERHOEVEN, 2016); (iv) vocabulary knowledge and processing (DE AZEVEDO; TOMITCH, 2019; LAUFER; AVIAD-LEVITZKY, 2017; NALOM; SOARES; CÁRNIO, 2015; NATION; COADY, 1988; SHEN, 2013); (v) motivation (CIROCKI; CAPAROSO, 2016; NAVARRO; ORELLANA; BALDWIN, 2018; SANTOS; MORAES; LIMA, 2018); and working memory capacity (ALPTEKIN; ERÇETIN, 2010; KING; JUST, 1991; MIYAKE; JUST; CARPENTER, 1994; RONDON, 2019). This chapter concerns the last factor listed above. Its objective is to present a three-month quasi-experimental study conducted in 2019 aimed at devising a tool for collecting adolescents' working memory capacity measures, *The Reading Span Test for Adolescent Speakers of Brazilian Portuguese* (RSTA). The measures obtained through the tool would be used for testing quantitative hypotheses correlating positive emotions, motivation in English as Foreign Language (EFL) reading, and WMC. The hypotheses, however, were proposed in the initial doctoral dissertation project written before the beginning of the COVID-19 Pandemic in 2020. Due to this unexpected event, no further data collection could be administered at the institution chosen, and thus, the test remains a proposal for future studies that intend to obtain WMC measures for correlational studies.

6.2 WORKING MEMORY AND WORKING MEMORY CAPACITY: DEFINING THE CONSTRUCTS

³² The terms second language (L2) and foreign language (FL) are being used interchangeably in this study.

Working memory (WM), broadly speaking, refers to the system responsible for the real-time manipulation and storage of information held in mind, considered necessary for accomplishing a wide variety of complex forms of thinking, such as reasoning, problem-solving, and decision-making. It regards a working space where a limited amount of information individuals are currently working on is maintained and processed for brief periods. According to the *Capacity-Constrained View of WM for language* (JUST; CARPENTER, 1992) adopted in this study, WM stores and manipulates sequential computations of linguistic forms to comprehend texts and spoken discourse. Just and Carpenter more precisely conceive the system “[] as the pool of operational resources that perform the symbolic computations and thereby generate the intermediate and final products.” (1992, p. 122). According to them, the operations performed by WM in language comprehension are processual, fueled by cognitive resources, and generate subproducts until a given task is fully accomplished.

Under the same view, working memory capacity (WMC) relates to the inherent limitation of the system that simultaneously carries out the processing and storage of linguistic computations involved in the accomplishment of the task. Accordant to Just and Carpenter, “[...] it can be expressed as the maximum amount of activation available in WM to support either of the two functions.” (1992, p. 123). Thus, activation is the commodity that allows for the execution and effectiveness of the operations executed by WM.

Following this reasoning, WM depends on the availability of activation to cyclically process and store orthographic, lexical, syntactic, semantic, and pragmatic information when it comes to reading comprehension tasks. Moreover, individual differences in WMC predict individual differences in reading performance once such capacity determines the extent to which textual elements can be mentally interrelated at a given time and inferentially integrated with information retrieved from long-term memory (LTM) (JUST; CARPENTER, 1992).

6.3 THE ASSESSMENT OF WORKING MEMORY CAPACITY IN EXPERIMENTAL RESEARCH ON READING COMPREHENSION

Researchers have developed different complex span tests whose measures have been considered good predictors of WMC, given their statistically significant correlations with measures reflecting various complex cognitive tasks, including reading comprehension. As explained by Rigatti *et al.* (2017), these tests involve the concurrent processing of input, such as sentences and mathematical operations, and storing some target items for posterior recall. As stated by Daneman and Carpenter (1980) and Just and Carpenter (1992), if the test's demands exceed the capacity of the system, the to-be-recalled items may be forgotten in two ways: first, by *displacement* when activation deallocates from the stored items to the processing or storage of additional incoming information; and second, by *decay*, when, due to high processing or storage demands, the system slows down, and the items lose their activation due to the passage of time. Thus, individuals who count on more activation to process the sets of operations and actively maintain their intermediate subproducts and final products also have a higher residual activation left for storing the to-be-recalled items. Because the processing and storage components compete for a shared-limited amount of activation that varies among individuals, the tests, which consider the number of items recalled as span measures, are believed to provide scores taken as indexes of WMC.

A highly recognized complex span test mentioned in the literature is the *Reading Span Test* (RST), developed by Daneman and Carpenter (1980). The test consists of a list of sixty general-knowledge unrelated sentences written in English, containing 13 to 16 words. The sentences, each ending with a different word, are organized in sets of different numbers, ranging from two (level one) to six (level five) (i.e., three sets of two sentences in level one up to three sets of six sentences in level five). Test takers are informed that they will be presented with sets of an increasing number of sentences and will have to read them aloud. They are also informed that immediately after reading the last sentence of each set, they will have to recall the last words of all previous sentences in the exact order they were presented. Test takers are also instructed to read each sentence at a normal pace but within an average limit of five seconds and with no pauses. This instruction is given to avoid participants' overt rehearsal of the to-be-recalled words. Participants' reading span measure is taken at the highest level that they succeed in correctly recalling the last words of two out of the three sets of sentences. For instance, if the test takers fail to accurately recall all last words of the three sets of sentences in level two (i.e., three sets of three sentences) but succeed in

recalling the words of at least two sets of sentences in the previous level, their reading span will be 2.0. Following this design, it is believed that, by requiring reading aloud, the test ensures real-time processing and active maintenance of the intermediate subproducts and final products necessary for comprehension to take place and that by requiring recall, it ensures storage.

Previous studies have assessed WMC using the RST and modified test versions. They have found significant correlations with measures related to different aspects of reading comprehension in L1 (DANEMAN; CARPENTER, 1983; DANEMAN; GREEN, 1986; JUST; CARPENTER, 1992; WATERS; CAPLAN, 1996; WATERS; CAPLAN; HILDEBRANDT, 1987), and also in L2 (ALPTEKIN; ERÇETIN, 2009, 2010; HARRINGTON; SAWYER, 1992).

A version of Daneman and Carpenter's (1980) RST in Brazilian Portuguese was devised by Tomitch in her doctoral study in 1995 and published in 2003b. Like the original, Tomitch's test consists of 60 sentences ranging from 13 to 17 words retrieved from popular Brazilian newspapers and magazines. One sentence contains 13 words; fourteen sentences contain 14; ten sentences contain 15; twenty sentences contain 16, and fifteen sentences contain 17 words. As in Daneman and Carpenter, the sentences are unrelated, and each one ends with a different word. The sentences' last words vary in the number of syllables: thirty-five sentences end with 3 syllables; nineteen with 4; five with 5; and one with 2 syllables. The sentences are organized in the same levels and sets as in the original RST. Tomitch's main criterion for the sentences' selection was their ecological validity, that is, their semantic relevance to readers and their syntax authenticity for real communication contexts. For Tomitch (2021), reading processing may be better guaranteed when the stimuli present meaningful information to readers.

Previous studies have also assessed WMC applying Tomitch's RST version and have found significant correlations with measures reflecting distinct aspects of reading comprehension in L1 (TOMITCH, 2003a, 2003b) and L2 (BAILER; TOMITCH; D'ELY, 2013; OLIVEIRA, 2016; PROCAILO, 2017; RONDON, 2019; WOELFER; TOMITCH, 2019).

Even though this RST version is already validated, Tomitch (2021) draws attention to the studies of Roscioli (2017) and Woelfer and Tomitch (2019). Participants of both studies, all of them adolescents, presented considerable difficulty reading some of the test sentences. Interestingly, this behavior persisted in Roscioli's study, even

using a version of the test already adapted to adolescents by Bailer (2011). Furthermore, Woelfer and Tomitch (2019), even having found a moderate to strong association between the inferential comprehension of cartoons and English as a foreign language (EFL) reading proficiency ($\chi^2 (1) = 9.4, p = .002$), only found a weak association between the inferential comprehension of cartoons and WMC ($\chi^2 (1) = 4.57, p = .033$), and a weak correlation between WMC and EFL reading proficiency ($r_s (58) = .321, p = .012$, two-tailed). These findings suggest that Tomitch's RST, devised initially to collect WMC measures from adults, may not be sensitive enough to simultaneously capture adolescents' real-time capacity to process and store information. Adolescents' partial lack of familiarity with the vocabulary of the sentences may have led them to difficulties executing minimal computations inherent to basic reading processes (i.e., matching, recoding, lexical access, and parsing) (GAGNÉ; YEKOVICH; YEKOWICH, 1993). Having the system slowed down while executing these computations, the to-be-recalled words may have lost activation and decayed due to the passage of time. This possible cognitive overload may have interfered with participants' performances and created ideal conditions for the occurrence of a floor effect in the results.

Therefore, this study aims to propose an RST consisting of sentences whose selection considers the age and, thus, adolescents' cognitive development stage. It is essential to acknowledge that because no specific tool for controlling cognitive development was used, the assumption of it is solely based on age. The test design is expected to provide more accurate WMC measures of samples at this age. Working memory capacity measures were strictly and leniently scored out and obtained utilizing Tomitch's version of the RST, and the RSTA proposed in this study. Reading comprehension measures were obtained through open-ended and multiple-choice questions.

6.4 HYPOTHESES

The previous rationale gave support to raise the subsequent hypotheses (Hs):

H1: In comparing the span tests, there is a higher positive correlation between WMC, when strictly measured using the Reading Span Test for Adolescents Speakers of Brazilian Portuguese, and reading comprehension, measured through open-ended questions.

H2: In comparing the span tests, there is a higher positive correlation between WMC, when strictly measured using the Reading Span Test for Adolescents Speakers of Brazilian Portuguese, and reading comprehension, measured through multiple-choice questions.

H3: In comparing span tests, there is a higher positive correlation between WMC, when leniently measured using the Reading Span Test for Adolescents Speakers of Brazilian Portuguese, and reading comprehension, measured through open-ended questions.

H4: In comparing the span tests, there is a higher correlation between WMC, when leniently measured using the Reading Span Test for Adolescents Speakers of Brazilian Portuguese, and reading comprehension, measured through multiple-choice questions.

H5: There is a positive, although weak correlation between the WMC measures obtained using the Reading Span Test, version of Tomitch (2003b), and the WMC measures obtained using the Reading Span Test for Adolescents Speakers of Brazilian Portuguese.

6.5 METHOD

This section describes the method adopted in this study in seven subsections. The subsections provide details about participants, materials, instruments, data collection procedures, data analysis procedures, the pilot study, and the study's approval by the Ethics Review Board.

6.5.1 Participants

Participants were Brazilian public school students ($N = 47$) aged 12-14 ($M = 12.95$, $SD = 0.82$) recruited through convenience sampling and enrolled in the 7th, 8th, and 9th grades.

6.5.2 Materials

The materials comprised two expository texts selected from two different textbooks: one of them was on science, originally contained 308 words, and was entitled *O controle da temperatura corporal*³³ (DO CANTO; CANTO, 2009) (APPENDIX B). The other was on geography, originally contained 325 words, and was entitled *Antártica: imenso laboratório de pesquisas*³⁴ (BOLIGIAN *et al.*, 2009) (APPENDIX C).

The criterion for selecting the texts was their appropriateness to the age, which was assumed to represent the participants' cognitive development stage. To meet this criterion, both texts were selected from textbooks submitted to a process of evaluation and approval of didactic works by the National Program of Books and Didactic Materials in Brazil (*Programa Nacional do Livro e do Material Didático - PNLD*). This evaluation process is carried out by educators and researchers with expertise in the areas of knowledge inherent to the materials analyzed. Materials meeting the criterion adopted for the texts' selection in this study are approved and distributed to Brazilian public schools (BRASIL, 2018).

Furthermore, texts complexity was examined using the *Flesch Index (F)* formula adapted to Portuguese by Martins *et al.* (1996). The index is based on the number of words in the sentences and the number of letters or syllables per word. The *Flesch Index* classifies texts complexity as *very easy* ($F = 100-75$), indicated to students in the initial grades of elementary school; as *easy* ($F = 75-50$), indicated to students in the final grades of elementary school; as *difficult* ($F=50-25$), indicated to high-school students, and as *very difficult* ($F= 25-0$), indicated to university students (MESQUITA, 2014; SOUSA; HÜBNER, 2015). To obtain the *Flesch* indices, the two texts were submitted to analyses in the *NILC Metrix*. NILC Metrix is an online tool that groups the metrics developed in the *Coh-Metrix-Port* and *Coh-Metrix-Dementia Projects*, and also

³³ Body temperature control.

³⁴ Antarctica: an immense research laboratory.

some psycholinguistic metrics developed at *Núcleo Interinstitucional de Linguística Computacional (NILC)* from 2016 to 2018, accessible on the website <http://fw.nilc.icmc.usp.br:23380/simpligo-ranking> (ALUÍSIO *et al.*, 2010; ALUÍSIO; CUNHA; SCARTON, 2016; SANTOS *et al.*, 2017; SCARTON; ALUÍSIO, 2010; SCARTON; GASPERIN; ALUÍSIO, 2010).

The analyses showed that both texts presented indices slightly differing from those expected for the population investigated in this study: ($F = 41.01$) for the science text (APPENDIX D) and ($F=31.18$) for the geography text (APPENDIX E). Considering these outcomes, it was decided to simplify the texts, and the resulting indices came out as follows: ($F= 51.70$) for the science text, reduced to 262 words, and ($F= 50.19$) (APPENDIX F) for the geography text, reduced to 277 words (APPENDIX G).

6.5.3 Instruments

The study designed four instruments for data collection. Two of them were applied to collect WM span measures: (a) the version of the *Reading Span Test* (DANEMAN; CARPENTER, 1980), adapted to Brazilian Portuguese by Tomitch (2003b), as already described (APPENDIX H); and (b) the *Reading Span Test for Adolescents Speakers of Brazilian Portuguese*, proposed in this study (APPENDIX I). The other two instruments were used to collect reading comprehension measures: (a) an open-ended-questions task (APPENDICES J and K); and (b) a multiple-choice task (APPENDICES L and M).

The *Reading Span Test for Adolescents Speakers of Brazilian Portuguese* (henceforth, Adolescents' version) matched Tomitch's RST test (henceforth Tomitch's version) in terms of sentence length (i.e., number of words), the lengths of the final words (i.e., number of syllables), and organization (i.e., the number of levels and sets, the sequence of sentences considering the number of words, and the sequence of sentences considering the number of syllables of the final words). Fourteen original sentences of the Adolescent's version (23,3%) were slightly modified to match the tests. Their main ideas were maintained, however. Based on the conclusions of Woelfer and Tomitch (2019) and Roscioli (2017) previously mentioned, the sentence selection criterion differed from Tomitch RST (2003b). Thirty were expository sentences from twenty textbooks of different areas of knowledge, such as

mathematics, history, and arts. These textbooks corresponded to the age and grade level of the sample investigated. The other thirty sentences were narrative sentences retrieved from twenty-one adolescent literary books. As well as for the reading materials, all textbooks and literary books consulted were priorly analyzed and approved by the National Program of Books and Didactic Materials in Brazil. The approval of the books is only issued if their terminology and language are appropriate to the student's age and, thus, stage of cognitive development (BRASIL, 2018). Besides that, the criteria of sentence atemporality and ecological validity suggested for the construction, application, and interpretation of the instruments' results for measuring the WM capacity were adopted, as suggested by Tomitch (2021). The criterion of atemporality, according to the researcher, ensures the applicability of the test across time once the sentences remain comprehensible regardless of specific contextual facts. Its replicability is fundamental for its validation. The criterion of ecological validity better guarantees the meaningfulness of the sentences, making them more prone to be processed by participants. Besides being found in the abovementioned appendices, the sentences of Tomitch's and the Adolescent's version and their group arrangements for the strict and lenient conditions are also available at <https://git.io/Jv7PL>.

The *open-ended-questions task* contained ten questions elaborated according to Pearson and Johnson's (1978) taxonomy for comprehension tasks. Five were *textually-explicit questions*, and the other five were *textually-implicit questions*³⁵.

The *multiple-choice task* contained ten questions with five alternatives each, being only one correct. This task was also designed according to Pearson and Johnson's taxonomy. As well as in the open-ended-questions task, the multiple-choice task also comprised five textually-explicit and five textually-implicit questions. Even though this taxonomy was not created initially to construct multiple-choice tasks, as in Alptekin and Erçetin (2009), its very same principles were applied to elaborate on the questions and the alternatives given.

6.5.4 Procedures for Data Collection

³⁵ Textually-explicit questions demand the reader's recall of verbatim information from the text. Textually-implicit questions demand the reader's generation of text inferences without counting on explicit language cues from the text (PEARSON; JOHNSON, 1978).

Four individual sessions with each participant were necessary to collect the WM span scores (i.e., 236 individual sessions), and ten joint sessions were needed to collect the reading comprehension scores (pilot study sessions included) (scores are shown in APPENDIX N). The data collection lasted three months and was entirely conducted in Portuguese, the participants' native language

Tomitch's (2003b) and the Adolescents' version of the test were applied twice each, in two different modes to be explained later, in the four initial data collection sessions. A counterbalancing design was used to reduce test order effects. Additionally, two weeks separated the application of each span test to reduce retest effects.

All participants received five standard instructions: (1) to read the sentences out loud at their own pace and with no pauses as soon as the experimenter projected them on the computer screen; (2) to pay attention to meaning while reading; (3) to memorize the last word of each sentence since they would have to be recalled at the end of each set; (4) to read the following sentence as soon as the experimenter projected it; and (5), to say the last words out loud immediately after having finished reading each set so as the experimenter could fill in participant's forms. According to Friedman and Miyake (2005), the two final instructions aim to avoid participants' use of idiosyncratic strategies for recall, such as overt rehearsal. Before starting the test, familiarization sessions were conducted until participants could elucidate their doubts.

Most studies collect span measures in only one session, and participants are instructed to recall the words in the exact order they were presented. Subsequently, researchers may apply different scoring methods for data analysis. Two commonly used scoring methods, which will be briefly introduced and more fully explained in the next session, are the *strict scoring method* and the *lenient scoring method* (FRIEDMAN; MIYAKE, 2005). For the current discussion, it is enough to summarize that in the strict scoring method, only words recalled in the exact order are considered correct and count in the participant's final score. In the lenient scoring method, words are considered correct and count in the participant's final score regardless of recall order.

Here, it is crucial to make a point. According to the instruction given in the study by Friedman and Miyake (2005, p. 583), "[...] when orally recalling the sentence-final words, the participants were to try to recall them in order, or at least, not to say the last word first." In their study, data was collected in a unique session. Even though the

effort to maintain the exact order is required, in the lenient scoring method, participants' final scores are determined by the total number of words recalled regardless of recall order, as explained above. That being the case, it seems pointless to ask participants to make an effort to maintain serial order when the test outcomes are leniently scored out.

On top of that, participants' differences in attentional control to recall the words in the exact order may end up blurred in comparing the two scoring methods. Because attentional control is considered an executive and a resource-consuming function of WM (BADDELEY, 2012, 2017; COWAN, 1999; ENGLE; KANE; TUHOLSKI, 1999), it was concluded that data in the present study should more discretely reflect the extent to which attentional control to word order recall would determine participants' WM spans. Also, this doctoral researcher wanted to check whether attention to order would play a significant role in the correlations between WMC and reading comprehension. To do that, participants were explicitly instructed to recall the words in the exact order in one condition and any order in the other in both span tests; besides applying strict and lenient scoring methods, it was also designed strict and lenient modes of application for the test.

The *strict mode* followed the design of experiment 1 by Daneman and Carpenter (1980). As already mentioned, participants in this condition were to recall the last words of the sentences in the exact order presented. The test would terminate at the highest level in which the participant succeeded in recalling the last words of two out of three sets of sentences. However, it was decided that the test would only finish when the participant failed to recall the expected words in two subsequent levels. As suggested by Tomitch (2003b), participants' anxiety at the beginning of the test may be detrimental to their performances, and as the test continues, that feeling may be overcome, and they can succeed again. Tomitch's suggestion matches the narrow hypotheses of the Broaden-and-Build Theory of Positive Emotions (FREDRICKSON; BRANIGAN, 2005) described in Chapter III: participants' performance may be affected by fear of failure in the test, an emotion that may produce resource-consuming thoughts. Finally, participants were told that the test would start with three sets of two sentences and that each subsequent level would contain an additional sentence in each set.

The *lenient mode* applied was based on the designs of experiment 2 by Daneman and Carpenter (1980) and the study of Turner and Engle (1989). As in those

studies, participants were to recall the last words of the sentences in any order; however, as in Daneman and Carpenter, (1983) and Friedman and Miyake (2005), they should not say the last words in the sets first. When that occurred, the experimenter requested participants to repeat that word after recalling the other words. The word only counted if recalled after the request. Additionally, instead of organizing the sentences in levels of increasing number (i.e., three sets of 2 sentences up to three sets of 6 sentences), the order of the levels was randomized to intermix the ease and difficulty of the test (i.e., three sets of 2 sentences, then three sets of 6 sentences, then three sets of 3, for instance). According to Friedman and Miyake (2005), this procedure allows low-ability participants to succeed at different test points, not only at lower levels. For the researchers, successive failures at higher levels can be a frustrating experience for these individuals, an emotional impact this doctoral researcher decided to avoid in participants. This procedure also matches The Broaden-and-Build Theory concerning alleviating strong negative emotions through the test: if a participant fails on one part but succeeds in another, their anxiety may be leveraged, hindering the narrowing effect on processing. The test only terminated when participants read all sentences of all levels.

The *open-ended questions and multiple-choice tasks* were applied in the fifth data collection session (participants were divided into ten small groups). Half of the groups read the science text and answered the open-ended-questions task. After ten minutes, they read the geography text and answered the multiple-choice task. They had four minutes to read each text and six minutes to answer each reading comprehension task. Before reading the texts, participants were informed about the reading comprehension tasks they would have to do afterward. Before doing the comprehension tasks, they were instructed not to guess any of the answers. Instead, they should leave them unanswered. A counterbalancing design was adopted to reduce test order effects; that is, the other half of the groups performed the steps above described in the reversed order. The groups had no contact with each other between sessions. The exact instructions given to participants in the main study are found in APPENDIX O.

6.5.5 Procedures for Data Analysis

All data were quantitatively analyzed. Details on the procedures adopted will follow.

Data obtained through Tomitch's test version (2003b) and the Adolescents' version were analyzed using the *strict scoring method*, and the *lenient scoring method* (FRIEDMAN; MIYAKE, 2005), as mentioned in the previous section.

In the *strict scoring method*, also known as the *truncated span scoring method*, participants' WM spans were determined by the highest level at which they recalled the final words of two out of the three sets in the exact order they were presented (DANEMAN; CARPENTER, 1980). For that to be possible, they had to have recalled all final words of all previous levels following the same criterion. As in experiment 2 by Daneman and Carpenter (1980), and the study of Tomitch (2003b), participants were given a credit of 0.5 when they recalled one set at a particular level. For instance, if the participant correctly recalled all final words of the sets in level two (i.e., three sets of 3 sentences) and the three final words of one set in level three (i.e., three sets of 4 sentences), they were attributed span 3.5. As put before, the strict scoring method is advantageous for its attentional demand for maintaining the correct order of the final words. It allows researchers to discriminate individual differences more precisely regarding executive attentional control. The maximum possible score was 6.

In the *lenient scoring method*, also known as the *total words scoring method*, participants' WM spans were determined by the total number of words recalled across all levels, regardless of recall order. For instance, if a participant recalled ten out of fifteen words at level four (i.e., three sets of 5 sentences), they would be scored 10. According to Friedman and Miyake (2005, p. 582),

[...] because this score included words recalled from a set even if the other words in that set were not recalled, it picked up differences between individuals who could recall some words from each set and individuals who forgot most of the words in the set.

Additionally, this scoring method guarantees variations within the two span tests to be considered, increasing participants' span measures reliability. As pointed out by Towse and Hitch (1995), Towse, Hitch, and Hutton (1998, 2002), and Conway *et al.* (2005), one of the variations within tests is sentence length. Sentences in both span tests of the present study vary in length and are randomly distributed across the five levels. That way, levels composed of sets with longer sentences may influence or even

determine participants' span threshold, thus decreasing the number of final words recalled. Levels composed of sets with shorter sentences, on the other hand, may create the opposite effect, allowing even low spans to reach their span threshold later in the test. Having that in mind, the lenient scoring method enables researchers to obtain data that more precisely discriminate participants' differences in terms of WMC since all of them are exposed to the whole stimulus and all its internal variations. The maximum possible score was 60.

Data obtained through the *open-ended-questions task* were submitted to a blinded-interrater evaluation. The raters were two Ph.D. students, including this doctoral researcher, and one MA student, all from language studies. Interrater reliability was high ($\alpha = .81$), meaning that the reliability degree reflected an excellent level of homogeneity among the raters' evaluations.

Also, the weighting attributed to the answers given to the textually-implicit questions ($x = 1,33$) and the weighting attributed to the answers given to the textually-explicit questions ($y = 0,67$) as differentiated, following the rounding criterion for two decimal places. The following system of equations determined the weightings:

$$\begin{cases} 5x + 5y = 10 \\ x = 2y \end{cases}$$

Even being a subjective decision, it was decided to apply different weightings to the two types of answers because it considered their differences in cognitive demands imposed on readers. Whereas textually-implicit questions demand the generation of text inferences without the support of textual clues, textually-explicit questions are limited to demanding the recall of verbatim information counting on such clues (PEARSON; JOHNSON, 1978). Even though textually-implicit answers do not necessarily involve complex inferential processing, this doctoral researcher infers that they should be attributed higher weighting since readers must generate logical or pragmatic inferences and not only recall exact information found on the surface of the text. The maximum possible score for the open-ended-questions task was 10.

Data obtained employing the *multiple-choice-questions task* were submitted to the system of equations described above for the same reasons already mentioned. The maximum possible score for the task was also 10.

6.5.6 Pilot Study

The pilot study participants were Brazilian public-school students ($N = 12$) aged 12-14 ($M = 13$, $SD = 0.81$), recruited through convenience sampling, and enrolled in the 7th, 8th, and 9th grades. The pilot study helped to test the instructions, determine the timing for reading the texts and performing the tasks, and verify the possible effect of topic prior knowledge on participants' performances in the reading comprehension tasks (APPENDICES P and Q).

Six participants were instructed to spend the time they considered necessary to read the texts to perform some reading comprehension tasks to check timing. They were told they could not consult the texts while doing them. Concerning the reading comprehension tasks, participants were instructed to spend the time they considered necessary to answer the items based on information they could recall from the reading materials or on inferences they could generate based on them. They were also strongly advised to leave the items they did not know unanswered to control for guessing effects.

Besides that, it was decided to control for participants' topic prior knowledge, as mentioned before. Previous research has shown that topic prior knowledge plays a significant effect on readers' performances and that such control should be taken into consideration in studies and at schools (MILLER; KEENAN, 2009; RECHT; LESLIE, 1988; SPILICH *et al.*, 1979). Especially for poor readers, topic prior knowledge may be strategically used to compensate for their difficulties in executing lower-level reading processes (PRIEBE; KEENAN; MILLER, 2012; SOUSA; HÜBNER, 2015). Thus, without having consulted the reading materials, the other six pilot study participants were instructed to perform the comprehension tasks based on knowledge acquired in out or in-school contexts. Again, participants were strongly advised not to guess the answers. This group equated to 12.7% of the total number of the main study participants. Results showed that all participants could answer questions 5 and 8 of the open-ended-questions task. The questions were replaced. Besides that, results showed that two participants were able to answer questions 1, 2, and 3, three participants questions 3, 5, and 7, and four participants the question 9 of the multiple-choice task. Based on that, these questions were replaced, and two additional alternatives were added to all questions to increase their difficulty level (the original ones had three alternatives). In a new session, the new open-ended and multiple-choice questions were no longer correctly answered by any participant. The exact instructions given to the pilot study are found in APPENDIX R.

6.5.7 Ethics Review Board

The Ethics Review Board of Federal University of Santa Catarina approved this study project, issued on August 8th, 2019, under the number 17696819.7.0000.0121. The approval complies with the requirements of Resolutions 466/12 and 510/16 on ethics in research with human beings in Brazil. All participants, parents, and guardians signed consent forms before data collection (APPENDICES S to V).

6.6 RESULTS

This session initially presents descriptive statistics, namely the results of analyses of internal reliability, normality of data distributions, and the correlations between the two reading comprehension measures. Then, it presents the hypotheses testing.

6.7 INTERNAL RELIABILITY

Cronbach's alpha was used to test the internal consistency of the instruments. Table 2 shows that the value of the standard alpha for all variables is above .7, which indicates high reliability.

Table 2 - Cronbach's alpha values of the instruments.

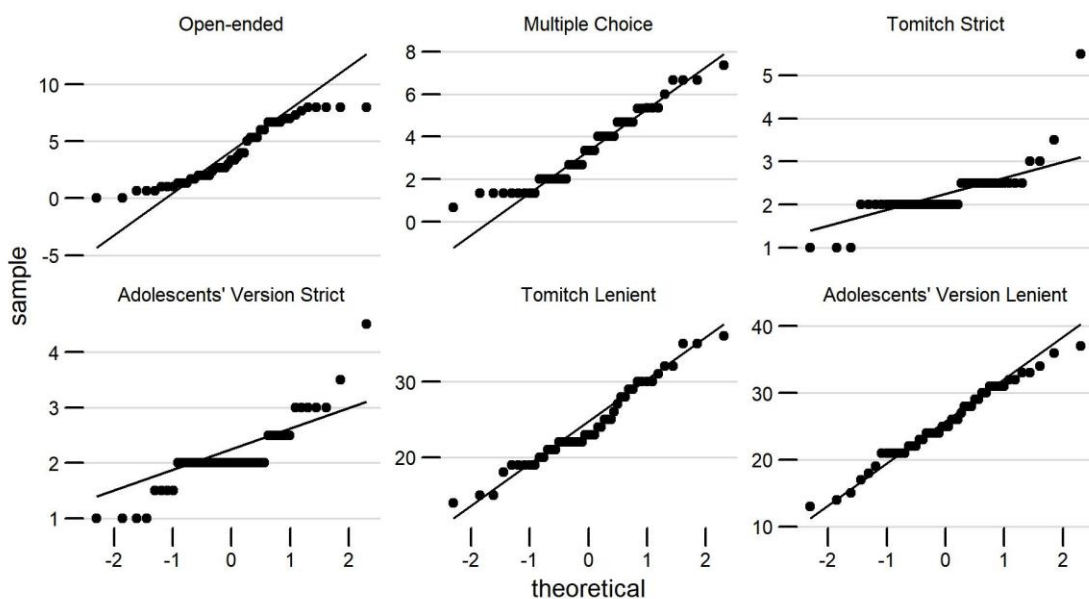
Test	Standard Alpha
Open-ended	.81
Multiple Choice	.83
Tomitch Strict	.79
Adolescents' Version Strict	.75
Tomitch Lenient	.79
Adolescents' Version Lenient	.74

Source: Created by the author of this study.

6.8 ANALYSIS OF NORMALITY OF DISTRIBUTIONS

As depicted in Figure 20, the inspection of normal QQ-plots shows that only data from the lenient measures do not show observable deviation from normality. The Shapiro-Wilk Normality Test (Table 2) corroborates this result.

Figure 20 - Normal quantile-quantile plots of the distributions of scores.



Source: Created by the author of this study using the Ggplot2 Package (version 3.3.0) of R Programming Language (version 3.5.1).

Table 3 - P-values of the Shapiro-Wilk Normality Test.

Test	p-value
Open-ended	.002*
Multiple Choice	.014*
Tomitch Strict	< .001*
Adolescents' Version Strict	< .001*
Tomitch Lenient	.129
Adolescents' Version Lenient	.739

Note: Statistically significant p-values (*) indicate a non-normal distribution.

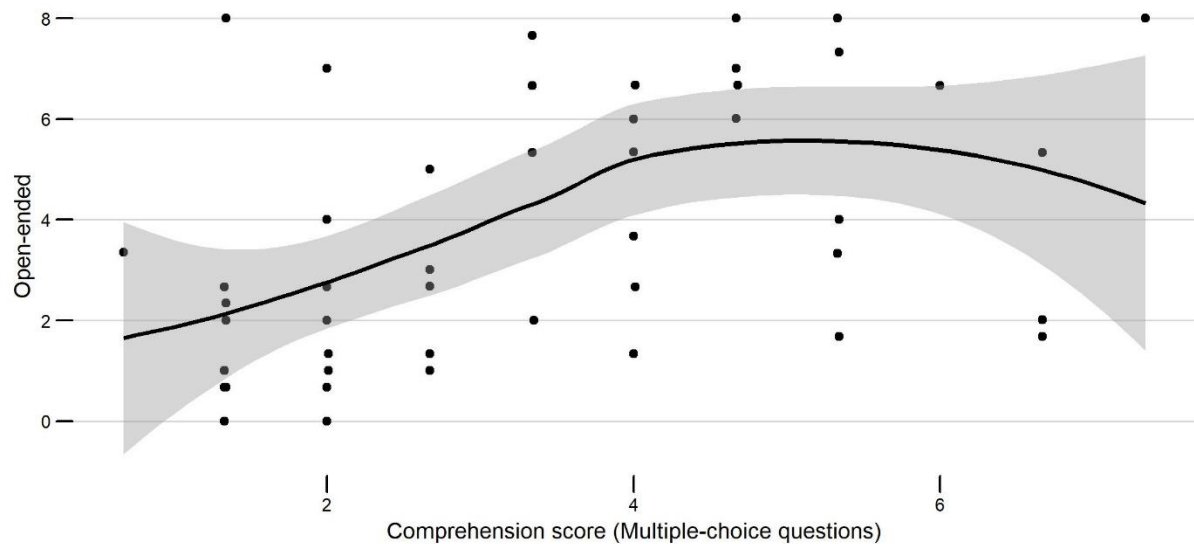
Source: Created by the author of this study.

The deviances of normality were expected for the strict measures because their result is ordinal and not continuous. On the other hand, Lenient measures result in continuous variables that can be modeled by a normal distribution, as reported by Friedman and Miyake (2005, p. 584). For this reason and considering that the result from open-ended questions also deviates from normality, Kendall's tau measure of a monotonic relationship was used to test the correlations.

6.9 CORRELATIONS BETWEEN THE TWO READING COMPREHENSION MEASURES

Since two different measures of reading comprehension were used, it is necessary to check to which extent they correlate to test the assumption that they measure the same construct. Kendall's tau is .36 for this correlation, a moderate positive statistically significant ($p < .001$) correlation that indicates that scores from both tasks measure the same constructs or at least constructs that share some similarity. Since the correlation was not strong, it can be assumed that the tasks measure different aspects of reading comprehension, as expected.

Figure 21 - Correlation between scores from Multiple-choice and Open-ended questions.

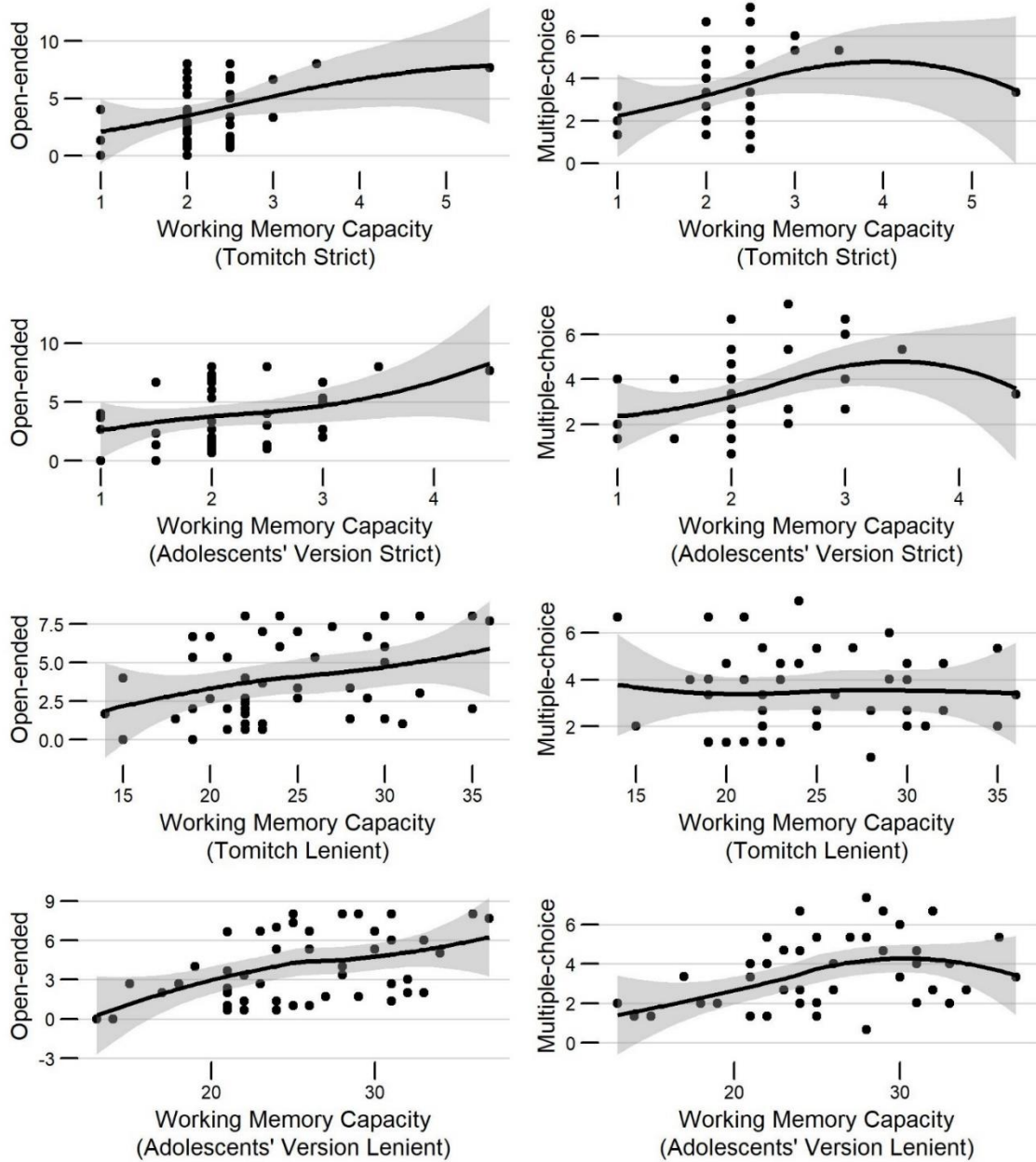


Source: Created by the author of this study using the Ggplot2 Package (version 3.3.0) of R Programming Language (version 3.5.1).

6.9.1 Hypotheses Testing

Figure 22 shows the correlations analyzed to test the hypotheses. Concerning the correlation between WMC measured strictly with Tomitch's version and open-ended question scores, Kendall's tau is .20, which implies a weak positive correlation between the variables. The correlation is statistically significant with $p = .043$ (all the reported p -values are for one-tailed correlation). In contrast, the correlation between the identical WMC scores and multiple-choice questions is .18, a weak positive, not statistically significant correlation ($p = .066$). Scores from the Adolescents' version, also strictly measured, behaved oppositely. The correlation between open-ended question scores was not statistically significant ($\tau = .16$, $p = .074$), while with multiple-choice question scores was a moderate statistically significant positive correlation ($\tau = .31$, $p = .003$). Considering the leniently measured WMC scores, Tomitch's version correlated statistically significantly with open-ended score questions but not multiple-choice scores, with correlations of .22 ($p = .016$) and .04 ($p = .342$), respectively. In contrast, the correlations of the Adolescents' version were statistically significant with both types of questions, with $\tau = .29$ ($p = .002$) with open-ended and $\tau = .31$ ($p = .002$) with multiple-choice question scores.

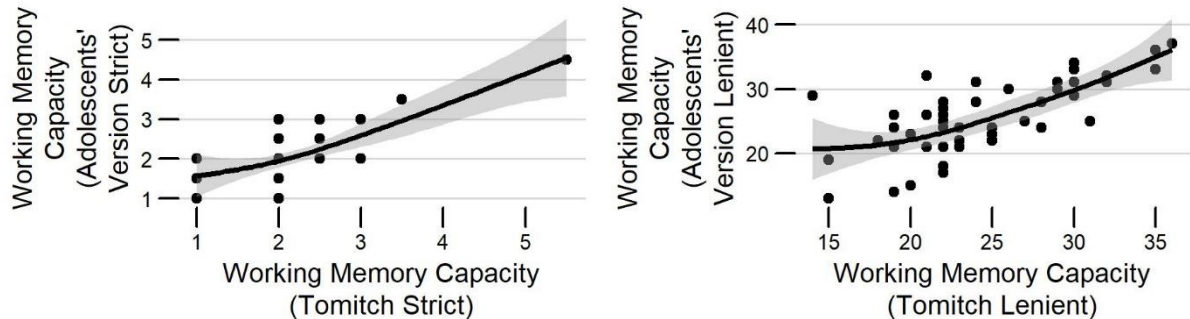
Figure 22 - Correlations between Working Memory Capacity and reading comprehension.



Source: Created by the author of this study using the Ggplot2 Package (version 3.3.0) of R Programming Language (version 3.5.1).

The correlations between scores from both versions of the Reading Span Test, Tomitch’s and the Adolescents’ version, considering both the strict and lenient scoring methods, were .39 ($p = .001$) and .53 ($p < .001$), respectively. Figure 23 shows these positive correlations.

Figure 23 - Correlations between scores from Tomitch’s and the Adolescents’ versions.



Source: Created by the author of this study using the Ggplot2 Package (version 3.3.0) of R Programming Language (version 3.5.1).

6.10 DISCUSSION

Table 4 summarizes the correlations reported previously. Hypothesis 1 predicts a higher positive correlation between strictly measured scores from the Adolescents’ version and open-ended questions than Tomitch’s version. However, the correlation from Tomitch’s version was higher, so the data do not support this hypothesis. Hypothesis 2 also predicts a higher correlation with strictly measured scores from the Adolescents’ version but with multiple-choice questions, and this was observed. Hypothesis 3 makes the identical prediction with leniently measured scores from the Adolescents’ version and open-ended questions, and this was also observed. Likewise, Hypothesis 4 makes the exact prediction as the previous one but with multiple-choice questions, which was also observed. Thus, Hypotheses 2, 3, and 4 are supported by the data.

Table 4 - Summary of correlations.

	Tomitch Strict	RSTA Strict	Tomitch Lenient	RSTA Lenient	Open-ended
Open-ended	.20*	.16	.22*	.29*	—
Multiple-choice	.18	.31*	.04	.31*	.36*

Note: The asterisk indicates statistically significant correlations at $\alpha = .05$.

Source: Created by the author of this study.

Hypothesis 5 predicts a weak positive correlation between WMC scores from Tomitch's and the Adolescents' versions. As already reported, there is a positive correlation between scores from the two versions, considering both the strict and lenient measures, with $\tau = .39$ and $\tau = .53$, respectively. However, these correlations cannot be considered weak considering Cohen's convention (see HEMPHILL, 2003, for a discussion about this convention).

Acknowledging that correlational studies show the magnitude and direction of the relationship between two variables, and not cause-effect relationships, results, in general, indicate that the Adolescents' version of the test seems to be an appropriate instrument to obtain WMC measures from the target population.

In sum, Kendall's rank correlations are statistically significant for the Adolescents' version in three conditions: (1) strict/multiple-choice questions, $\tau = .31$ (moderate); (2) lenient/open-ended questions, $\tau = .29$ (weak); and (3) lenient/multiple-choice questions, $\tau = .31$ (moderate). Nevertheless, the correlation is insignificant in the strict/open-ended question condition, $\tau = .16$ (weak).

Regarding Tomitch's RST version, Kendall's rank correlations were statistically significant in two conditions: (1) strict/open-ended questions, $\tau = .20$ (weak); and (2) lenient/open-ended questions, $\tau = .22$ (weak). However, correlations were not significant in the other two conditions: (1) strict/multiple-choice questions, $\tau = .18$ (weak); and (2) lenient/multiple-choice questions, $\tau = .04$ (negligible). As expected, all correlations are positive.

The scenario shows that the scores of the Adolescents' version correlate better with scores obtained through multiple-choice questions. Importantly, correlations in both conditions, strict and lenient, are both moderately positive and statistically significant, $\tau = .31$. Nonetheless, when leniently applied and scored out, the Adolescents' version also has its measures significantly correlated with scores obtained using open-ended questions, $\tau = .29$.

In the opposite direction, the results show that Tomitch's RST version correlates better with scores obtained through open-ended questions. However, correlations in both conditions, strict and lenient, even being significant, are just positively weak, $\tau = .20$ and $\tau = .22$, respectively. Also, the difference between Tomitch's RST and the Adolescents' version correlations in the strict/open-ended question condition is not large, $\tau = .20$ and $\tau = .16$, respectively. The approximate correlations may imply similarity in the efficiency of the two tests to measure variations within this same

condition. Additionally, the correlation with Tomitch's version was slightly weaker than the one with the Adolescents' version in the lenient/open-ended question condition: $\tau = .22$ and $\tau = .29$, respectively. Nevertheless, when it comes to multiple-choice questions, it is possible to observe more accentuated differences between the correlations of Tomitch's and the Adolescents' in both the strict, $\tau = .18$ and $\tau = .31$, and the lenient condition, $\tau = .04$ and $\tau = .31$, respectively. Finally, and as already reported, correlations with Tomitch's version are not significant in any of the two multiple-choice conditions, being even negligibly positive in the condition of the lenient/multiple-choice question.

Altogether, results show that correlations from WM leniently measured scores with open-ended question scores are higher with $\tau = .22$ and $\tau = .29$ for Tomitch's and the Adolescents' version of the RST than the ones from strictly measured scores ($\tau = .20$, $\tau = .16$). Besides, the higher correlation with open-ended questions was observed with scores from the Adolescents' version of the test using the lenient scoring method ($\tau = .29$). Finally, the Adolescents' version also resulted in stronger correlations with scores from multiple-choice questions than Tomitch's version. Both the strict and lenient scoring methods resulted in a correlation of $.31$.

At this point, it is necessary to highlight two additional findings: (1) Kendall's tau of $.36$ ($p < .001$) showing a statistically significant correlation between the two reading comprehension tasks, which suggests that they measured the same constructs, or at least similar constructs, as previously mentioned; and (2) the correlations between the WMC scores of the two span tests which are not weak as expected ($\tau = .39$, $p = .001$ and $\tau = .53$, $p < .001$, when scored strictly and leniently, respectively). These results may be an indication that the pattern observed in the strict condition, that is, the correlation between the results from Tomitch's version with open-ended questions and not multiple-choice questions, and the opposite with the Adolescents' version, are possibly related to participants' more distinct performances in the span tests, and not necessarily in the comprehension tasks.

Because the RST proposed in this study remarkably correlated with reading comprehension when assessed through multiple-choice questions, the effectiveness of this type of comprehension task is also worthy of discussion.

Researchers have pointed out that multiple-choice questions are ineffective for assessing reading comprehension. They can be disadvantageous as they may allow respondents to randomly choose a correct answer without having abstracted ideas

from the text (CAIN; OAKHILL, 2006; KEENAN; BETJEMANN, 2009). Also, they may facilitate the use of compensatory strategies, such as the identification of grammatical cues that lead to correct answers, the elimination of less possible alternatives, and the generation of offline inferences, thus putting at risk the reliability of their results (BARETTA; PEREIRA, 2018; SOUSA; HÜBNER, 2015). As already pointed out, to reduce these disadvantages, the multiple-choice questions used in this study were designed based on Pearson and Johnson's (1978) taxonomy for comprehension tasks, as in Alptekin and Erçetin (2009). This framework allowed the construction of questions and alternatives that required more than the exclusive recall of verbatim information from the texts. In the case of the textually-implicit questions, participants had to generate text inferences without counting on linguistic cues from the texts as support for them to choose the correct alternatives.

Additionally, the alternatives given were also textually implicit and, thus, demanded the generation of text inferences; even though participants were given the alternatives, this doctoral researcher understands that they had to make a considerable cognitive effort to compare them with information from the texts activated in WM, generate the necessary text inferences, and then choose the correct answers. As stated by Alptekin and Erçetin (2009), this process does require readers "[...] to control their selective attention to suppress irrelevant items and focus on relevant ones." (p. 214). Other than that, the instruction given to the participants emphasized that they should leave unanswered the questions they could not respond. It is believed that this instruction helped eliminate or at least considerably reduce guessing effects. Finally, participants' average reading comprehension means ($M = 3.90$, $SD = 2.63$ and $M = 3.43$, $SD = 1.76$) for the open-ended and multiple-choice questions, respectively, may indicate that the latter task was not easier than the first.

It is essential to notice, however, that even though the Adolescents' version, when compared to Tomitch's, obtained higher correlations with reading comprehension when assessed through multiple-choice questions in both conditions, it also presented a higher correlation with open-ended questions in the lenient condition. Previous studies had concluded that when leniently scored out, span tests tend to discriminate individual differences more accurately regarding WMC (CONWAY *et al.*, 2005; TOWSE; HITCH, 1995; TOWSE; HITCH; HUTTON, 1998, 2002). As put before, participants' exposure to the whole stimuli more sensitively reflects the effects of the internal variabilities of span tests, such as sentence length and the number of

syllables of the final words in the WMC measures obtained. Bearing this in mind, the abovementioned studies have proposed that the lenient scoring method, compared to the strict, provides more reliable WMC measures. Based on that, and the higher correlations with measures obtained through the two comprehensions tasks in the lenient conditions of this study, the new test, even in the stage of validation, demonstrated to be an appropriate tool to obtain measures reflecting adolescents' capacity to hold and process information in WM simultaneously.

6.11 FINAL REMARKS

The study's objective was to devise an RST to obtain WMC measures from adolescents. To do that, 47 students from an elementary school took Tomitch's (2003b) RST and the proposed *Reading Span Test for Adolescent Speakers of Brazilian Portuguese* (RSTA). The first test was initially designed to obtain WMC measures from adults. The design of the RSTA followed a set of criteria so it could be more appropriate to the age and, thus, the level of cognitive development of the target population. Working memory capacity measures correlated with two measures of L1 reading comprehension that were gathered employing multiple-choice and open-ended questions.

In conclusion, the study confirmed H2, H3, and H4. It found a higher positive correlation between WMC when strictly and leniently scored by means of the RSTA and reading comprehension when measured through multiple-choice questions. Aside from this, the statistical analyses show a higher positive correlation between WMC when leniently scored by means of the RSTA and reading comprehension when measured using open-ended questions. Despite this, H1 was not confirmed, showing no higher positive correlation between WMC when strictly measured by means of the RSTA and reading comprehension when measured using open-ended questions. Additionally, H5 was not confirmed since the expected weak correlation between the two tests was not observed.

The study indicates that the RSTA, compared to Tomitch's RST, is more efficient in measuring adolescents' WMC, as shown by the correlations with measures of reading comprehension obtained employing multiple-choice questions in strict and lenient WM test conditions. Also, the RSTA seems more efficient when its measures

correlate with open-ended questions in the lenient condition. Given the limitations of its design, the *Reading Span Test for Adolescent Speaker of Brazilian Portuguese* needs now to be submitted to new experimental studies to be consolidated as a reliable tool.

6.12 PEDAGOGICAL IMPLICATIONS, LIMITATIONS, AND SUGGESTIONS FOR FUTURE RESEARCH

The average reading comprehension sample means above reported may be considered low, indicating that the participants of this study are poor L1 readers. Even being selected from age-appropriate materials, analyzed by the NILC Metrix, and having their complexity adapted, the two texts used in this study still seemed too difficult for the participants. Another possibility is that the two reading comprehension tasks were too complex for them. Such difficulty may be associated with their low average WMC sample means. This possible association implies a relevant pedagogical implication. Low WMC students do not necessarily fail because of alleged intellectual limitations but because they must maintain and process excessive amounts of information and instructions in WM at a time while reading or doing comprehension tasks. It seems advisable for schools to consider the possibility of applying batteries of WMC tests to identify one of the possible factors that underly students' difficulties in terms of reading comprehension. With data at hand, schools could adjust the environment, the materials, and the instructions given to low WMC students, thus reducing the cognitive loads imposed on them. Actions like these could provide equal opportunities for all students to experience success at school.

As for the study's limitations and suggestions for further research, two main aspects should be initially pointed out. The first was the reduced sample size gathered within a single context. Repeated measures obtained from adolescents from other settings, thus composing more diverse and larger sample sizes, would improve the reliability of the results. The second was the quasi-experimental design of this study, characterized by its convenience sampling. By elevating its status to experimental, the study, through random sampling, could have allowed participants to have an equal or known probability of belonging to any of the groups, considerably reducing attribute-related trends that may have affected the dependent variable.

On the suggestions for further research, studies may apply more rigid rules for the selection and construction of the reading span tests' sentences, such as the ones proposed by Rigatti *et al.* (2017) in a recent study on the translation and adaptation of Waters and Caplan (1996) RST to Brazilian Portuguese. Among other aspects, the authors suggest controlling for the repetition of phonemes in the last words of the sentences in the same sets since it can function as a retrieval cue. Also, they recommend that the final words contain no more than three syllables. In an experiment with some participants, the authors concluded that words longer than the trisyllabics might make the task excessively demanding.

Using the proposed RSTA in studies on L2 reading comprehension is another suggestion for further studies. For Koda (2005, p. 202), “[...] working memory provides a shared cognitive resource across languages.”, meaning that individual differences in WMC, as measured through a WMC test in Brazilian Portuguese, may also account for individual differences in L2 reading comprehension. Furthermore, Linck *et al.* (2014) put forth that an RST in an L2 may not exclusively measure WMC but also language proficiency, which may produce confounds in participants' scores. Further studies may investigate the extent to which this rationale holds.

6.13 CHAPTER VI SUMMARY

This chapter initially presented a brief review of studies on distinct variables associated with individual differences in reading comprehension in L1 and L2. It focused on the variable working memory capacity (WMC) to meet its purposes. After the review, the chapter proposed the study's primary goal, which was to devise an RST to collect WMC measures from adolescent speakers of Brazilian Portuguese. Subsequently, while incorporating the *Capacity-Constrained View of Working Memory for Language* (JUST; CARPENTER, 1992) into the study's theoretical framework, the chapter defined operational definitions for the constructs of WM and WMC. Having defined the constructs, the chapter followed with a description of both the seminal study of Daneman and Carpenter (1980) that gave origin to the RST and the Brazilian version of the test proposed by Tomitch (1995, 2003b). Next, the chapter remarked on why Woelfer and Tomitch (2019) identified the need to construct an RST more appropriately designed for samples composed of adolescent speakers of Brazilian Portuguese. In

the method section, the chapter provided information about the sample, sampling method, materials, instruments, procedures for data collection, and analysis. After that, the chapter summarized the study's findings showing that, compared to Tomitch's RST version, the RSTA presented higher correlations with scores from multiple-choice questions in all conditions. Also, leniently-scored measures of the RSTA presented a higher correlation with scores from open-ended questions. However, Tomitch's RST measures, when strictly scored out, presented a higher correlation with scores from open-ended questions.

In conclusion, the RSTA proved to be efficient in the majority of the conditions. As for pedagogical implications, it is suggested that textual and activity complexity be analyzed with caution in schools, as excessive cognitive loads can be problematic for low WMC students. The study's main weaknesses were its quasi-experimental design and small sample size, which were suggested as improvements for future studies. Finally, the chapter challenged future studies in L2 reading comprehension to utilize the RSTA to collect WMC measures. This suggestion aims to augment the reliability and attribute validity to the test.

6.14 ACKNOWLEDGMENTS

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7 PROPOSALS, REFLECTIONS AND CONCLUSIONS, FINAL REMARKS, LIMITATIONS, AND SUGGESTIONS FOR FURTHER RESEARCH AND PEDAGOGICAL IMPLICATIONS

This chapter initially outlines some of the doctoral dissertation's proposals, reflections, and conclusions. Subsequently, it presents some final remarks, limitations, and suggestions for further research. Lastly, the chapter points out some pedagogical limitations.

This chapter will not repeat pedagogical implications, limitations, and suggestions for future research of Chapter VI. They were maintained there to preserve the characteristics of a chapter that reports a complete study.

7.1 PROPOSALS, REFLECTIONS, AND CONCLUSIONS

Chapter I stated the purpose of this doctoral dissertation, its significance, and its organization. On top of it, it included a narrative on some musical elements accompanying human life and language development. The purpose of the narrative was to illustrate how musical elements accompany human life and language development. It all starts with the beating of a heart, which evolves to the perception of external vowel sounds, mommy's voice, lullabies, and songs learned and sung at school, including those in English as a foreign language. It is up to science to find ways to turn singing, something so inherent to the human condition, into a tool for EFL vocabulary teaching.

The objective of Chapter II was to situate the present doctoral dissertation in its research niche from a historical perspective and to introduce its theoretical framework through a multidisciplinary review of studies. The chapter situated the doctoral dissertation in the research niche of Second Language Acquisition from the perspective of Positive Psychology (PP in SLA). It showed that from Abraham Maslow to Peter D. MacIntyre, Tammy Gregersen, and others, PP and PP in SLA have crossed their darker and meaner to their lighter and kinder half and have sought to foster what can be built upon negative emotions, seeking light in positive ones. The chapter also demonstrated that PP and PP in SLA have developed robust empirical methods, which differentiate them from the mass-media culture of positivity and self-help and make

them grounds for promising research avenues. Besides, Chapter II introduced the theoretical framework of the doctoral dissertation through studies indicating that positive emotions enable individuals to build enduring personal resources. Resources can be intellectual, such as decision-making and semantic mapping (ISEN; MEANS, 1985; ROWE; HIRSH; ANDERSON, 2007; ISEN *et al.* 1985), psychological, such as resilience, altruism, positive mindsets, adversity coping (FREDRICKSON *et al.* 2003; PFATTHEICHER *et al.*, 2020; WEST *et al.*, 2021 GUZ; TETIURKA, 2016; MACINTYRE; GREGERSEN; MERCER,2020), among others.

The objective of Chapter III was to review The Broaden-and-build Theory of Positive Emotions (FREDRICKSON, 1998, 2004; FREDRICKSON; BRANIGAN, 2005) and studies of Positive Psychology in SLA, tracing theoretical associations between the theory and the studies' findings. The chapter reviewed the theory and identified its five hypotheses. They are (i) the broaden hypothesis; (ii) the narrow hypothesis; (iii) the undoing hypothesis; (iv) the build hypothesis; and (v) the upward spirals of positive emotions hypothesis. The broaden hypothesis, on the one hand, proposes that mild positive emotions expand individuals' scopes of attention and cognition. This phenomenon allows them a broader sensorial capture of external stimuli and increases their cognitive processing capacity. The narrow hypothesis, on the other hand, proposes that negative emotions shrink and decrease these arrays. The undoing hypothesis has a close relationship with the broaden and narrow hypotheses. It proposes that a broadened mindset shaped by mild positive emotions helps undo the effect of negative emotions on individuals. This mindset allows them to elaborate on their life situations more flexibly and helps them undo the focus on something considered a problem, a threat, or a negative thought. Its broadened setting enables individuals to explore possibilities. This cognitive flexibility may assist individuals in building resilience, anxiety coping, and hope, for instance. A narrowed mindset, following the hypothesis, decreases these possibilities. The build hypothesis is also closely related to the broaden and narrow hypotheses. According to it, the broadened focus of attention and cognition triggered by mild positive emotions underlie individuals' willingness to explore and interact. As already stated, individuals' exploration and interaction allow them to build long-lasting intellectual, physical, social, and psychological resources. These resources augment their odds of a better life in current and future situations. The upward spiral of positive emotions hypothesis encompasses a continuous cycle constituted by an interaction of the products mentioned in the other

four hypotheses. It proposes that positive emotions broaden and build the scopes of attention and cognition, which constitute a pre-condition for the undoing of negative emotions and the building of a large set of resources, which in turn improves the quality of individuals' lives, which yields new positive emotions on them and so on. The chapter's review on studies of PP in SLA also traced theoretical associations between the studies and the tenets of the Broaden and Build theory. They were: (i) positive emotions enhanced by PP interventions augment learners' eagerness to undergo EFL learning experiences (i.e., the building of intellectual and social resources); (ii) positive emotion in the form of contentment is associated with better foreign language (FL) proficiency (i.e., the building of intellectual resources), among others. The review also concluded that strong positive emotions might underlie overreliance phenomena such as self-serving bias (BLAINE; CROCKER, 1993) and the illusion of knowing (EPSTEIN; GLENBERG; BRADLEY, 1984; TOMITCH, 2003a), both detrimental to EFL learning.

Such a conclusion indicates that mild negative emotions play a critical role in learning in that they narrow learners' scope of cognition and attention to analytical bottom-up processing of details. The review of studies also indicated the insufficiency of positive emotions in the effectiveness of EFL vocabulary learning. Drawing on António Damásio and Mary Helen Immordino-Yang's studies, the chapter put forth that adolescent learners must undergo experiences that allow them to intertwine conceptual knowledge with personally-meaningful emotions. This intertwining process enables them to understand the implications of the conceptual knowledge's use. In that sense, it can be drawn again from Chapter III that some negative emotions have beneficial roles. For instance, if one understands that applying certain types of conceptual knowledge may cause hunger and war, a more profound elaboration from sadness may help them develop compassion, a rudder that steers thinking. From de concepts centrality analysis based on semantic networks of cliques, Chapter III found that Fredrickson's theory constitutes a net of important concepts and interconnection between pairs of concepts that help ground PP in SLA research.

The objective of Chapter IV was to review Mathewson's (1985) Comprehensive Model of Affect in the Reading Process and draw theoretical consonances between the model and the Broaden-and-build Theory of Positive Emotions (FREDRICKSON, 1998, 2004; FREDRICKSON; BRANIGAN 2005) through a review of studies on EFL reading through singing. The chapter reviewed Mathewson's model and set the view

of reading adopted in this doctoral dissertation. The view postulates that reading is an interactive process that involves cognitive and affective factors. Consonant to the view, affective factors, namely attitude, motivation, affect, and physical feelings, precede and maintain the reading process. Through cognitively mediated decision-making, they trigger the implementation of primary reading cognitive processes, namely physical orientation and activity, and secondary reading cognitive processes, namely recall, reflection, and application. Primary and secondary reading processes interact with each other in mutual assistance. The efficiency of the reading processes, via feedback, acts upon the affective factors influencing the reader's willingness to continue or stop reading. At last, the model proposes that unconscious negative affect may also act upon the reading processes, impairing their implementation. The model accomplishes its mission of positing the interaction between affect and cognition. However, it is limited in describing low-level cognitive processes, such as decoding and literal comprehension, and high-level processes, such as inferential comprehension and comprehension monitoring. The chapter also drew a series of consonances between Mathewson's model and Fredrickson's theory through a comprehensive review of studies. The consonances were mainly based on the positive emotion interest inherent to motivation. It was found that music, overall, assists adolescents in various aspects, including social bonding, character shaping, sense of belonging, improvement of self-esteem, self-care, and discouragement of suicidal behaviors (NORTH; HARGREAVES; O'NEILL, 2000; CAMPBELL; CONNELL; BEEGLE, 2007; TER BOGT, SOITOS; DELSING, 2011; MIRANDA, 2013; FINGER; SOUZA; HAAG, 2016). Chapter III also found that singing increases learners' willingness to study the language, increasing their curiosity to learn about foreign cultures. Singing was also associated with improved spelling, pronunciation, accuracy, and vocabulary retention (CHEN; CHEN, 2009; ROMERO; BERNAL; OLIVARES, 2012; YAMAMI, 2016; DŽANIC; PEJIĆ, 2016). Besides, studies indicated that this practice enhances phonemic, phonological, and orthographic awareness, word decoding, reading comprehension, fluency, acquisition, and expansion of sight vocabulary (IWASAKI *et al.*, 2013; HANSEN; BERNSTORF, 2002; REGISTER *et al.*; 2007; STANDLEY, 2008). Finally, the chapter's review of studies brought that EFL reading through singing, as compared to other forms of reading, promotes higher vocabulary learning and recall of chunks of words facilitated by melody recall (DAVIS; FAN, 2016; LI; BRAND, 2009; CHOU, 2014; COYLE; GRACIA, 2014; GOOD; RUSSO; SULLIVAN, 2015). Lastly, Chapter III added

two additional contributions to the discussion on vocabulary learning through singing. The first is that the melody and text components may be dual-coded in memory, facilitating vocabulary learning since one component may cue the retrieval of the other. (SERAFINE; CROWDER; REPP, 1984; SERAFINE *et al.*, 1986). The second is that involuntary rehearsal phenomena in memory may help consolidate vocabulary knowledge (KRASHEN, 1983; MURPHEY, 1990; 1992).

The objective of Chapter V was to operationalize the constructs of WM and working memory capacity (WMC) based on Cowan's (1988, 1999) Embedded-Processes Model of Working Memory and propose theoretical discussions on the role of positive emotions evoked by the practice of EFL reading through singing in WM focus of attention. After having operationalized the constructs, the following can be drawn:

- (i) Mild positive emotions appear to build intellectual resources. They cause WM focus of attention to devote its resources to a broader sensorial capture of relevant textual information, broader activation and retrieval of relevant information from LTM, and thus, broader maintenance and processing of both types of information. This broadening effect, in the case of EFL reading through singing, seems to be beneficial for vocabulary learning for its spreading resources to the automatization of melody, phoneme-grapheme mapping, and versification chunking;
- (ii) Mild positive emotions appear to build social and psychological resources. This building effect, in the case of EFL reading through singing, can be beneficial for its improving EFL and teachers' interaction, resilience, and coping;
- (iii) Strong positive emotions appear to cause WM focus of attention to devote its resources to a broader sensorial capture of irrelevant external stimuli, broader activation and retrieval of irrelevant information from LTM, and thus, broader maintenance and processing of both types of stimuli. This broadening effect, in the case of EFL reading through singing, seems to be detrimental to vocabulary learning for its spreading resources to distractive information;
- (iv) Strong positive emotions also seem to be detrimental in that they may trigger EFL readers' overreliance and consequential poorer vocabulary learning;
- (v) Strong negative emotions appear to hinder the building of various resources. When strong negative emotions cause WM focus to devote its resources to the processing and maintenance of exogenous and endogenous threatening

information, no resources are left to learning. Memory and body tend to focus on the threat, the willingness to learn is put at risk, and rumination of negative thoughts hampers learning.

7.2 FINAL REMARKS

The final remarks will bring a poetic license to the text. The present doctoral dissertation concluded that positive emotions play a critical role in English as a Foreign Language (EFL) reading through singing for vocabulary learning. It also suggested that negative emotions should not be banished from this process when cognitively downregulated. This conclusion leads to the idea that in EFL reading, there needs to be a

[...] balance between levity and gravity. Levity is that unseen force that lifts you skyward, whereas gravity is the opposing force that pulls you earthward. Unchecked gravity leaves you flighty, ungrounded, and unreal. Unchecked gravity leaves you collapsed in a heap of mystery. Yet when properly combined, these two opposing forces leave you buoyant, dynamic, realistic, and ready for anything. Appropriate negativity delivers the promise of gravity. It grounds you in reality. Heartfelt positivity, by contrast, provides the lift that makes you buoyant and ready to flourish. Consider a sailboat. Rising from a sailboat is an enormous mast that allows the sail to catch the wind. Below the waterline is the keel, which can weigh tons. You can take the mast going up as positivity and the keel down below as negativity. If you've ever sailed, you know that you can't get anywhere without the keel. If you tried, at best you'd slide aimlessly across the water, or at worst you'd capsize. Although it's the sail hanging on the mast of positivity that catches the wind and gives you fuel, it's the keel of negativity that keeps the boat on course and manageable. And just as the keel matters most when you're going upwind, appropriate negativity matters most in hard times. (FREDRICKSON, 2009, p.137)

Continuing with the sailboat metaphor, let us reinstate Mary Helen Immordino Yang and Antonio Damasio from Chapter II. According to the researchers, "Emotions are, in essence, the rudder that steers thinking." (IMMORDINO-YANG; DAMÁSIO, 2016, P.28). More specifically, the researchers propose that

The basic premise is that when learning and knowledge are relatively devoid of emotions, when people learn things by "rote" without internally driven motivation and without a sense of interest or real-world relevance, then it is likely that they won't be able to use what they learn

efficiently in the real world. (IMMORDINO-YANG; DAMÁSIO, 2016, p. 28, emphasis given by the authors).

Consider the sea an English song. Based on Fredrickson (2009) above, let us conceive that the keel keeps the reader balanced under the waterline, or put differently, attained to the surface of the text and its details (i.e., the narrow hypothesis). The mast, however, from above its height, allows the reader to explore, and visualize the full view of the ocean text (i.e., the song's lyrics), savor its meaning, get its gist, and make connections between words, sentences, and paragraphs (i.e., the broaden hypothesis). On the other hand, the rudder channels the reader to drive the knowledge built during the voyage to personally-relevant destinations. The rudder itself imbues positive and negative emotions. It can be turned to the right based on mild positive emotions or left based on mild negative emotions (a negative memory from hitting an iceberg would play an important role here, for instance). It fits this discussion, Williams Ford, and Kensinger (2022) in that negative autobiographical memories may help us "[...] better *navigate* the future, which often occurs by being able to extract some lesson from a past negative experience." (p. 14, my emphasis) (the verb used by Williams and colleagues deserves a Eureka!). All the emotions pertinent to readers' previous knowledge will inform them how this knowledge can be applied effectively and with relevance for them and the world, which is the *knowledge destination*. One may infer that being merely buoyant and in a balance between gravity and levity on the ocean text would represent a reading act with no final purpose. There is a need for a direction, for use, for spread. An important role in the rudder's direction to the sailboat depends on the EFL teacher. The teacher holds the rudder together with the student. In EFL reading lessons, it occurs, for instance, when the teacher, during post-reading, guides readers to extrapolate from the literal meaning of the lyrics and explore its relevance and usefulness in the real world (TOMITCH, 2009).

Let us also reference Gagné *et al.* (1993) and establish a relationship between their model and the reasoning above. It is assertable that the force of gravity proposed by Fredrickson (2009) would represent the attention that keeps readers closer to the low levels of reading comprehension, including decoding, in which readers "[...] crack the code of print to make print meaningful." (GAGNÉ; YEKOVICH; YEKOVICH, 1993, p. 269), and literal comprehension, whose function "[...] is to derive literal meaning from text". (GAGNÉ; YEKOVICH; YEKOVICH, 1993, p. 272). Through these two

reading processes, the reader remains in a bottom-up reading movement closer to the surface of the ocean text, focused on details. Following this line of thought, the force of levity would be related to high-level reading comprehension processes. That would include inferential comprehension, which “[...] involves going beyond the idea explicitly stated, to integrate, summarize and elaborate on these ideas.” (GAGNÉ; YEKOVICH; YEKOVICH, 1993, p. 272); that is, visualizing the landscape of the whole ocean text. Moreover, it also includes comprehension monitoring, which “[...] involves setting a reading goal, checking if the goal is being reached, and implementing remedial strategies when one’s goal is not being reached.” (GAGNÉ; YEKOVICH; YEKOVICH, 1993, p. 272). Through these two reading processes, from the height of the mast, readers can trace interconnections among what is in the text and activate relevant prior knowledge to broaden the text’s meaningfulness, while keeping a metacognitive eye on the reading process (i.e., am I navigating well towards my destination?). Notably, the keel, the mast, and the rudder all operate simultaneously, the same way reading operates, with low-level and high-level reading comprehension processes in constant interaction through the ocean text. All operations, as put by Mathewson (1985), are regulated by affective factors.

7.3 LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

According to Procaïlo (2017), doctoral dissertations comprise informed choices to add contributions to previous research in the field. However, they are not devoid of limitations, which was no different in the case of this dissertation.

The first limitation regards the primarily literature-review basis of the dissertation. Research primarily based on a literature review has its pros and cons. Its pros, on the hand, include the compilation of a large body of studies that directly or indirectly may provide evidence for or against particular hypotheses. The studies may also give theoretical support to the reader for adopting theories, models, and methods for replication studies. Its cons, on the other hand, include the lack of own empiricism, which may put the research at risk of proposing theorizations and hypotheses lacking the implementation of the scientific method. Though they point to future directions, these pros and cons do not constitute an exhaustive list.

Unsystematic approach for narrative reviews. This approach was adopted for the literature reviews in Chapters II, III, and IV. The approach helps provide general insightful thoughts to researchers and practitioners. It commonly makes up an overall portrait of the extant literature on a particular topic. Nevertheless, this approach may be opinion-oriented and biased by the researchers' expertise (GREEN; JOHNSON; ADAMS, 2006). This doctoral researcher tried to gather informative studies to comply with its research objective and avoid such a subjective pitfall.

Nevertheless, future studies on the role of positive emotions, WM focus of attention, and EFL reading through singing for vocabulary learning should build literature reviews more narrowly focused on study-based pieces of information in more delimited contexts. Two literature review approaches worthy of consideration are the *Systematic approach for descriptive reviews* and the *Systematic approach for scoping reviews* (PARÉ; KITSIOU, 2016). The Systematic approach for descriptive reviews, according to Paré and Kitsiou, specifies the characteristics investigated in the studies reviewed, including, for example, “[...] publication year, research methods, data collection techniques, and direction or strength of research outcomes.” (2016, p. 162-163). By delimiting these characteristics, the review becomes more carefully data-driven and can identify patterns and trends within a limited collection of studies. The review then moves away from offering a general overview of a topic and, more specifically, directs the reader to one with specific characteristics. If a Systematic approach for descriptive reviews more strictly directs the reader to the object of study, a Systematic approach for scoping reviews goes even more profound in this process. It seeks to find gaps in the extant research, subjects the entire process of choosing studies to peer reviews, and finally maps the existing literature on a given topic (PHAM *et al.*, 2014). Systematicity in this approach may include three stages, which are: (i) identifying relevant studies; (ii) developing inclusion and exclusion criteria; and (iii) defining criteria for the process of data extraction (ARKSEY *et al.*, 2002). To identify relevant studies, Arskey and colleagues (2002) include the identification of crucial journals and organizations and developing criteria for electronic databases, including grey literature, among others. To develop inclusion and exclusion criteria, they list the identification of study and intervention types and delineate specific populations investigated, among others. Concerning the definition of criteria for the process of data extraction, Arskey and colleagues include studies that met the two previous stages, including, for instance, duration of interventions, outcomes, and countries where

studies were carried out. Thus, future studies on the topic are proposed to use the abovementioned literature review approaches to better portray the extant literature.

Working memory (WM) and working memory capacity (WMC) views. From the beginning, this dissertation made clear its interest in the practice of EFL reading through singing for vocabulary learning among *adolescents*. The model of WM adopted as the third theoretical pillar of the dissertation was The Embedded-Processes Model of WM (COWAN, 1988; 1999; COWAN; MOREY; NAVEH-BENJAMIN, 2021). The model was presented, and the concepts of WM and WMC were defined. However, earlier in its text, the dissertation emphasized that adolescents are a particular population because they undergo intense physiological, emotional, cognitive, and social changes. The dissertation then presents the deficiency of not discussing specifics of WM and WMC inherent to this life period. It adopts the model as if all its tenets present no variables worth to be accounted for among adolescents. Future studies may address this issue to test whether the positive emotions that Fredrickson's group has investigated chiefly in adult populations resemble or not those of adolescents.

The number of studies on adolescents. Adjacent to the limitation above, the dissertation weaves reflections and proposals with generalizations concerning EFL reading through singing for vocabulary learning among adolescents. Out of the thirty studies fully reviewed, (i) eighteen are on adults (FREDRICKSON; JOINER, 2002; FREDRICKSON *et al.*, 2003; ISEN; MEANS, 1983; KOK *et al.*, 2003; PFATTHEICHER *et al.*, 2020; WEST *et al.*; 2021; YAMAMI, 2016), to mention some; (ii) six are on children (DŽANIĆ AND PEJIĆ, 2016; DAVIS; FAN, 2016; STANDLEY; 2008; CHOU, 2014); (iii) eight are on adolescents (CHEN; CHEN, 2009; DEWAELE; ALFAWZAN, 2018; LI, 2019; CAMPBELL; CONNELL; BEEGLE, 2007; MIRANDA, 2013), to mention some; and (iv) one is on adolescents directly tackling EFL reading through singing for vocabulary learning (GOOD; RUSSO; SULLIVAN, 2015). While this review reveals a population underinvestigated on the topic, it also weakens the dissertation's generalizations. It is recommendable that future research incorporates more studies on adolescents in this specific topic.

Types of positive and negative emotions taken as the basis for the dissertation's theoretical reasoning. The study that gave rise to the Broaden-and-Build Theory of Positive Emotions tested two types of positive emotions, *amusement* and *contentment*, and two negative emotions, *anger* and *anxiety* (FREDRICKSON; BRANIGAN, 2005).

The researchers acknowledge that and enquire, “[...] do broadening effects extend to positive emotions beyond amusement and contentment?”. (FREDRICKSON; BRANIGAN, 2005, p. 328). The same applies to the narrowing effect of negative emotions beyond anger and anxiety. Despite that, the present dissertation presented generalized reflections and proposals on the broadening and narrowing effects on adolescents’ scopes of cognition and attention regardless of the emotion types. It may be that other emotions, such as compassion, happiness, fear, and anguish, may differ in their effects. In that manner, future studies should consider lists with more discrete categorizations of emotions and their effects on adolescents’ scopes of cognition and attention.

Studies on the effects of positive emotion in the reading comprehension of texts. In several parts of the dissertation, the studies of Rowe, Hirsh, and Anderson (2007) and Isen *et al.* (1985) were used as a basis to defend that positive emotions increase readers’ ability to establish more diverse and creative associations between words, which could lead them to learn vocabulary more effectively. However, the studies were based on experiments that presented participants with lists of unrelated words written in L1. The remaining question is whether positive emotions similarly affect the EFL reading of texts. Addressing this question would be paramount to propose that EFL reading through singing enhances vocabulary learning since songs are not mere lists of unrelated words. Songs have texture, which makes them more complex to be comprehended. This limitation suggests that future studies could investigate such an effect since this dissertation intended not to dissert on vocabulary learning of isolated words but words from texts.

Innovative data collection methods for PP in SLA research. At last, it is suggested that future studies that focus on the effects of emotions on EFL reading triangulate quantitative psychological and psychophysiological measures with qualitative behavioral measures (which are already abundant in PP in SLA studies). The measures may include, among others, heartbeat, vagal tone, facial electromyography (EMG), and oxytocin levels. Besides that, brain studies would enrich the investigation, providing, through fMRI, real-time images of how the brain processes EFL reading under the induction of distinct emotions. Data triangulation using such measures would bring more evidence to propose with higher robustness that mild positive and negative emotions enhance EFL reading. What is more, using these and other measures would be innovative in the area.

7.4 PEDAGOGICAL IMPLICATIONS

This dissertation is directly concerned with English as a foreign language teaching and learning. Therefore, it has several pedagogical implications, some of which will be described next.

Foreign language classroom anxiety (FLCA). Building on Izquierdo (2018), Fredrickson (2004, 2008), and Mathewson (1985), EFL readers' FLCA is detrimental to learning. It puts EFL readers in a state of fear of the school environment, of a specific class, teacher, or pedagogical practice. There is no guarantee that EFL reading through singing for vocabulary learning will not trigger such anxiety. Teachers, then, must be careful about the design of this practice. The literature suggests that classroom singing be practiced in groups (NADERA, 2015). It is common sense that many adolescents do not like to be exposed, so group singing may more fully fulfill its role in putting them in a state of entrainment (CLAYTON, 2012) to favor vocabulary learning.

Teachers' song repertoire choice. Based on Immordino-Yang (2021), EFL vocabulary teaching should not confine itself to teaching EFL readers mere bunches of words. It should be concerned with helping them pull into that knowledge and turn it into something meaningful that helps them deal with their and the world's issues. Immordino-Yang emphasizes that learning should not be limited to ingesting conceptual knowledge but also digesting it so it can be turned into something personally relevant to be used in practice. In that sense, teachers' song repertoire is crucial. Far from imposing moralistic rules on EFL teachers, choosing songs that simultaneously meet the curriculum's demands and the issues inherent in adolescence seems wise. Studies reviewed in the dissertation pointed to popular songs as adolescents' favorite ones (DOMONEY; HARRIS, 1993; MURPHEY; 1992; NORTH; HARGREAVES; O'NEILL, 2000). Several popular songs are composed and performed to the taste of teenagers, and they can undoubtedly make up such a repertoire. Of course, EFL teachers can also expand students' repertoire knowledge and suggest songs from other eras, styles, and singers. This is one way to bring culture to class. Besides, bringing pop songs that amuse adolescents to teach vocabulary is not to be discarded. Amusement is among the four emotions tested in Fredrickson and

Branigan's (2005) study from which the Broaden-and-build theory was designed. The study suggests that amusement broadens individuals' scope of attention and cognition, which are essential for building intellectual resources.

Spaced-out learning. Based on Tomitch (2009) on the three phases of EFL reading comprehension (i.e., pre-reading, while-reading, and post-reading), spaced-out learning gains significance. As explained by the researcher, knowledge is manipulated in different ways and for different purposes in each phase. It has also already been mentioned earlier that the elaboration of knowledge takes place at times when the Default Mode Network comes into play, at times of non-oriented tasks, and when the learner is in a state of relaxation (IMMORDINO-YANG, 2016) (e.g., it is the moment EFL readers generate offline inferences on the meaningfulness of texts). Based on Tomitch and Immordino-Yang research, it is possible to predict that the post-reading phase should be done with longer spacing separating the pre-reading and while-reading phases from post-reading. As Tomitch (2009) explains, it is in post-reading that the meaning of the text is extrapolated to other horizons and applications to the readers' lives. Then, it can be asserted that what is learned in an EFL reading class tends to be more elaborate within readers' memory in the next. Let us add Sprenger (2018) on *rehearsal and sleep* and Anderson (2020) on *distributed practice* to this discussion. Sprenger states that encoding occurs during sleep; "The networks of neurons that form during learning reconnect during the sleeping process." (2018, p. 111). The researcher postulates that sleep is necessary to consolidate information previously processed in WM in long-term memory (LTM). In other words, sleep (i.e., quality sleep) allows EFL readers to learn so they can recall information later. What Sprenger proposed harmonizes with the results of the study by Lemos, Weissheimer, and Ribeiro (2014). Lemos and colleagues had adolescents aged 10 to 15 years attend a lecture. Experimentals took naps afterward in their own school environment. Controls had regular classes after the lecture. Using a pre-post-test paradigm after 1, 2, and 5 days, experimentals and controls showed learning gains on the first day, but from the second to the fifth day, the gains remained in the experimental group only, while in the control group, there was a considerable drop, especially on the fifth day. With some design differences, the second experiment showed the same trend at more extended post-testing periods. The study indicates that naps after content input affect memory consolidation among adolescents.

Anderson (2020) also exposes that learning in a distributed fashion, even if not always achievable due to time limitations, is better than massed learning. In schools, for instance, curriculum demands may be one of the reasons why EFL teachers concentrate on the three phases of reading in one go. However, Anderson states that “[...] repeating the same study material twice yield far better memory if repetitions are spaced in time (preferably with other intervening activities), rather than massed together, with no intervals separating the repetitions.” (ANDERSON, 2020, p. 120). In the discussion, Anderson acknowledges that the time lag has to be appropriate not to hamper retention. Despite the time limitations, EFL teachers should consider the famous saying that *sometimes less is more* for several reasons. EFL vocabulary teaching from songs should be spaced-out to allow non-oriented elaborative inference generation to occur after periods of sleep and retaking the study material in post-reading. At last, singing repetition is paramount so that learners’ WM is not overloaded with excessive non-automatized musical and verbal information.

Building nurturing EFL reading classes environments. As stated by Williams, Ford, and Kensinger, “[...] it is possible that part of what makes negative memories powerful relates to whether, before we have brought the memory to mind, we anticipate the impact of that recollective experience” (2022, p. 13). Thus, the nurturing environment that EFL reading through singing is said to create may diminish the effect of negative autobiographical or episodic memories on EFL readers’ behavior. The practice may prevent them from focusing on the rumination of negative thoughts that steal attentional resources from WM. In parallel, such environments may constitute a proper place for EFL readers to build new autobiographical and episodic memories that, in the future, will make them anxious (in the good sense of the word) while hearing the rhythmic footsteps of EFL teachers coming near the classroom with their inventive musical ideas.

Using EFL reading through singing for vocabulary learning through interdisciplinary projects. Exceptions aside, using EFL songs for teaching vocabulary is primarily a teaching interest. Long before that, adolescents live in a musical world and use music for different purposes. Early in the dissertation, the review of studies showed that adolescents find in music regulation for their own emotions, references for building a social identity, information about new cultures, and important clues about self-care and caring for others (CAMPBELL; CONNELL; BEEGLE, 2007; NORTH; HARGREAVES; O’NEILL, 2000; MIRANDA, 2013; TER BOGT; SOITOS; DELSING,

2011; FINGER; SOUZA; HAAG, 2016). EFL teachers can use this inherent adolescent taste to insert vocabulary teaching through songs into interdisciplinary projects. As explained by Silva (2019),

One aspect of interdisciplinarity is its interrelationship among subjects that work together, and with no overvaluation of any, the relationship assists the development of them with a single purpose, the development of students. (p. 3, my translation).³⁶

By breaking out of the English classroom bubble and working with songs more comprehensively in interdisciplinary projects, EFL teachers can make songs even more meaningful to EFL readers. The more elaborate the ideas became from the perspective of different disciplines, the greater the sense of knowledge applicability EFL readers may build.

As stated at the beginning of this subsection, this dissertation contains several pedagogical implications. Those that recurred most frequently throughout the text and can be most immediately informative to EFL teachers were chosen for reporting. Even with this, the listing is not exhaustive. Future publications arising from this dissertation should undertake to report on them.

7.5 A FINAL WORD

A tiny heart starts beating in the mother's womb from the fifth week of gestation. Let us, EFL researchers and teachers take on the role of keeping that beat and being musical composers of these beings' lives, especially during the challenging adolescence. In this way, both EFL research and teaching may become (and now I invite my parents, Raimundo and Carmelita, to type the two last syllables of this dissertation) an act of *love*.

³⁶ In the original: "[...] um aspecto da interdisciplinaridade é a inter-relação entre as disciplinas, que trabalham de maneira conjunta, e não existe supervalorização de nenhuma, a relação existente entre elas é a de auxiliar no desenvolvimento de ambas com um único propósito, o avanço dos alunos." (SILVA, 2019, p. 3).

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APPENDIX A – List of stopwords extracted from the texts used to construct the Broaden-and-Build Theory of Positive Emotions semantic network of cliques

* A lista do pacote stopwords (e.g., default English list of the R package stopwords (BENOIT; MUHR; WATANABE, 2021) vai até "will" (linha 175). A partir de "also" (linha 176) são as palavras que adicionamos após a primeira análise.

1. i	43. be	85. hasn't
2. me	44. been	86. haven't
3. my	45. being	87. hadn't
4. myself	46. have	88. doesn't
5. we	47. has	89. don't
6. our	48. had	90. didn't
7. ours	49. having	91. won't
8. ourselves	50. do	92. wouldn't
9. you	51. does	93. shan't
10. your	52. did	94. shouldn't
11. yours	53. doing	95. can't
12. yourself	54. would	96. cannot
13. yourselves	55. should	97. couldn't
14. he	56. could	98. mustn't
15. him	57. ought	99. let's
16. his	58. i'm	100. that's
17. himself	59. you're	101. who's
18. she	60. he's	102. what's
19. her	61. she's	103. here's
20. hers	62. it's	104. there's
21. herself	63. we're	105. when's
22. it	64. they're	106. where's
23. its	65. i've	107. why's
24. itself	66. you've	108. how's
25. they	67. we've	109. a
26. them	68. they've	110. an
27. their	69. i'd	111. the
28. theirs	70. you'd	112. and
29. themselves	71. he'd	113. but
30. what	72. she'd	114. if
31. which	73. we'd	115. or
32. who	74. they'd	116. because
33. whom	75. i'll	117. as
34. this	76. you'll	118. until
35. that	77. he'll	119. while
36. these	78. she'll	120. of
37. those	79. we'll	121. at
38. am	80. they'll	122. by
39. is	81. isn't	123. for
40. are	82. aren't	124. with
41. was	83. wasn't	125. about
42. were	84. weren't	126. against

127.	between	177.	may
128.	into	178.	can
129.	through	179.	instance
130.	during	180.	yet
131.	before	181.	etc
132.	after	182.	else
133.	above	183.	ii
134.	below	184.	june
135.	to	185.	et
136.	from	186.	al
137.	up	187.	s
138.	down	188.	co
139.	in	189.	h
140.	out	190.	tst
141.	on	191.	vt
142.	off	192.	re
143.	over	193.	se
144.	under	194.	isre
145.	again	195.	erg
146.	further	196.	ive
147.	then	197.	ppa
148.	once	198.	rgp
149.	here	199.	e
150.	there	200.	don
151.	when	201.	de
152.	where	202.	le
153.	why	203.	drm
154.	how	204.	sem
155.	all	205.	l
156.	any	206.	b
157.	both	207.	ns
158.	each	208.	v
159.	few		
160.	more		
161.	most		
162.	other		
163.	some		
164.	such		
165.	no		
166.	nor		
167.	not		
168.	only		
169.	own		
170.	same		
171.	so		
172.	than		
173.	too		
174.	very		
175.	*will		
176.	also		

APPENDIX B – Text “O controle da temperatura corporal” (DO CANTO; CANTO, 2009)

3. O controle da temperatura corporal

Você já usou um termômetro para verificar se está com febre? No ser humano a temperatura do corpo permanece praticamente constante ao redor de 37 graus Celsius. A febre é uma condição caracterizada por temperatura corporal acima do valor normal. Na maioria dos casos, a febre é o resultado da reação do organismo a alguma doença.

O ser humano é um exemplo de organismo **homeotérmico**, ou seja, que tem sua temperatura regulada pelo próprio corpo.

Já uma lagartixa não possui essa característica. A sua temperatura pode ser maior ou menor, dependendo do local em que ela está. Nas épocas mais frias do ano, a temperatura desse réptil tende a ser menor do que nas épocas mais quentes. Organismos cuja temperatura não permanece constante são denominados **pecilotérmicos**.

As aves e os mamíferos são homeotérmicos. Todos os outros seres vivos — vertebrados e invertebrados — são pecilotérmicos.

Que vantagens há em ser homeotérmico? E em ser pecilotérmico?

Os homeotérmicos conseguem regular a temperatura corporal, por isso estão menos sujeitos às variações de temperatura do ambiente. Além disso, alguns deles podem suportar a vida em locais bastante frios, como é o caso do pinguim-imperador, que vive nas regiões geladas do Polo Sul. No entanto, para manter a temperatura constante, os homeotérmicos precisam de bastante alimento. É a energia dos alimentos que é usada para manter o corpo aquecido. Um homeotérmico pode viver em local frio, desde que encontre alimento em quantidade suficiente.

Já os pecilotérmicos precisam de relativamente menos alimento, porém estão mais sujeitos às mudanças da temperatura ambiente. Você já percebeu como as lagartixas fogem rapidamente de você em dias quentes, mas, nas noites frias, elas praticamente nem se mexem quando você se aproxima? É porque, com o corpo mais frio, os reflexos da lagartixa ficam mais lentos. Se ela fosse homeotérmica, suas reações seriam praticamente iguais quando estivesse quente ou frio.



comprimento da cabeça à cauda: 30 cm

Os répteis — como esse lagarto (*Diploglossus fasciatus*), encontrado em vários estados do Brasil — são exemplos de animais pecilotérmicos.



comprimento: até 40 cm



Saiba de onde vêm as palavras

“Homeotérmico”, “homeotermo” e “homotermo” são sinônimos e vêm do grego *homóios*, semelhante, e *thérme*, calor, temperatura.

“Pecilotérmico”, “pecilotermo” e “poiquilotermo” são sinônimos e vêm do grego *poikilos*, variado, e *thérme*, calor, temperatura.



ATIVIDADE

Isso entra no nosso vocabulário!

- homeotérmico
- pecilotérmico



altura: 60 cm

Os mamíferos, como o tapiti (ao lado), e as aves, como o colhereiro (acima), são homeotérmicos. Os pelos dos mamíferos e as penas das aves retêm ar, e essa camada de ar dificulta a perda de calor para o ambiente, auxiliando a homeotermia desses animais.

APPENDIX C – Text “Antártica: imenso laboratório de pesquisas” (BOLIGIAN et al., 2009)

Antártica: imenso laboratório de pesquisas

Ao contrário da região polar norte, tomada pelas águas oceânicas em sua parte central, a região polar sul possui extensa área de terras formada pela Antártica, continente com cerca de 14 milhões de km². No inverno, essa área aumenta devido ao congelamento da superfície oceânica à sua volta, chegando a atingir 19 milhões de km².

Embora o maior congelamento ocorra no inverno polar, o solo antártico permanece coberto por espessas camadas de gelo (as *inlandsis*) durante o ano todo. Apenas em alguns lugares, como na península Antártica, o solo fica exposto durante o verão. Estima-se que nas geleiras que cobrem o continente estejam concentrados cerca de 70% das reservas de água doce do planeta.

As temperaturas na região polar sul são mais baixas que as da região polar norte e também as menores da Terra. No verão, são inferiores a 0 °C e, no inverno, em alguns lugares, podem atingir -80 °C.

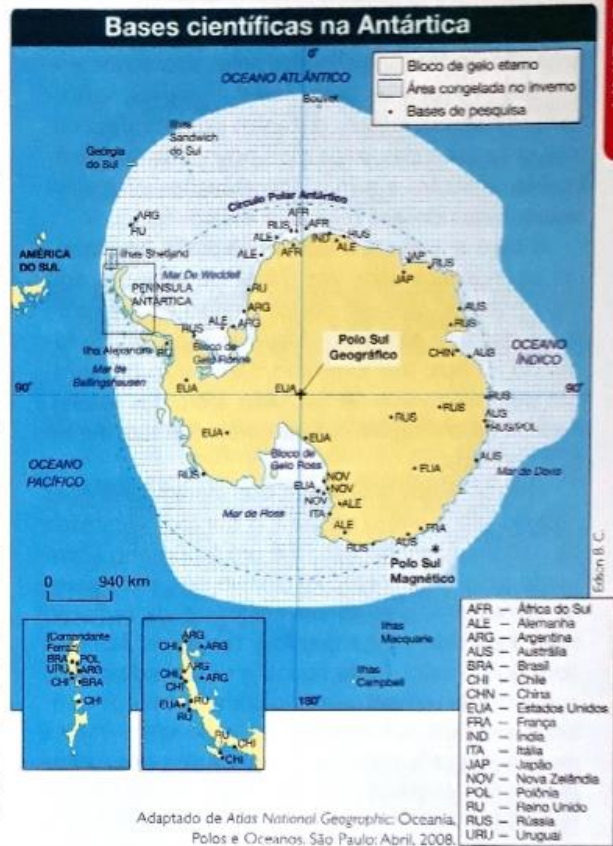
O rigor climático é um dos principais fatores que impedem a ocupação da região. A Antártica não é povoada como o Ártico; lá vivem somente pesquisadores de diferentes nacionalidades. Nas bases científicas da região (observe o mapa desta página), são realizadas pesquisas que beneficiam diversas áreas do conhecimento, como a Biologia, a Geologia e a Geografia.

A ocupação do território antártico por bases de pesquisa é regulamentada desde 1961, quando foi ratificado o Tratado da Antártica. Nesse tratado, decidiu-se que o continente não pertenceria a nenhum país. Naquela ocasião, foram também liberadas as pesquisas com fins pacíficos e proibidos testes nucleares, depósitos de lixo radioativo e exercícios militares na região.

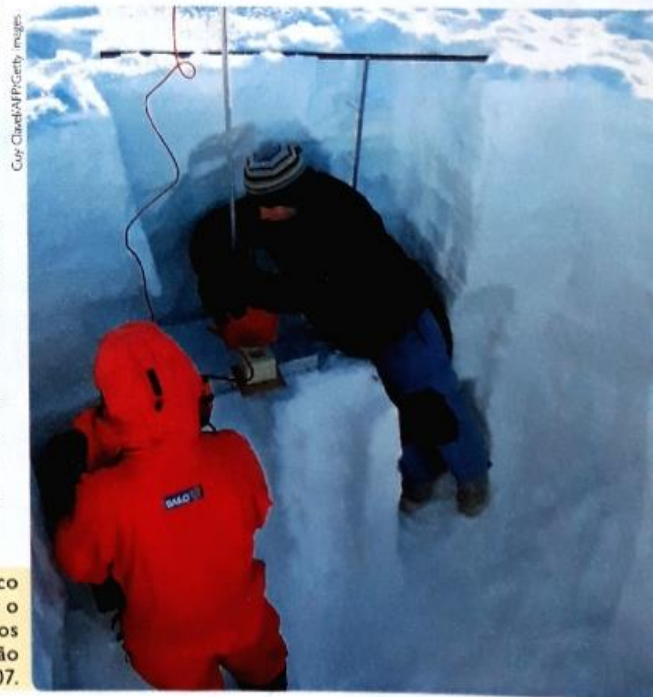
Além dessas resoluções, foram proibidas as atividades econômicas extrativas, com exceção da pesca, permitida no oceano. Estima-se que na Antártica existam importantes reservas de petróleo, além de ouro, prata, urânio, manganês, cobre, entre outros minérios.

Todas as medidas de proibição visam a proteger o ambiente polar, que abriga aproximadamente 50 espécies de aves, além de leões-marinhos, baleias, focas, entre outras espécies da riquíssima fauna antártica.

A realização de pesquisas no continente antártico permite que os cientistas conheçam cada vez melhor o meio polar e a própria biosfera. Ao lado, geólogos coletando amostras de gelo próximo a uma estação franco-italiana, no ano de 2007.



Adaptado de Atlas Nacional Geographic: Oceanias, Polos e Ozeanos. São Paulo: Abril, 2008.



APPENDIX D – Text “O controle da temperatura corporal” (DO CANTO; CANTO, 2009) - Flesch Index (F)

O controle da temperatura corporal

(F = 41.01187)

Você já usou um termômetro para verificar se está com febre? No ser humano a temperatura do corpo permanece praticamente constante ao redor de 37 graus Celsius. A febre é uma condição caracterizada por temperatura corporal acima do valor normal. Na maioria dos casos a febre é o resultado da reação do organismo a alguma doença.

O ser humano é um exemplo de organismo homeotérmico, ou seja, que tem sua temperatura regulada pelo próprio corpo.

Já uma lagartixa não possui essa característica. A sua temperatura pode ser maior ou menor, dependendo do local em que ela está. Nas épocas mais frias do ano, a temperatura desse réptil tende a ser menor do que nas épocas mais quentes. Organismos cuja temperatura não permanece constante são denominados pecilotérmicos.

As aves e os mamíferos são homeotérmicos. Todos os outros seres vivos – vertebrados e invertebrados – são pecilotérmicos.

Que vantagens há em ser homeotérmico? E em ser pecilotérmico?

Os homeotérmicos conseguem regular a temperatura corporal, por isso estão menos sujeitos às variações de temperatura do ambiente. Além disso, alguns deles podem suportar a vida em locais bastante frios, como é o caso do pinguim-imperador, que vive nas regiões geladas do Polo Sul. No entanto, para manter a temperatura constante, os homeotérmicos precisam de bastante alimento. É a energia dos alimentos que é usada para manter o corpo aquecido. Um homeotérmico pode viver em local frio, desde que encontre alimento em quantidade suficiente.

Já os pecilotérmicos precisam de relativamente menos alimentos, porém estão mais sujeitos às mudanças da temperatura ambiente. Você já percebeu como as lagartixas fogem rapidamente de você em dias quentes, mas, nas noites frias, elas praticamente nem se mexem quando você se aproxima? É porque, com o corpo mais frio, os reflexos da lagartixa ficam mais lentos. Se ela fosse homeotérmica, suas reações seriam praticamente iguais quando estivesse quente ou frio.

Fonte: Eduardo Leite do Campo (2009).
Ciências Naturais. Aprendendo com o cotidiano. 7º ano.
São Paulo: Editora Moderna.

APPENDIX E – Text “Antártica: imenso laboratório de pesquisas” (BOLIGIAN et al., 2009) - Flesch Index (F)

Antártica: imenso laboratório de pesquisas

(F = 31.18689)

Ao contrário da região polar norte, tomada pelas águas oceânicas em sua parte central, a região polar sul possui extensa área de terras formada pela Antártica, continente com cerca de 14 milhões de Km². No inverno, essa área aumenta devido ao congelamento da superfície oceânica à sua volta, chegando a atingir 19 milhões de Km².

Embora o maior congelamento ocorra no inverno polar, o solo antártico permanece coberto por espessas camadas de gelo (as *inlandsis*) durante o ano todo. Apenas em alguns lugares como na península Antártica, o solo fica exposto durante o verão. Estima-se que nas geleiras que cobrem o continente estejam concentrados cerca de 70% das reservas de água doce do planeta.

As temperaturas na região polar sul são mais baixas que as da região polar norte e também as menores da Terra. No verão, são inferiores a 0 °C e, no inverno, em alguns lugares, podem atingir -80 °C.

O rigor climático é um dos principais fatores que impedem a ocupação da região. A Antártica não é povoada como o Ártico; lá vivem somente pesquisadores de diferentes nacionalidades. Nas bases científicas da região (observe o mapa desta página), são realizadas pesquisas que beneficiam diversas áreas do conhecimento, como a Biologia, a Geologia e a Geografia.

A ocupação do território antártico por bases de pesquisa é regulamentada desde 1961, quando foi ratificado o Tratado da Antártica. Nesse tratado, decidiu-se que o continente não pertenceria a nenhum país. Naquela ocasião, foram também liberadas as pesquisas com fins pacíficos e proibidos testes nucleares, depósitos de lixo radioativo e exercícios militares na região.

Além dessas resoluções, foram proibidas as atividades extrativas, com exceção da pesca, permitida no oceano. Estima-se que na Antártica existam importantes reservas de petróleo, além de ouro, prata, urânio, manganês, cobre, entre outros minérios.

Todas as medidas de proibição visam proteger o ambiente polar, que abriga aproximadamente 50 espécies de aves, além de leões-marinhos, baleias, focas, entre outras espécies da riquíssima fauna antártica.

Fonte: Levon Boligian, Wanessa Garcia, Rogério Martinez e Andressa Alves.
Geografia. Espaço e Vivência. 9º ano.
São Paulo: Atual Editora.

APPENDIX F – Text “O controle da temperatura corporal” (DO CANTO; CANTO, 2009) - Flesch Index (F) adapted

**O controle da temperatura corporal
(Adaptações do texto em vermelho)
(F= 51.70)**

Você já usou um termômetro para verificar se está com febre? No ser humano a temperatura do corpo permanece praticamente constante ao redor de 37 graus Celsius. Em caso de febre a temperatura corporal fica acima do valor normal. Na maioria dos casos ela é o resultado da reação do organismo a alguma doença.

O ser humano é um exemplo de organismo homeotérmico. Isso significa que ele tem sua temperatura regulada pelo próprio corpo.

Já uma lagartixa não possui essa característica. A sua temperatura pode ser maior ou menor, dependendo do local em que ela está. Nas épocas mais frias do ano, ela tende a ser menor do que nas épocas mais quentes. Organismos cuja temperatura não permanece constante são chamados pecilotérmicos.

As aves e os mamíferos são homeotérmicos. Todos os outros seres vivos (**fragmento extraído**) são pecilotérmicos.

Os homeotérmicos conseguem regular a temperatura corporal. Por esse motivo, estão menos sujeitos às variações de temperatura do ambiente. Além disso, alguns deles podem suportar a vida em locais bastante frios. Um exemplo é o pinguim-imperador, que vive nas regiões geladas do Polo Sul. No entanto, para manter a temperatura constante, os homeotérmicos precisam de bastante alimento. É a energia dos alimentos que é usada para manter o corpo aquecido. Assim, eles podem viver em local frio, desde que encontrem alimento em quantidade suficiente.

Já os pecilotérmicos precisam de relativamente menos alimentos. No entanto, eles estão mais sujeitos às mudanças da temperatura ambiente. Você notou que as lagartixas fogem rapidamente de você em dias quentes, mas, nas noites frias, elas praticamente nem se mexem (**fragmento extraído**)? É porque, com o corpo mais frio, seus reflexos ficam mais lentos. Se ela regulasse a própria temperatura, suas reações seriam praticamente iguais quando estivesse quente ou frio.

Fonte: Eduardo Leite do Campo (2009).
Ciências Naturais. Aprendendo com o cotidiano. 7º ano.
São Paulo: Editora Moderna.

APPENDIX G – APPENDIX 5 – Text “Antártica: imenso laboratório de pesquisas” (BOLIGIAN *et al.*, 2009) - Flesch Index (F) adapted

Antártica: imenso laboratório de pesquisas

(Adaptações do texto em vermelho)

(F= 50.19)

(Fragmento extraído) A região polar sul possui extensa área de terras formada pela Antártica. O continente tem cerca de 14 milhões de Km². No inverno, essa área (fragmento extraído) chega a atingir 19 milhões de Km². Isso ocorre devido ao congelamento da superfície oceânica à sua volta.

(fragmento extraído) Mesmo assim, o solo antártico permanece coberto por espessas camadas de gelo (fragmento extraído) durante o ano todo. Apenas em alguns lugares como na Península Antártica, o solo fica exposto durante o verão. Estima-se que nas geleiras (fragmento extraído) do continente estejam concentradas cerca de 70% das reservas de água doce do planeta.

As temperaturas na região polar sul são mais baixas que as da região polar norte. São também as menores da Terra. No verão, são inferiores a 0 °C e, no inverno, em alguns lugares, podem atingir -80 °C.

O rigor climático é um dos principais fatores que impedem a ocupação da região. A Antártica não é povoada como o Ártico. Lá vivem somente pesquisadores de diferentes nacionalidades. Nas bases científicas da região (fragmento extraído), são realizadas pesquisas (fragmento extraído) em diversas áreas do conhecimento (fragmento extraído).

Sua ocupação (fragmento extraído) por bases de pesquisa é regulamentada desde 1961. Naquele ano foi aprovado o Tratado da Antártica. Nesse tratado, decidiu-se que o continente não pertenceria a nenhum país. (fragmento extraído) Foram também liberadas as pesquisas com fins pacíficos. Além disso, foram proibidos testes nucleares, depósitos de lixo radioativo e exercícios militares (fragmento extraído).

Além (fragmento extraído) disso, foram proibidas as atividades extrativas, com exceção da pesca, permitida no oceano. Estima-se que na Antártica existam importantes reservas de petróleo, além de ouro, prata, urânio, manganês, cobre, entre outros minérios.

Todas as medidas de proibição visam proteger o ambiente polar. Ele abriga aproximadamente 50 espécies de aves, além de leões-marinhos, baleias, focas, entre outras espécies (fragmento extraído).

Fonte: Levon Boligian, Wanessa Garcia, Rogério Martinez e Andressa Alves.
Geografia. Espaço e Vivência. 9º ano.
São Paulo: Atual Editora.

APPENDIX H - The version of the Reading Span Test (DANEMAN; CARPENTER, 1980), adapted to Brazilian Portuguese by Tomitch (2003b) – Sentences

1 - O intelsat-6 foi lançado em 1990, mas nunca funcionou – ficou numa órbita **errada**. (13 palavras, *Veja*, 20 de maio de 1992, p.63).

2 - A iniciativa deve partir da própria pessoa interessada em ter um corpo bonito e **saudável**. (15 palavras, *Veja SC*, 15 de abril de 1992, p.4).

03 - Se o Brasil pretende ir ao espaço sem pedir licença, não pode dispensar um programa de **foguetes**. (17 palavras, *Superinteressante*, setembro de 1992, p.10).

04 - O médico deve levar em conta a idade, número de filhos e saúde do **paciente**. (15 palavras, *Folha de S. Paulo*, 17 de setembro de 1992).

05 - Soube que o marido não ganhou o direito de protestar contra o abandono em momento tão **delicado**. (17 palavras, *Superinteressante*, setembro de 1992, p.4).

06 - Nós pedimos para o mundo falar e a mensagem soou alta, clara e extraordinariamente **perfeita**. (15 palavras, *Veja*, 3 de junho de 1992, p.98).

07 - O telefone celular pode ser usado em qualquer ponto da cidade coberto por uma **célula**. (15 palavras, *Folha de S. Paulo*, 28 de setembro de 1992).

08 - Grandes quantidades de sal tornam a água mais pesada ou densa, diminuindo em consequência, seu **volume**. (16 palavras, *Superinteressante*, julho de 1992, p.17).

09 - Como seres civilizados, deixamos as cavernas nas últimas glaciações, no início da Idade da Pedra **Polida**. (16 palavras, *Superinteressante*, agosto de 1992, p.73).

10 - A desvalorização é o que mais dói no orgulho nacional e no bolso de suas **vítimas**. (16 palavras, *Veja*, 23 de setembro de 1992, p.78).

11 – É quase impossível ter um critério justo, e a decisão acaba ficando nas mãos da **burocracia**. (16 palavras – *Veja*, 23 de setembro de 1992, p. 81).

12 - Os efeitos do sal na pressão das artérias dependem de outros minerais no **organismo**. (14 palavras, *Superinteressante*, fevereiro de 1992, p.15).

13 - Para realizar as atividades cerebrais do pensamento, os neurônios tiram energia do oxigênio e da **glicose**. (14 palavras, *Superinteressante*, julho de 1992, p.10).

14 – O processo de fabricação é o problema que aflige a maior parte dos pequenos **empresários**. (15 palavras – *Folha de S. Paulo*, 29 de novembro de 1992).

15 - Cerca de 250 milhões de pessoas, ao redor do mundo, se encontram na mais profunda **depressão**. (16 palavras, *Superinteressante*, setembro de 1992, p.57).

16 - O Brasil reforça sua presença no milionário clube da telefonia celular com o anúncio de novos **editais**. (17 palavras, *Veja*, 23 de setembro de 1992, p.85).

17 - Quando o cineasta dá rédea solta ao puro amor pelas imagens, o filme arrebata os **sentidos**. (16 palavras, *Folha de S. Paulo*, 23 de setembro de 1992).

18 - Na catarata, a vítima perde a visão gradualmente porque as células do cristalino tornam-se mais **opacas**. (16 palavras, *Superinteressante*, fevereiro de 1992, p.9).

19- É difícil acreditar no acidente que interrompeu a arrancada do trem voador japonês, rumo às rotas **comerciais**. (17 palavras, *Superinteressante*, fevereiro de 1992, versão online).

20 - Os conservadores usaram e abusaram das teses de perversidade, da futilidade e da **ameaça**. (14 palavras, *Folha de S. Paulo*, 23 de setembro de 1992).

21 – A igreja do bispo extorque dinheiro dos fiéis, que são obrigados a fazer doações compulsórias nos **cultos**. (17 palavras – *Veja*, 3 de junho, 1992, p.33).

22 - As bactérias degradam as emulsões coloridas do filme, criando imagens que podem ser definidas como **futuristas**. (16 palavras, *Superinteressante*, fevereiro de 1992, p.14).

23 - A obra custou caro demais, a utilidade é incerta e o resultado final, **polêmico**. (14 palavras, *Veja*, 23 de setembro de 1992, p.60).

24 - É a primeira vez que se consegue em órbita a ovulação e fertilização de espécies **animais**. (16 palavras, *Veja*, 23 de setembro de 1992, p.61).

25 - Os fabricantes de microcomputadores estão criando produtos com novas tecnologias, a preços mais **atraentes**. (14 palavras, *Folha de S. Paulo*, 23 de setembro de 1992).

26 - Pesquisadores descobrem que o antílope das pradarias norte-americanas é o mais resistente dos mamíferos **terrestres**. (15 palavras, *Superinteressante*, julho de 1992, p.37).

27 - Mesmo sem saber o índice de queda nas vendas, desvalorizou as ações da **empresa**. (14 palavras, *Veja*, 23 de setembro de 1992, p.86).

28 - Para os oitenta milhões de telespectadores brasileiros, a televisão significa lazer acessível e **barato**. (14 palavras, *Veja*, 23 de setembro de 1992, p.92).

29 - É preciso desmontar os motores em terra para prever as falhas, trabalho que consome tempo e **dinheiro**. (17 palavras, *Superinteressante*, julho de 1992, p.10).

30 - O paciente precisa de ressuscitação cardiopulmonar o mais rápido possível, feita por pessoas **treinadas**. (14 palavras, *Folha de S. Paulo*, 28 de setembro de 1992).

31 - Segundo Senna, a chuva fez com que o desgaste dos pneus fosse excessivo na **corrida**. (15 palavras, *Folha de S. Paulo*, 28 de setembro de 1992).

32 - O povo com certeza irá ocupar as ruas para mostrar aos deputados o que querem seus **eleitores**. (17 palavras, *Folha de S. Paulo*, 28 de setembro de 1992).

33 – O presidente francês tem um câncer na próstata que pode ser tratado com **medicamentos**. (14 palavras – *Folha de S. Paulo*, 17 de setembro de 1992).

34 – Uma manifestação estudantil ontem em Brasília foi marcada por atritos com a polícia **militar**. (14 palavras – *Folha de S. Paulo*, 17 de setembro de 1992).

35 - Mostra a capacidade do homem em transformar coisas simples em obras de arte, através da **dedicação**. (16 palavras, *Superinteressante*, setembro de 1992, p.3).

36 - Elas mostraram sinais de rotas das caravanas de mercadores, que levaram os pesquisadores à **cidade**. (15 palavras, *Superinteressante*, junho de 1992, p.10).

37 - Cartão-postal sob suspeita: radiação eletromagnética das antenas da Avenida Paulista pode afetar a saúde **humana**. (15 palavras, *Superinteressante*, junho de 1992, versão online).

38 - O investidor pode estar procurando a segurança do ouro, um investimento tradicional, neste momento de crise **política**. (17 palavras, *Folha de S. Paulo*, 23 de setembro de 1992).

39 - As fêmeas dos escorpiões só deixavam os abrigos dez vezes por ano, no **máximo**. (14 palavras, *Superinteressante*, agosto de 1992, p.8).

40 – Não se vê um único exemplar das cem carpas japonesas que vivem no lago **artificial**. (15 palavras – *Veja*, 23 de setembro de 1992, p.8).

41 - A padronização agrícola, para atender aos consumidores, ameaça a diversidade biológica do mundo **vegetal**. (14 palavras, *Superinteressante*, julho de 1992, p.10).

42– O governo desistiu de limitar a importação de carros, conforme proposta defendida pela Secretaria Nacional da **Economia**. (17 palavras – *Folha de São Paulo*, 6 de setembro, 1992).

43- O neandertal tinha testa curta e grossa, mandíbula forte, de queixo curto, e seus ossos eram **pesados**. (17 palavras, *Superinteressante*, julho de 1992, p.37).

44 – Depois de rejeitar acordo em plebiscito, a Dinamarca quer alterar a tendência de centralismo da unificação **Europeia**. (17 palavras – *Folha de S. Paulo*, 23 de setembro de 1992).

45 - Às vésperas do fim da reserva da informática, cresce a pressão por novos privilégios e **favores**. (16 palavras, *Veja*, 23 de setembro de 1992, p.80).

46- Seu público eram as pessoas que olham muito para a pechincha e pouco para a **qualidade**. (16 palavras, *Veja*, 23 de setembro de 1992, p.83).

47- É a primeira vez que o Brasil vende tênis em quantidades expressivas no **exterior**. (14 palavras, *Veja*, 23 de setembro de 1992, p.84).

48 - O resto é luz do céu, claridade que desce da lua prateando a superfície **gelada**. (15 palavras, *VIP EXAME*, junho de 1992, p.44).

49 - O IBGE lançou um Atlas que mostra trezentas e três espécies de animais ameaçadas de **extinção**. (16 palavras, *Folha de S. Paulo*, 23 de setembro de 1992).

50 - O equipamento tem memória que permite dar ao usuário detalhes sobre eventuais defeitos em processos **industriais**. (16 palavras, *Folha de S. Paulo*, 23 de setembro de 1992).

51 - Os bosques de mangues, regados pelas marés, garantem comida farta para a fauna dos **oceanos**. (15 palavras, *Superinteressante*, maio de 1992, p.25).

52 - Hoje, quando o planeta é visto de cima pelos satélites, seus contornos não têm mais **segredo**. (16 palavras, *Superinteressante*, maio de 1992, p.34).

53- A expressão refere-se à tentativa de conciliar o progresso com a preservação da **natureza**. (14 palavras, *Veja*, 3 de junho de 1992, p.34).

54 – Uma proteína do amendoim ajudou células retiradas de tumores do intestino grosso a se reproduzirem em **laboratório**. (17 palavras – *Folha de S. Paulo*, 17 de setembro de 1992).

55- Pesquisa do Sebrae aponta que o novo salário mínimo deve provocar uma onda de **demissões**. (15 palavras, *Folha de S. Paulo*, 17 de setembro de 1992).

56- Os satélites ajudam os oceanógrafos a descobrir a temperatura da água em diversos locais do **planeta**. (16 palavras, *Superinteressante*, agosto de 1992, p.5).

57 - Nos casos de históricos de vida sedentária, evitar esportes anaeróbicos que exigem melhor condicionamento **físico**. (15 palavras, *VIP EXAME*, junho de 1992, p.19).

58- Catástrofes à parte, a maior atração da viagem são a própria galáxia e seus incríveis **habitantes**. (16 palavras, *Superinteressante*, agosto de 1992, p.24).

59 - O computador mostrou que, mesmo sem se quebrarem, alguns capacetes transmitem muita energia mecânica para a **cabeça**. (17 palavras, *Superinteressante*, agosto de 1992, p.30).

60 - A saúde instável do presidente serviu como outro elemento psicológico do ataque de nervos do **mercado**. (16 palavras, *Veja*, 23 de setembro de 1992).

APPENDIX I – The Reading Span Test for Adolescents Speakers of Brazilian Portuguese - Sentences

1 – O rei chora, como se tivesse guardado aquela dor durante muitos séculos **seguidos**. (3 sílabas/palavra final - 13 palavras – Bagno, Marcos – *O espelho dos nomes*, 2014, p. 117).

2 – Quando faltam nutrientes na alimentação, a pessoa pode ficar desnutrida e ter problemas de **saúde**. (3 sílabas/palavra final – 15 palavras – do Canto, Eduardo Leite – *Ciências Naturais. Aprendendo com o cotidiano. 6º ano*, 2009, p. 82).

3 – O pior é que não sabia nem como tinha ido parar ali, quanto mais como iria **escapar**. (3 sílabas/palavra final – 17 palavras – Carpes, Patrícia – *Naufragados*, 2012, p. 33).

4 - Muitas palavras do vocabulário, alimentos e costumes do brasileiro de hoje derivam de culturas **indígenas**. (4 sílabas/palavra final – 15 palavras – Vicentino, Cláudio e Vicentino, José Bruno – *Projeto Mosaico – História - 6º ano*, 2015, p. 63).

5 - A mulher está sorrindo e aperta sua mão com tanta força que ela sente os dedos **estalando**. (4 sílabas/palavra final – 17 palavras – Camargo, Maria – *O medo do mar*, 2014, p. 81).

6 – As regiões polares, também chamadas de polos, localizam-se nos extremos norte e sul do **planeta**. (3 sílabas/palavra final – 15 palavras – Sampaio, Fernando dos Santos, de Medeiros, Marlon Clovis e da Silva, Vagner Augusto – *Geografia – Para Viver Juntos –9º ano*, 2012, p. 249).

7 – Ele não ouve nada e ninguém, a não ser o que passa na janela **mágica**. (3 sílabas/palavra final – 15 palavras – Alencar, Alécio – *Janela mágica*, 1997, p. 18).

8 – Os conhecimentos obtidos em viagens escolares podem ser o ponto de partida para estudos mais **profundos**. (3 sílabas/palavra final – 16 palavras – Sampaio, Fernando dos Santos, de Medeiros, Marlon Clovis e da Silva, Vagner Augusto – *Geografia – Para Viver Juntos –8º ano*, 2012, p. 95).

9 – Em uma multiplicação, é possível trocar a ordem dos fatores que o resultado não se **altera**. (3 sílabas/palavra final – 16 palavras - Souza, Joamir e Pataro, Patricia Moreno – *Vontade de Saber – Matemática – 6º ano*, 2015, p. 68).

10 – O homem que servia cafezinho para as pessoas não se conteve e abraçou os dois **músicos**. (3 sílabas/palavra final – 16 palavras – Azevedo, Ricardo – *Trezentos parafusos a menos*, 2009, p. 126).

11 – A comunicação e a troca de informações entre pessoas também ajudam a organizar o espaço **geográfico**. (5 sílabas/palavra final – 16 palavras – de Sene, Eustáquio e Moreira, João Carlos – *Geografia –6º ano*, 2013, p. 23).

12 – Andaram muitos dias pela mata virgem até que avistaram uma porta de outra **povoação**. (4 sílabas/palavra final – 14 palavras – Caruso, Carla – *Zumbi. O último herói dos Palmares*, 2005, p. 31).

13 – As plantas também precisam de energia, porém não se alimentam da mesma forma que os **animais**. (3 sílabas/palavra final – 16 palavras – do Canto, Eduardo Leite – *Ciências Naturais. Aprendendo com o cotidiano. 6º ano*, 2009, p. 21).

14 – A vida foi se instalando, novamente cheia de prazer, até o galo cantar a **madrugada**. (4 sílabas/palavra final – 15 palavras – Albissú, Nelson – *É difícil de entender, vô!*, 2010, p. 36).

15 – Os mapas representam áreas mais extensas da superfície da Terra; por isso não mostram muitos **detalhes**. (3 sílabas/palavra final – 16 palavras – de Sene, Eustáquio e Moreira, João Carlos – *Geografia – 6º ano*, 2013, p. 61).

16 – Logo após serem alertados pelo alarme do banco, vários carros de polícia chegaram com as sirenes **abertas**. (3 sílabas/palavra final – 17 palavras – Bandeira, Pedro – *A droga da obediência*, 1997, p. 61).

17 – Para medirmos o tempo do dia, utilizamos o relógio, que pode ser de ponteiros ou **digital**. (3 sílabas/palavra final – 16 palavras - Souza, Joamir e Pataro, Patricia Moreno – *Vontade de Saber – Matemática – 6º ano*, 2015, p. 254).

18 – Elas desfiam o pano e depois amarram uns fios de tecido com os outros, formando **desenhos**. (3 sílabas/palavra final – 16 palavras – Alegria, João e Medeiros, Rodrigo – *Manual do defensor do planeta*, 2012, p. 47).

19 – Um dos critérios que os biólogos escolheram diz respeito à maneira como o ser vivo obtém **alimento**. (4 sílabas/palavra final – 17 palavras – do Canto, Eduardo Leite – *Ciências Naturais. Aprendendo com o cotidiano. 7º ano*, 2012, p.19).

20 – Durante a travessia, os comunistas conquistaram novos adeptos e difundiram suas ideias aos **camponeses**. (4 sílabas/palavra final – 14 palavras – Braick, Patrícia Ramos – *Estudar História – 9º ano*, 2015, p. 151).

21 – Confessou à princesa que tudo aquilo que fez foi pelo prazer simples de trazer felicidade a **alguém**. (2 sílabas/palavra final - 17 palavras – Bagno, Marcos – *O espelho dos nomes*, 2014, p. 59).

22 – A essa hora o lugar está deserto e também muito escuro devido à falta de **energia**. (4 sílabas/palavra final - 16 palavras – Azevedo, Ricardo – *A hora do cachorro louco*, 2006, p. 86).

23 – O homem ficou a noite inteira olhando aquele grande corpo escuro com cabeça **luminosa**. (4 sílabas/palavra final - 14 palavras – Ayala, Walmir - *Moça lua e outras lendas*, 2012, p. 58).

24 – Os gregos acreditavam que os deuses podiam tanto favorecer quanto prejudicar os seres **humanos**. (3 sílabas/palavra final – 14 palavras – Boulos Júnior, Alfredo – *História – Sociedade e Cidadania – 6º ano*, 2015, p. 232).

- 25 – O pai costuma dizer que está com saudades delas, já que agora raramente **aparecem**. (4 sílabas/palavra final – 14 palavras – Camargo, Maria – *O medo do mar*, 2014, p. 34).
- 26 – Os dois giraram vagarosamente, um para cada lado, olhando o depósito, até que deram de cara **conosco**. (3 sílabas/palavra final – 17 palavras – Alves-Calado, Ivanir – *A caverna dos Titãs*, 2008, p. 129).
- 27 – Disseram que estava muito frio por lá, mas que a festa era muito **bonita**. (3 sílabas/palavra final – 14 palavras – Carpes, Patrícia – *Naufragados*, 2012, p. 11).
- 28 – Os semideuses, embora tenham dons especiais, não são donos de seu destino nem **imortais**. (3 sílabas/palavra final – 14 palavras – Cereja, William e Cochar, Thereza – *Português Linguagens – 7º ano*, 2015, p. 21).
- 29 – Os trabalhadores informais exercem atividades rurais, na construção civil, em oficinas, fábricas e no setor de **transporte**. (3 sílabas/palavra final – 17 palavras – Sampaio, Fernando dos Santos, de Medeiros, Marlon Clovis e da Silva – *Geografia – Para Viver Juntos – 7º ano*, 2012, p. 73).
- 30 – Os sons podem ser classificados com base no estudo e características das fontes **sonoras**. (3 sílabas/palavra final – 14 palavras – Utuari, Solange, Kater, Carlos, Fischer Bruno e Ferrari, Pascoal – *Por toda Parte - Artes – 6º ano*, 2015, p. 39).
- 31 – Quando eles descobrissem qual era esse detalhe, com certeza chegariam com rapidez à solução do **problema**. (3 sílabas/palavra final – 16 palavras – Bandeira, Pedro – *A droga da obediência*, 1997, p. 28).
- 32 – A cidade é um lugar de encontro, onde as pessoas podem compartilhar a dor e a **alegria**. (4 sílabas/palavra final – 17 palavras – Meira, Beá, Soter Silvia, Elia, Ricardo, Presto, Rafael – *Projeto Mosaico – Arte – 7º ano*, 2015, p.12).
- 33 – Com a Internet, até mesmo a forma de escrever as palavras tem se **modificado**. (5 sílabas/palavra final – 14 palavras – Cereja, William e Cochar, Thereza – *Português Linguagens – 6º ano*, 2015, p. 40).
- 34 – Bateu na mesa e continuou, o rosto mais vermelho que o caminhão de **bombeiros**. (3 sílabas/palavra final – 16 palavras – Cazarré, Lourenço – *O mistério da obra-prima*, 1993, p. 59).
- 35 – Assim, os passageiros daquele voo desceram normalmente e dirigiram-se para o local onde apresentariam os **passaportes**. (4 sílabas/palavra final – 16 palavras – Bandeira, Pedro – *Anjo da morte*, 1995, p. 83).
- 36 – As cidades crescem graças ao comércio, e, quanto maiores ficam, mais se transformam em centros de **consumo**. (3 sílabas/palavra final – 17 palavras – Meira, Beá, Soter Silvia, Elia, Ricardo, Presto, Rafael – *Projeto Mosaico – Arte – 7º ano*, 2015, p.17).
- 37 – O inglês parou um pouco, tomando fôlego, tentando, tentando lembrar-se com esforço do que havia **ouvido**. (3 sílabas/palavra final – 16 palavras – Bandeira, Pedro – *A hora da verdade*, 1998, p. 72).

38 – Uma célula é uma pequena estrutura viva, que pode ser vista com o auxílio de um **microscópio**. (4 sílabas/palavra final – 17 palavras – do Canto, Eduardo Leite _ Ciências Naturais. *Aprendendo com o cotidiano*. 7º ano, 2012, p.45).

39 – O velho deu meia-volta e encaminhou-se de cabeça baixa para uma porta **lateral**. (3 sílabas/palavra final – 14 palavras – Bandeira, Pedro – *Anjo da morte*, 1995, p. 68).

40 – De uma hora para outra, tudo naquela casa parecia ter ficado velho, gasto e **ultrapassado**. (5 sílabas/palavra final – 15 palavras – Azevedo, Ricardo – *Trezentos parafusos a menos*, 2009, p. 62).

41 – Os faraós egípcios trabalhavam na construção de obras grandiosas, como túmulos, templos e **palácios**. (3 sílabas/palavra final – 14 palavras – Boulos Júnior, Alfredo – *História – Sociedade e Cidadania –6º ano*, 2015, p. 151).

42 – De costas para a TV, a empregada lava a louça e canta baixinho um belo hino **religioso**. (5 sílabas/palavra final - 17 palavras – Azevedo, Ricardo – *A hora do cachorro louco*, 2006, p. 12).

43 – A formação de grandes reinos ao sul do Saara esteve diretamente ligada ao comércio a longa **distância**. (3 sílabas/palavra final – 17 palavras – Apolinário, Maria Raquel – *Projeto Araribá – História - 7º ano*, 2010, p. 50).

44 – Podemos dizer que um texto está em prosa quando ele é organizado em frases contínuas formando **parágrafos**. (4 sílabas/palavra final – 17 palavras – Borgato, Ana Trinconi, Bertin, Terezinha e Marchezi, Vera – *Projeto Teláris - Português –6º ano*, 2014, p. 22).

45 – Espalhados pelo pátio, outros alunos também tentavam conseguir informações sobre a nova professora, mas sem **sucesso**. (3 sílabas/palavra final – 16 palavras – Barlow, Steve e Skidmore, Steve – Tradução de Lando, Isa Mara e Lando, Mauro - *Estátua*, 2010, p. 23).

46 – Mas já que não pode perguntar tudo o que quer saber, pergunta apenas o mais **importante**. (4 sílabas/palavra final – 16 palavras – Colasanti, Marina – *Ana Z. aonde vai você?*, 2007, p. 15).

47 – Uma aula de Geografia arrastou-se inteirinha, até que batesse o sinal para o **intervalo**. (4 sílabas/palavra final – 14 palavras – Bandeira, Pedro – *A hora da verdade*, 1998, p. 111).

48 – Em meio ao clarão aparece uma garra, só uma, enorme, raspando devagar o piso **áspero**. (3 sílabas/palavra final – 15 palavras – Alves-Calado, Ivanir – *A caverna dos Titãs*, 2008, p. 07).

49 – Rolava para um lado, depois para o outro, enquanto mil pensamentos rodavam na sua **cabeça**. (3 sílabas/palavra final – 15 palavras – Albissú, Nelson – *É difícil de entender, vô!*, 2010, p. 32).

50 – Apesar de perder a predominância, o açúcar ainda continuou sendo um produto importante para as **exportações**. (4 sílabas/palavra final – 16 palavras – Apolinário, Maria Raquel – *Projeto Araribá – História - 8º ano*, 2014, p. 201).

51 – Uma criança que trabalha não consegue desfrutar de direitos básicos, como lazer e **educação**. (4 sílabas/palavra final – 15 palavras – Vicentino, Cláudio e Vicentino, José Bruno – *Projeto Mosaico – História - 6º ano*, 2015, p. 177).

52 – Escolheram um lugar especial, no alto de uma colina, de onde dava para ver toda a **cidade**. (3 sílabas/palavra final – 16 palavras – Alegria, João e Medeiros, Rodrigo – *Manual do defensor do planeta*, 2012, p. 140).

53 – As terras situadas a oeste das treze colônias ficaram sob controle militar da **metrópole**. (4 sílabas/palavra final – 14 palavras – Apolinário, Maria Raquel – *Projeto Araribá – História - 8º ano*, 2014, p. 95).

54 – A intensidade da exploração dos recursos pela industrialização levou ao esgotamento total dos recursos minerais e **energéticos**. (5 sílabas/palavra final – 17 palavras – Sampaio, Fernando dos Santos, de Medeiros, Marlon Clovis e da Silva, Vagner Augusto – *Geografia – Para Viver Juntos – 9º ano*, 2012, p. 87).

55 – A ameaça de uma invasão alemã à ilha foi utilizada como tema de vários **cartazes**. (3 sílabas/palavra final – 15 palavras – Braick, Patrícia Ramos – *Estudar História – 9º ano*, 2015, p. 69).

56 - Sua boca abriu-se como se ele estivesse prestes a comer uma maçã com uma só **dentada**. (3 sílabas/palavra final – 16 palavras – Cazarré, Lourenço – *O mistério da obra-prima*, 1993, p. 39).

57 – O menino sorridente esperava por ela e adormeceu ouvindo a linda história daquele **passeio**. (3 sílabas/palavra final - 14 palavras – Ayala, Walmir - *Moça lua e outras lendas*, 2012, p. 72).

58 – Em áreas onde a vegetação está bem preservada, a água das chuvas escoava lentamente pela **superfície**. (4 sílabas/palavra final – 16 palavras – de Sene, Eustáquio e Moreira, João Carlos – *Geografia – 6º ano*, 2013, p. 145).

59 – As denúncias de trabalho escravo também atingem os caminhoneiros, outros trabalhadores que podem ser considerados escravos **urbanos**. (3 sílabas/palavra final – 17 palavras – Apolinário, Maria Raquel – *Projeto Araribá – História - 7º ano*, 2010, p. 245).

60 – Ao recontar uma história, é muito comum que ela seja modificada e adaptada ao público **ouvinte**. (3 sílabas/palavra final – 16 palavras – Cereja, William e Cochar, Thereza – *Português Linguagens – 6º ano*, 2015, p. 53).

APPENDIX J – Reading comprehension task 1 - Open-ended questions

Tarefa de Compreensão Leitora 1 - Questionário

Participante número _____

Data: ____/____/2019.

Com base no texto que você acabou de ler, responda as questões abaixo atenciosamente. Suas respostas serão mantidas em sigilo.

- 01) Podemos afirmar que o organismo da lagartixa é homeotérmico? Justifique sua resposta.

- 02) O que garante a sobrevivência do ser humano em locais com temperatura muito superior à de seu corpo?

- 03) Por que os seres peilotérmicos apresentam tanta variação de temperatura durante as quatro estações do ano?

- 04) Por que em situações de risco as chances de fuga dos mamíferos não são tão afetadas pelos efeitos de baixas temperaturas em seus organismos?

- 05) Além do ser humano e do pinguim-imperador, mencione mais dois exemplos de seres que possuem organismos homeotérmicos:

- 06) O que é preciso para manter um organismo homeotérmico em temperatura constante?

- 07) O que a febre costuma significar na maioria dos casos?

- 08) Em qual região do planeta vive o pinguim-imperador?

- 09) Quais são os seres que necessitam de relativamente menos alimentos?

- 10) Como tende a ser a temperatura do organismo da lagartixa nas épocas mais frias do ano?

Muito obrigado! 😊

APPENDIX K – Reading comprehension task 1 - Open-ended questions with possible answers

Tarefa de Compreensão Leitora 1 - Questionário com respostas

Participante número _____

Data: ____/____/2019.

Com base no texto que você acabou de ler, responda as questões abaixo atentadamente. Suas respostas serão mantidas em sigilo.

01) Podemos afirmar que o organismo da lagartixa é homeotérmico? Justifique sua resposta.

Não, pois a sua temperatura varia de acordo com o ambiente. **Textualmente implícita.**

Não, pois a sua temperatura não é regulada pelo próprio corpo.

Não, pois a temperatura de seu corpo não é constante.

02) O que garante a sobrevivência do ser humano em locais com temperatura muito superior à de seu corpo?

O fato de ele ter sua temperatura regulada pelo próprio corpo. **Textualmente implícita.**

03) Por que os seres peclotérmicos apresentam tanta variação de temperatura durante as quatro estações do ano?

Porque a temperatura de cada estação influencia a temperatura de seus corpos. **Textualmente implícita.**

04) Por que em situações de risco as chances de fuga dos mamíferos não são tão afetadas pelos efeitos de baixas temperaturas em seus organismos?

Porque seus corpos permanecem em temperatura constante, e, por isso, seus reflexos não são afetados. **Textualmente implícita.**

05) Além do ser humano e do pinguim-imperador, mencione mais dois exemplos de seres que possuem organismos homeotérmicos?

Qualquer exemplo de ave ou de mamífero. **Esquemáticamente implícita.**

06) O que é preciso para manter um organismo homeotérmico em temperatura constante?

Bastante alimento. **Textualmente explícita.**

07) O que a febre costuma significar na maioria dos casos?

O resultado da reação do organismo a alguma doença. **Textualmente explícita.**

- 08) Em qual região do planeta vive o pinguim-imperador?
Polo Sul. **Textualmente explícita.**
- 09) Quais são os seres que necessitam de relativamente menos alimentos?
Os seres pecilotérmicos. **Textualmente explícita.**
- 10) Como tende a ser a temperatura do organismo da lagartixa nas épocas mais frias do ano?
Ela tende a ser menor. **Textualmente explícita.**

APPENDIX L – Reading comprehension task 2 – Multiple-choice questions**Tarefa de Compreensão Leitora 2**

Participante número _____

Data: ____/____/2019.

Após ter lido o texto, assinale apenas “1” resposta para cada uma das questões abaixo. Suas respostas serão mantidas em sigilo.

1. O que o Tratado da Antártica determina quanto às atividades extrativas econômicas?

- A () determina que naquele continente não é autorizada a extração de ouro e prata, entre outros minérios.
- B () determina que naquele continente é autorizada a extração de ouro e cobre entre outros minérios.
- C () determina que naquele continente não é autorizada a extração de minérios, com exceção do manganês e do urânio.

2. O que ocorre com o território da Antártica durante o ano devido às mudanças de temperatura?

- A () o aumento contínuo de seu tamanho.
- B () a diminuição de seu tamanho devido às baixas temperaturas.
- C () o aumento e a diminuição de seu tamanho.

3. O que o texto afirma sobre as reservas de água doce que existem na Antártica?

- A () que no inverno elas chegam a totalizar aproximadamente 70% das reservas existentes no planeta.
- B () que possivelmente mais da metade das reservas existentes no planeta se encontram naquele continente.
- C () que essas reservas existem em aproximadamente 70% das geleiras daquele continente.

4. De que modo o Tratado da Antártica protege a vida animal daquela região?

- A () protegendo toda a sua fauna das atividades econômicas extrativistas.
- B () protegendo parte da sua fauna das atividades econômicas extrativistas.
- C () proibindo totalmente a realização de atividades econômicas extrativistas.

5. Por qual motivo o Ártico possui mais habitantes que a Antártica?

- A () por possuir temperaturas menos baixas.
- B () por possuir maior extensão territorial.

C () por receber um grande número de pesquisadores de várias nacionalidades.

6. O que o texto afirma sobre as espécies de aves que existem na Antártica?

A () que elas compõem 50% da sua fauna.

B () que existem aproximadamente 50 espécies.

C () que existem somente 50 espécies.

7. A quem pertence a Antártica?

A () pertence aos países que realizam pesquisas naquele território.

B () não pertence a país nenhum.

C () pertence aos países que assinaram o Tratado da Antártica.

8. Qual é a extensão aproximada da área de terras da Antártica?

A () 15 milhões de Km².

B () 16 milhões de Km².

C () 14 milhões de Km².

9. Assinale a alternativa que apresenta uma das proibições do Tratado da Antártica:

A () a realização de exercícios militares.

B () a condução de pesquisas com fins pacíficos.

C () a existência de bases científicas na região.

10. O que ocorre com o solo da Antártica no verão?

A () ele fica exposto na maioria dos lugares.

B () ele fica exposto na região da Península Antártica.

C () ele permanece coberto de gelo em 70% das regiões.

Muito obrigado! ☺

APPENDIX M – Reading comprehension task 2 – Multiple-choice questions with answers

Tarefa de Compreensão Leitora 2

Participante número _____

Data: ____/____/2019.

Após ter lido o texto, assinale apenas “1” resposta para cada uma das questões abaixo. Suas respostas serão mantidas em sigilo.

1. O que o Tratado da Antártica determina quanto às atividades extrativas econômicas?

A () determina que naquele continente não é autorizada a extração de ouro e prata, entre outros minérios. **Textualmente Implícita.**

B () determina que naquele continente é autorizada a extração de ouro e cobre entre outros minérios.

C () determina que naquele continente não é autorizada a extração de minérios, com exceção do manganês e do urânio.

2. O que ocorre com o território da Antártica durante o ano devido às mudanças de temperatura?

A () o aumento contínuo de seu tamanho.

B () a diminuição de seu tamanho devido às baixas temperaturas.

C () o aumento e a diminuição de seu tamanho. **Textualmente Implícita.**

3. O que o texto afirma sobre as reservas de água doce que existem na Antártica?

A () que no inverno elas chegam a totalizar aproximadamente 70% das reservas existentes no planeta.

B () que possivelmente mais da metade das reservas existentes no planeta se encontram naquele continente. **Textualmente Implícita.**

C () que essas reservas existem em aproximadamente 70% das geleiras daquele continente.

4. De que modo o Tratado da Antártica protege a vida animal daquela região?

A () protegendo toda a sua fauna das atividades econômicas extrativistas.

B () protegendo parte da sua fauna das atividades econômicas extrativistas. **Textualmente Implícita.**

C () proibindo totalmente a realização de atividades econômicas extrativistas.

5. Por qual motivo o Ártico possui mais habitantes que a Antártica?

A () por possuir temperaturas menos baixas. **Textualmente Implícita.**

B () por possuir maior extensão territorial.

C () por receber um grande número de pesquisadores de várias nacionalidades.

6. O que o texto afirma sobre as espécies de aves que existem na Antártica?

- A () que elas compõem 50% da sua fauna.
B () que existem aproximadamente 50 espécies. **Textualmente Explícita.**
C () que existem somente 50 espécies.

7. A quem pertence a Antártica?

- A () pertence aos países que realizam pesquisas naquele território.
B () não pertence a país nenhum. **Textualmente Explícita.**
C () pertence aos países que assinaram o Tratado da Antártica.

8. Qual é a extensão aproximada da área de terras da Antártica?

- A () 15 milhões de Km².
B () 16 milhões de Km².
C () 14 milhões de Km². **Textualmente Explícita.**

9. Assinale a alternativa que apresenta uma das proibições do Tratado da Antártica:

- A () a realização de exercícios militares. **Textualmente Explícita.**
B () a condução de pesquisas com fins pacíficos.
C () a existência de bases científicas na região.

10. O que ocorre com o solo da Antártica no verão?

- A () ele fica exposto na maioria dos lugares.
B () ele fica exposto na região da Península Antártica. **Textualmente Explícita.**
C () ele permanece coberto de gelo em 70% das regiões.

APPENDIX N – Participants' scores of the main study

Participante Nº	Questionário	Múltipla Escolha	Tomitch	RSTA	Tomitch	RSTA
			Span Rig.	Span Rig.	Span Len.	Span Len.
01	1,005	2,01	2	2,5	31	25
02	1,34	4	2	1,5	18	22
03	0,67	1,33	2	2	23	22
04	8,005	5,33	3,5	3,5	35	36
05	6,67	4,01	2	1,5	19	26
06	6,665	6	3	3	29	30
07	1,335	2,01	2,5	2,5	30	31
08	5,005	2,67	2,5	3	30	34
09	1,005	2,67	2,5	2,5	22	26
10	7,665	3,34	5,5	4,5	36	37
11	2,665	1,33	2	1	20	15
12	1,675	6,67	2,5	2	14	29
13	00	2	2	1	15	13
14	7,005	4,67	2,5	2	23	24
15	00	1,33	1	1,5	19	14
16	2,34	1,34	2	1,5	22	21
17	6,67	4,68	2	2	20	23
18	2,0	1,34	2	2	19	21
19	6,66	3,34	2,5	2	19	21
20	8,0	7,34	2,5	2,5	24	28
21	6,0	4	2	2	30	33
22	2,68	2,67	2	2	25	23
23	1,675	5,34	2,5	2	22	27
24	1,34	2,67	1	2	28	24
25	5,335	3,34	2,5	2	26	30
26	8,005	4,67	2,5	2	30	29
27	2,01	6,67	2	3	21	32
28	7,33	5,34	2	2	27	25
29	3,35	0,67	2,5	2	28	28
30	7,005	2	2,5	2	25	24
31	5,33	6,67	2	3	19	24
32	2,67	2	2,5	2	22	18
33	2,005	3,35	2	2	22	17
34	4,0	2	1	1	15	19
35	6,005	4,67	2	2	24	31
36	1,005	1,33	2	2	23	21
37	8,0	4,67	2	2	32	31
38	8,005	1,34	2	2	22	25
39	4,0	5,34	2	2,5	22	28
40	3,675	4	2	1	23	21
41	1,995	2	2	2	35	33
42	0,67	2	2,5	2	22	24

43	5,34	4	2	2	21	26
44	3,33	5,33	3	2	25	22
45	0,67	1,34	2,5	2	21	21
46	3,005	2,67	2	2,5	32	32
47	2,67	4,01	2	3	29	31
Totals	183,45 <i>M= 3.903</i>	161.5 <i>M=</i> 3.436	105.5 <i>M=</i> 2.244	100 <i>M=</i> 2.12	1139 <i>M=</i> 24.234	1197 <i>M=</i> 25.468

APPENDIX O – Instructions – Main Study

RST (Tomitch, 2003b) e RSTA – Instruções padrão

Por favor, leia as frases em voz alta, ao seu próprio ritmo e sem pausas, assim que elas aparecerem na tela do computador. Preste atenção ao significado durante a leitura. Ou seja, busque entender o que você está lendo. Além disso, memorize a última palavra de cada frase. Quando aparecer o ponto de interrogação, diga as últimas palavras de cada uma das frases que você leu em voz alta para eu anotar. Assim que eu terminar de anotar, novas frases aparecerão. Leia-as assim que aparecerem, como lhe expliquei antes.

RST (Tomitch, 2003b) e RSTA – Instruções adicionais para o método leniente de aplicação do teste

[...] diga as últimas palavras de cada uma das frases que você leu, na ordem exata que elas apareceram, em voz alta para eu anotar.

Começaremos com três conjuntos contendo duas frases cada. Depois iremos aumentando uma palavra a cada três conjuntos.

RST (Tomitch, 2003b) e RSTA – Instruções adicionais para o método rigoroso de aplicação do teste

[...] diga as últimas palavras de cada uma das frases que você leu, em qualquer ordem, em voz alta para eu anotar. Só um detalhe, pode ser em qualquer ordem, mas não comece falando a última palavra da última frase que você leu. Caso você falar ela primeira, eu vou pedir que você a repita depois que terminar de falar as outras.

As frases serão organizadas em três conjuntos de duas, três, quatro e cinco frases. Às vezes você irá ler três conjuntos de duas frases, às vezes de três, de cinco, e assim por diante. Sempre será diferente.

Textos 1 e 2

Você receberá um texto de uma página e terá quatro minutos para lê-lo. Leia-o silenciosamente e com atenção. Passados os quatro minutos, o texto será recolhido e você responderá dez perguntas sobre o seu conteúdo.

Tarefa de compreensão leitora com perguntas abertas

Leia as perguntas atentamente e responda-as de acordo com as informações do texto que você acabou de ler. Você terá seis minutos para realizar essa tarefa.

Tarefa de compreensão leitora com questões de múltipla escolha

Você receberá um texto de uma página e terá quatro minutos para lê-lo. Leia-o silenciosamente e com atenção. Passados os quatro minutos, o texto será recolhido e você responderá dez questões de múltipla escolha sobre o seu conteúdo.

Instruções comuns às duas tarefas de compreensão leitora

Caso não souber alguma resposta, deixe-a em branco. Não chute e nem tente adivinhar as respostas. Isso é muito importante para a pesquisa. Lembrem que vocês não estão sendo avaliados e que os nomes de vocês serão mantidos sob total sigilo!

APPENDIX P – Participants' scores of the pilot study in the RST (Tomitch 2003b) and in the RSTA

Participant N°	Tomitch	RSTA	Tomitch	RSTA
	Span Rig.	Span Rig.	Span Len.	Span Len.
1	2.0	---	---	23
2	1.0	---	---	23
3	---	2.0	21	---
4	---	2.0	29	---
5	3.0	---	---	28
6	---	2.5	20	---
7	2.0	---	---	21
8	2.0	---	---	23
9	---	2.0	26	---
10	---	2	16	---
11	2.0	---	---	19
12	---	3.5	37	---

APPENDIX Q – Participants' scores of the pilot study in the reading comprehension tasks 1 and 2 with details on timing and prior knowledge

Part. Nº	Quest. Efeito Conhec. prévio	Múltipla Escolha Efeito Conhec. prévio	Tempo Leitura Texto 1	Tempo Leitura Texto 2	Tempo Tarefa 1	Tempo Tarefa 2	Pont. Tarefa 1	Pont. Tarefa 2
01	X	---	1'30"	3'	---	3'10"	---	7.0
02	(8) Polo Norte	---	2'	3'	---	3'15"	---	3.0
03	---	(2) e (3)	3'40"	3'17"	4'52"	---	0.0	---
04	---	(9)	3'20"	3'06"	4'52"	---	1.0	---
05	(8)	---	3'56"	3'26"	---	3'14"	---	8.0
06	---	(1) (5) (6) (9)	3'21"	3'28"	6'23"	---	4.0	---
07	X	---	2'46"	3'40"	---	3'	---	1.0
08	X	---	2'21"	2'21"	---	4'	---	7.0
09	---	X	3'19"	4'04"	4'	---	3.0	---
10	---	(9)	3'26"	4'11"	6'37"	---	2.0	---
11	X	---	1'27"	1'37"	---	3'05"	---	6.0
12	---	(1) (2) (6) (7) (9)	1'48"	4'07"	6'46"	---	8.0	---
Tot.	-	-	3'04"	3'28"	5'58"	3'23	-----	-----

APPENDIX R – Instructions – Pilot study

Tarefa de compreensão leitora com perguntas abertas – Conhecimento prévio

Você está recebendo um questionário sobre um texto chamado: “O controle da temperatura corporal”. Caso você saiba a resposta de alguma das questões mesmo sem ler esse texto, responda-a. Caso não souber, deixe em branco.

Tarefa de compreensão leitora com questões de múltipla escolha – Conhecimento prévio

Você está recebendo um exercício de múltipla escolha sobre um texto chamado: “Antártica: um imenso laboratório de pesquisas”. Para cada pergunta, há apenas uma alternativa certa. Caso você saiba qual é essa alternativa correta, mesmo sem ler o texto, assinale-a. Caso não souber, deixe em branco.

Textos 1 e 2 - Tempo de leitura

Você está recebendo um texto chamado “Antártica: um imenso laboratório de pesquisas/O controle da temperatura corporal”. Leia o texto imaginando que na sequência você fosse responder algumas questões sobre o seu conteúdo, sem poder consultá-lo. Tome o tempo que achares necessário para terminar de ler e compreender o texto.

Tarefa de compreensão leitora com perguntas abertas

Você está recebendo um questionário com 10 perguntas sobre o texto que acabou de ler. Tente respondê-las. As que não souber, deixe em branco.

Tarefa de compreensão leitora com questões de múltipla escolha

Você está recebendo um exercício de múltipla escolha com 10 questões sobre o texto que acabou de ler. Para cada pergunta, há 5 alternativas de respostas e somente uma está certa. Assinale-a quando souber. As que não souber, deixe em branco.

APPENDIX S - Participants' assent form - Pilot study



UNIVERSIDADE FEDERAL DE SANTA CATARINA PROGRAMA DE PÓS-GRADUAÇÃO EM INGLÊS: ESTUDOS LINGUÍSTICOS E LITERÁRIOS

TERMO DE ASSENTIMENTO LIVRE E ESCLARECIDO Estudo Inicial - Piloto – Participantes

Prezado (a) estudante:

Eu me chamo **Sidnei Werner Woelfer** e sou estudante de Doutorado da **Universidade Federal de Santa Catarina**. Faço pesquisa na área de leitura e cognição e sou orientado pela Professora Doutora **Lêda Maria Braga Tomitch**.

Estou lhe entregando este documento para lhe convidar a participar voluntariamente do estudo piloto da etapa inicial da pesquisa intitulada “**Capacidade da Memória de Trabalho e o Papel do Canto na Aquisição de Vocabulário e no Desenvolvimento da Motivação para Aprender Inglês como Língua Estrangeira**”. Nessa etapa inicial, será desenvolvido um teste chamado “**Teste de Capacidade de Memória de Trabalho para Adolescentes Brasileiros**”. Para isso, precisarei testar algumas tarefas nesse estudo piloto para o qual eu lhe convido. Explicarei os detalhes abaixo.

Por que esta pesquisa está sendo realizada?

Estudos indicam que uma boa aprendizagem depende de nossa capacidade de simultaneamente processar e armazenar informações em tempo real em nossa memória. Essa memória que simultaneamente processa e armazena informações em tempo real é conhecida como “memória de trabalho”, e é bastante limitada. Apesar dessa limitação, dependemos dela para aprender matemática, português, línguas estrangeiras e música, por exemplo. Assim, na etapa inicial dessa pesquisa, temos como objetivo desenvolver um teste para medir a capacidade da memória de trabalho de adolescentes brasileiros. Essa ferramenta poderá ser muito importante para futuras pesquisas científica que investigam o funcionamento da memória de adolescentes e também para os profissionais que atuam na área da educação. Ela poderá ajudar professores e orientadores pedagógicos a verificarem se as dificuldades que alguns estudantes apresentam podem estar relacionadas à uma baixa capacidade de memória de trabalho. Com essa verificação, será possível desenvolver materiais e métodos de ensino que auxiliem esses estudantes. Bem, para desenvolver esse teste de memória de trabalho, uma “coleta de dados” será realizada nesse estudo piloto.

O que será realizado nessa “coleta de dados”?

Os estudantes que aceitarem e que forem autorizados por seus pais e/ou responsáveis a participarem do estudo piloto realizarão seis tarefas nas próprias dependências da escola. Isso tudo ocorrerá durante as aulas de inglês. A realização dessa pesquisa foi autorizada pela Secretaria de Estado da Educação, pela direção da escola, e pela professora de inglês das turmas envolvidas, já que o seu objetivo geral é o de investigar o papel da leitura em forma de canto na aprendizagem de vocabulário em língua inglesa, bem como o papel da motivação nesse processo. As

datas de realização das tarefas serão combinadas com antecedência. Falarei agora sobre cada uma delas.

- A primeira e segunda tarefas serão dois testes de capacidade de memória de trabalho: um teste que já é tradicionalmente usado no Brasil e que foi desenvolvido pela pesquisadora Lêda Maria Braga Tomitch em 1995, e o novo teste, que é esse que estamos desenvolvendo nessa pesquisa. Nos dois testes, os participantes irão ler uma série de frases escritas em português na tela de um computador, e deverão memorizar a última palavra de cada uma delas. Por fim, deverão escrever as palavras lembradas em uma planilha. Cada um dos testes durará aproximadamente 20 minutos e serão realizados em dias separados para evitar cansaço.
- A terceira tarefa será a leitura de um texto de aproximadamente uma página que será retirado de um livro didático de ciências. A duração da leitura será de aproximadamente 10 minutos.
- A quarta tarefa será um questionário de 10 perguntas sobre o texto lido, sem poder consultá-lo. Essa tarefa terá a duração de aproximadamente 20 minutos.
- A quinta tarefa será a leitura de outro texto de aproximadamente uma página que será retirado de um livro didático de geografia. A duração dessa tarefa será de aproximadamente 10 minutos.
- A sexta e última tarefa será um exercício de múltipla escolha. Os participantes lerão perguntas e deverão assinalar, entre 4 alternativas, aquela que apresentará a resposta correta. O texto não poderá ser consultado durante a realização dessa tarefa. Sua duração será de aproximadamente 20 minutos. As tarefas 1 e 2 serão realizadas individualmente, em uma sala separada. As tarefas 3, 4, 5 e 6 serão realizadas em grupo e em sala de aula.

Os resultados obtidos nessas tarefas não serão utilizados para avaliação escolar, ou seja, não gerarão notas.

Os estudantes que não desejarem ou que não forem autorizados a participar desse estudo piloto serão acompanhados pela professora de inglês da turma e realizarão outras atividades em uma sala separada. Assim, não perderão as aulas. Essas atividades, porém, não gerarão notas para não prejudicar aqueles estudantes que estarão participando da pesquisa.

Haverá algum risco envolvido nessa pesquisa?

Na verdade, as tarefas a serem realizadas, com exceção dos dois testes de capacidade de memória de trabalho, são muito parecidas com as tarefas que são feitas na escola e os seus riscos são mínimos. De modo geral, o que poderá acontecer é os participantes ficarem ansiosos, pois essa geralmente é a reação que as pessoas têm quando realizam tarefas que serão avaliadas. Para evitar isso, explicações bem detalhadas sobre o que deverá ser feito serão dadas e os participantes terão o direito de tirar suas dúvidas antes de realizar cada uma das tarefas. Isso lhes ajudará a se sentirem mais tranquilos.

Nos dois testes de capacidade de memória de trabalho, de modo especial, todos os participantes realizarão uma sessão de familiarização, ou seja, uma espécie de “treino” para tirarem todas as dúvidas sobre o que deverão fazer e assim não se sentirem nervosos.

Destaco também que a quebra de sigilo involuntária e não intencional dos dados dos participantes é um risco que precisa ser admitido. No entanto, todas as medidas e

cuidados necessários serão tomados para garantir que isso não ocorra. Se ocorrer, os participantes terão o direito legal de indenização nos termos da lei.

E haverá algum benefício?

Sim. Nos testes de capacidade de memória de trabalho os participantes terão a oportunidade de compreender melhor como funcionam o processamento e o armazenamento de informações na memória de trabalho. Poderão verificar sua capacidade de manter o foco da atenção naquilo que estão fazendo no momento presente. Será uma forma de autopercepção sobre a própria capacidade de realizar várias tarefas mentais ao mesmo tempo. Já os textos que serão lidos e as tarefas de compreensão que serão realizadas foram elaborados para desafiar os participantes a fazerem conexões entre diferentes partes do texto, a fim de que possam compreender as ideias que são claramente expostas, bem como as ideias que estão nas famosas “entrelinhas”, e que exigem atenção. A compreensão textual é uma importante ferramenta que permite aos indivíduos o acesso e a compreensão de informações provindas de diversas fontes. Esse acesso e compreensão os tornam independentes e capazes de exercerem ativamente seu papel na sociedade e a serem conhecedores de seus deveres e direitos. Quando falamos de educação, porém, temos que entender que os ganhos nem sempre são imediatos: eles dependem do contínuo empenho do estudante, de suas condições de saúde, do apoio da família e do acesso a uma escola que conte com boa estrutura e com uma boa equipe de profissionais, dentre outras coisas.

A identidade dos participantes será revelada?

Não. Os nomes dos participantes serão mantidos sob sigilo em uma planilha à qual somente eu e minha orientadora teremos acesso. Além disso, cada participante receberá um número confidencial e somente esse número será usado para identificá-los nas tarefas que serão realizadas. No futuro, os resultados dessa pesquisa poderão ser divulgados em revistas científicas ou em eventos acadêmicos, porém serão apresentados como um todo, sem revelar nomes, instituições ou qualquer informação relacionada à privacidade.

Haverá acompanhamento aos participantes em caso de necessidade?

Sim. Os participantes terão meu acompanhamento em todas as etapas, pois aplicarei as tarefas pessoalmente. Quaisquer dúvidas ou dificuldades serão atendidas prontamente.

Os participantes, seus pais, ou responsáveis terão acesso aos resultados da pesquisa?

Sim. Após a coleta e a análise dos dados, informarei quais foram as conclusões da pesquisa através da distribuição de um relatório individual que será entregue separadamente à cada participante.

A participação nessa pesquisa é obrigatória?

Não. A participação é totalmente voluntária. Este documento se trata de um convite. Se o (a) estudante não desejar participar, ou seus pais e/ou responsáveis não o (a) autorizarem, suas decisões serão respeitadas e isso não afetará as suas relações com a escola ou com a professora de inglês.

Haverá alguma despesa para quem decidir participar?

Não. Como a coleta de dados ocorrerá na escola e em horário de aula, e como todos os materiais usados serão providenciados por mim, é previsto que os participantes não tenham despesas. Caso ocorra alguma despesa extraordinária, os participantes serão ressarcidos nos termos da lei.

Em caso de danos, haverá alguma forma de indenização?

Sim, caso haja algum dano material ou imaterial em decorrência da pesquisa, é direito do participante solicitar indenização nos termos da lei.

É possível desistir de participar da pesquisa mesmo depois de ter aceitado?

Sim. Mesmo tendo aceitado participar da pesquisa, o participante poderá desistir, e os pais e/ou responsáveis poderão desautorizá-lo (a) a qualquer momento sem prejuízo em notas e sem problemas na relação com a escola ou com a professora de inglês. Peço apenas que me comunique a desistência através do telefone (48) 991850085, ou pessoalmente, na escola.

Em caso de outras dúvidas, com quem se deve entrar em contato?

Em caso de dúvidas ou sugestões, o contato poderá ser feito através do telefone citado acima, do meu e-mail (sidnei.ww@gmail.com), ou do e-mail de minha orientadora (leda@cce.ufsc.br). Também disponibilizo meu endereço abaixo:

Sidnei Werner Woelfer

Avenida Pioneiros Wacholz, 609 - Vila Mariana – Taió – Santa Catarina

CEP 89.190-000 - Fones: (47) 3562-1345 – (48) 99185-0085

Caso restem outras dúvidas sobre a legalidade dessa pesquisa, os participantes poderão contactar o **Comitê de Ética em Pesquisas com Seres Humanos - CEPESH-UFSC**, através de uma das seguintes formas de contato:

Comitê de Ética em Pesquisas com Seres Humanos - CEPESH-UFSC

Prédio Reitoria II

Rua Desembargador Vitor Lima, nº 222, sala 401, Trindade, Florianópolis/SC

CEP 88.040-400 - Telefone: (48) 3721-6094

Página na Internet: <http://cep.ufsc.br/>

E-mail: cep.propesq@contato.ufsc.br


O que é o “Comitê de Ética em Pesquisas com Seres Humanos - CEPESH-UFSC”?

O Conselho de Ética em Pesquisas com Seres Humanos (CEPSH) é um órgão que analisa e autoriza a realização de pesquisas envolvendo seres humanos, e que são conduzidas por estudantes da UFSC. Esse órgão, apesar de ter vínculo com a universidade, é independente na tomada de suas decisões. Seus membros, seguindo resoluções específicas, avaliam os objetivos, justificativas e métodos das pesquisas a serem realizadas, com o objetivo de verificar os seus padrões éticos. Conforme descrito em seu website (<http://cep.ufsc.br/>), o trabalho do CEPESH é muito importante, pois ele defende “os interesses dos participantes da pesquisa em sua integridade e dignidade”.

Esta pesquisa cumpre todas as exigências legais necessárias?

Sim. Declaro para os devidos fins que essa pesquisa cumpre todas as exigências legais necessárias e que cumprirei os termos das Resoluções CNS 466/12 e 510/16 e suas complementares, que são os documentos que normatizam a realização de pesquisas com seres humanos no Brasil.

Assinando este documento de assentimento pós-informação, você estará aceitando participar de livre e espontânea vontade desse estudo piloto. Duas cópias estão sendo rubricadas e assinadas por você, pelo pesquisador responsável e por sua orientadora. Guarde cuidadosamente a sua cópia, pois é um documento que traz importantes informações de contato e garante os seus direitos como participante da pesquisa.



 Sidnei Werner Woelfer
Pesquisador



 Lêda Maria Braga Tomitch
Orientadora

Declaração de assentimento:

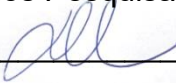
Declaro que li as informações acima. Quando necessário, fiz perguntas e recebi esclarecimentos. De livre e espontânea vontade, concordo em participar desse estudo piloto.

Nome:

Assinatura do(a) participante

CPF/RG

Assinatura dos Pesquisadores Responsáveis



 Sidnei Werner Woelfer
Pesquisador



 Lêda Maria Braga Tomitch
Orientadora

Data: 11/09/2019.

APPENDIX T – Parents/Guardians' consent form - Pilot study



UNIVERSIDADE FEDERAL DE SANTA CATARINA PROGRAMA DE PÓS-GRADUAÇÃO EM INGLÊS: ESTUDOS LINGUÍSTICOS E LITERÁRIOS

TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO

Estudo Inicial - Piloto – Pais ou Responsáveis

Prezados Pais ou Responsáveis:

Eu me chamo **Sidnei Werner Woelfer** e sou estudante de Doutorado da **Universidade Federal de Santa Catarina**. Faço pesquisa na área de leitura e cognição e sou orientado pela Professora Doutora **Lêda Maria Braga Tomitch**.

Estou lhe entregando este documento para convidar seu (sua) filho (a) ou menor pelo (a) qual é responsável a participar voluntariamente do estudo piloto da etapa inicial da pesquisa intitulada “**Capacidade da Memória de Trabalho e o Papel do Canto na Aquisição de Vocabulário e no Desenvolvimento da Motivação para Aprender Inglês como Língua Estrangeira**”. Nessa etapa inicial, será desenvolvido um teste chamado “**Teste de Capacidade de Memória de Trabalho para Adolescentes Brasileiros**”. Para isso, precisarei testar algumas tarefas nesse estudo piloto. Explicarei os detalhes abaixo.

Por que esta pesquisa está sendo realizada?

Estudos indicam que uma boa aprendizagem depende de nossa capacidade de simultaneamente processar e armazenar informações em tempo real em nossa memória. Essa memória que simultaneamente processa e armazena informações em tempo real é conhecida como “memória de trabalho”, e é bastante limitada. Apesar dessa limitação, dependemos dela para aprender matemática, português, línguas estrangeiras e música, por exemplo. Assim, na etapa inicial dessa pesquisa, temos como objetivo desenvolver um teste para medir a capacidade da memória de trabalho de adolescentes brasileiros. Essa ferramenta poderá ser muito importante para futuras pesquisas científica que investigam o funcionamento da memória de adolescentes e também para os profissionais que atuam na área da educação. Ela poderá ajudar professores e orientadores pedagógicos a verificarem se as dificuldades que alguns estudantes apresentam podem estar relacionadas à uma baixa capacidade de memória de trabalho. Com essa verificação, será possível desenvolver materiais e métodos de ensino que auxiliem esses estudantes. Bem, para desenvolver esse teste de memória de trabalho, uma “coleta de dados” será realizada nesse estudo piloto.

O que será realizado nessa “coleta de dados”?

Os estudantes que aceitarem e que forem autorizados por seus pais e/ou responsáveis a participarem do estudo piloto realizarão seis tarefas nas próprias dependências da escola. Isso tudo ocorrerá durante as aulas de inglês. A realização dessa pesquisa foi autorizada pela Secretaria de Estado da Educação, pela direção da escola, e pela professora de inglês das turmas envolvidas, já que o seu objetivo

geral é o de investigar o papel da leitura em forma de canto na aprendizagem de vocabulário em língua inglesa, bem como o papel da motivação nesse processo. As datas de realização das tarefas serão combinadas com antecedência. Falarei agora sobre cada uma delas.

- A primeira e segunda tarefas serão dois testes de capacidade de memória de trabalho: um teste que já é tradicionalmente usado no Brasil e que foi desenvolvido pela pesquisadora Lêda Maria Braga Tomitch em 1995, e o novo teste, que é esse que estamos desenvolvendo nessa pesquisa. Nos dois testes, os participantes irão ler uma série de frases escritas em português na tela de um computador, e deverão memorizar a última palavra de cada uma delas. Por fim, deverão escrever as palavras lembradas em uma planilha. Cada um dos testes durará aproximadamente 20 minutos e serão realizados em dias separados para evitar cansaço.
- A terceira tarefa será a leitura de um texto de aproximadamente uma página que será retirado de um livro didático de ciências. A duração da leitura será de aproximadamente 10 minutos.
- A quarta tarefa será um questionário de 10 perguntas sobre o texto lido, sem poder consultá-lo. Essa tarefa terá a duração de aproximadamente 20 minutos.
- A quinta tarefa será a leitura de outro texto de aproximadamente uma página que será retirado de um livro didático de geografia. A duração dessa tarefa será de aproximadamente 10 minutos.
- A sexta e última tarefa será um exercício de múltipla escolha. Os participantes lerão perguntas e deverão assinalar, entre 4 alternativas, aquela que apresentará a resposta correta. O texto não poderá ser consultado durante a realização dessa tarefa. Sua duração será de aproximadamente 20 minutos. As tarefas 1 e 2 serão realizadas individualmente, em uma sala separada. As tarefas 3, 4, 5 e 6 serão realizadas em grupo e em sala de aula.

Os resultados obtidos nessas tarefas não serão utilizados para avaliação escolar, ou seja, não gerarão notas.

Os estudantes que não desejarem ou que não forem autorizados a participar desse estudo piloto serão acompanhados pela professora de inglês da turma e realizarão outras atividades em uma sala separada. Assim, não perderão as aulas. Essas atividades, porém, não gerarão notas para não prejudicar aqueles estudantes que estarão participando da pesquisa.

Haverá algum risco envolvido nessa pesquisa?

Na verdade, as tarefas a serem realizadas, com exceção dos dois testes de capacidade de memória de trabalho, são muito parecidas com as tarefas que são feitas na escola e os seus riscos são mínimos. De modo geral, o que poderá acontecer é os participantes ficarem ansiosos, pois essa geralmente é a reação que as pessoas têm quando realizam tarefas que serão avaliadas. Para evitar isso, explicações bem detalhadas sobre o que deverá ser feito serão dadas e os participantes terão o direito de tirar suas dúvidas antes de realizar cada uma das tarefas. Isso lhes ajudará a se sentirem mais tranquilos.

Nos dois testes de capacidade de memória de trabalho, de modo especial, todos os participantes realizarão uma sessão de familiarização, ou seja, uma espécie de “treino” para tirarem todas as dúvidas sobre o que deverão fazer e assim não se sentirem nervosos.

Destaco também que a quebra de sigilo involuntária e não intencional dos dados dos participantes é um risco que precisa ser admitido. No entanto, todas as medidas e

cuidados necessários serão tomados para garantir que isso não ocorra. Se ocorrer, os participantes terão o direito legal de indenização nos termos da lei.

E haverá algum benefício?

Sim. Nos testes de capacidade de memória de trabalho os participantes terão a oportunidade de compreender melhor como funcionam o processamento e o armazenamento de informações na memória de trabalho. Poderão verificar sua capacidade de manter o foco da atenção naquilo que estão fazendo no momento presente. Será uma forma de autopercepção sobre a própria capacidade de realizar várias tarefas mentais ao mesmo tempo. Já os textos que serão lidos e as tarefas de compreensão que serão realizadas foram elaborados para desafiar os participantes a fazerem conexões entre diferentes partes do texto, a fim de que possam compreender as ideias que são claramente expostas, bem como as ideias que estão nas famosas “entrelinhas”, e que exigem atenção. A compreensão textual é uma importante ferramenta que permite aos indivíduos o acesso e a compreensão de informações providas de diversas fontes. Esse acesso e compreensão os tornam independentes e capazes de exercerem ativamente seu papel na sociedade e a serem conhecedores de seus deveres e direitos. Quando falamos de educação, porém, temos que entender que os ganhos nem sempre são imediatos: eles dependem do contínuo empenho do estudante, de suas condições de saúde, do apoio da família e do acesso a uma escola que conte com boa estrutura e com uma boa equipe de profissionais, dentre outras coisas.

A identidade dos participantes será revelada?

Não. Os nomes dos participantes serão mantidos sob sigilo em uma planilha à qual somente eu e minha orientadora teremos acesso. Além disso, cada participante receberá um número confidencial e somente esse número será usado para identificá-los nas tarefas que serão realizadas. No futuro, os resultados dessa pesquisa poderão ser divulgados em revistas científicas ou em eventos acadêmicos, porém serão apresentados como um todo, sem revelar nomes, instituições ou qualquer informação relacionada à privacidade.

Haverá acompanhamento aos participantes em caso de necessidade?

Sim. Os participantes terão meu acompanhamento em todas as etapas, pois aplicarei as tarefas pessoalmente. Quaisquer dúvidas ou dificuldades serão atendidas prontamente.

Os participantes, seus pais, ou responsáveis terão acesso aos resultados da pesquisa?

Sim. Após a coleta e a análise dos dados, informarei quais foram as conclusões da pesquisa através da distribuição de um relatório individual que será entregue separadamente à cada participante.

A participação nessa pesquisa é obrigatória?

Não. A participação é totalmente voluntária. Este documento se trata de um convite. Se o (a) estudante não desejar participar, ou seus pais e/ou responsáveis não o (a) autorizarem, suas decisões serão respeitadas e isso não afetará as suas relações com a escola ou com a professora de inglês.

Haverá alguma despesa para quem decidir participar?

Não. Como a coleta de dados ocorrerá na escola e em horário de aula, e como todos os materiais usados serão providenciados por mim, é previsto que os participantes

não tenham despesas. Caso ocorra alguma despesa extraordinária, os participantes serão ressarcidos nos termos da lei.

Em caso de danos, haverá alguma forma de indenização?

Sim, caso haja algum dano material ou imaterial em decorrência da pesquisa, é direito do participante solicitar indenização nos termos da lei.

É possível desistir de participar da pesquisa mesmo depois de ter aceitado?

Sim. Mesmo tendo aceitado participar da pesquisa, o participante poderá desistir, e os pais e/ou responsáveis poderão desautorizá-lo (a) a qualquer momento sem prejuízo em notas e sem problemas na relação com a escola ou com a professora de inglês. Peço apenas que me comunique a desistência através do telefone (48) 991850085, ou pessoalmente, na escola.

Em caso de outras dúvidas, com quem se deve entrar em contato?

Em caso de dúvidas ou sugestões, o contato poderá ser feito através do telefone citado acima, do meu e-mail (sidnei.ww@gmail.com), ou do e-mail de minha orientadora (leda@cce.ufsc.br). Também disponibilizo meu endereço abaixo:

Sidnei Werner Woelfer
Avenida Pioneiros Wacholz, 609
Vila Mariana – Taió – Santa Catarina
CEP 89.190-000
Fones: (47) 3562-1345 – (48) 99185-0085

Caso restem outras dúvidas sobre a legalidade dessa pesquisa, os participantes poderão contactar o **Comitê de Ética em Pesquisas com Seres Humanos - CEPESH-UFSC**, através de uma das seguintes formas de contato:

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Rua Desembargador Vitor Lima, nº 222, sala 401, Trindade, Florianópolis/SC
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Esta pesquisa cumpre todas as exigências legais necessárias?

Sim. Declaro para os devidos fins que essa pesquisa cumpre todas as exigências legais necessárias e que cumprirei os termos das Resoluções CNS 466/12 e 510/16 e suas complementares, que são os documentos que normatizam a realização de pesquisas com seres humanos no Brasil.

Assinando este documento de consentimento pós-informação, você estará de livre e espontânea vontade autorizando seu (sua) filho (a) ou menor pelo (a) qual é responsável a participar desse estudo piloto.

Duas cópias estão sendo rubricadas e assinadas por você, pelo pesquisador responsável e por sua orientadora. Guarde cuidadosamente a sua cópia, pois é um documento que traz importantes informações de contato e garante os direitos dos participantes da pesquisa.



Sidnei Werner Woelfer
Pesquisador



Lêda Maria Braga Tomitch
Orientadora

Declaração de consentimento:

Declaro que li as informações acima. Quando necessário, fiz perguntas e recebi esclarecimentos. De livre e espontânea vontade, autorizo meu (minha) filho (a) ou menor pelo (a) qual sou responsável a participar desse estudo piloto.

Nome:

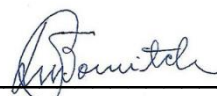
Assinatura do pai/mãe e/ou responsável

CPF/RG

Assinatura dos Pesquisadores Responsáveis



Sidnei Werner Woelfer
Pesquisador



Lêda Maria Braga Tomitch
Orientadora

Data: 11/09/2019.

APPENDIX U – Participants’ assent form – Main study



UNIVERSIDADE FEDERAL DE SANTA CATARINA PROGRAMA DE PÓS-GRADUAÇÃO EM INGLÊS: ESTUDOS LINGUÍSTICOS E LITERÁRIOS

TERMO DE ASSENTIMENTO LIVRE E ESCLARECIDO Estudo Principal – Participantes

Prezado (a) estudante:

Eu me chamo **Sidnei Werner Woelfer** e sou estudante de Doutorado da **Universidade Federal de Santa Catarina**. Faço pesquisa na área de leitura e cognição e sou orientado pela Professora Doutora **Lêda Maria Braga Tomitch**.

Estou lhe entregando este documento para lhe convidar a participar voluntariamente da etapa principal da pesquisa intitulada “**Capacidade da Memória de Trabalho e o Papel do Canto na Aquisição de Vocabulário e no Desenvolvimento da Motivação para Aprender Inglês como Língua Estrangeira**”. Nessa etapa inicial, será desenvolvido um teste chamado “**Teste de Capacidade de Memória de Trabalho para Adolescentes Brasileiros**”. Explicarei os detalhes abaixo.

Por que esta pesquisa está sendo realizada?

Estudos indicam que uma boa aprendizagem depende de nossa capacidade de simultaneamente processar e armazenar informações em tempo real em nossa memória. Essa memória que simultaneamente processa e armazena informações em tempo real é conhecida como “memória de trabalho”, e é bastante limitada. Apesar dessa limitação, dependemos dela para aprender matemática, português, línguas estrangeiras e música, por exemplo. Assim, na etapa inicial dessa pesquisa, temos como objetivo desenvolver um teste para medir a capacidade da memória de trabalho de adolescentes brasileiros. Essa ferramenta poderá ser muito importante para futuras pesquisas científica que investigam o funcionamento da memória de adolescentes e também para os profissionais que atuam na área da educação. Ela poderá ajudar professores e orientadores pedagógicos a verificarem se as dificuldades que alguns estudantes apresentam podem estar relacionadas à uma baixa capacidade de memória de trabalho. Com essa verificação, será possível desenvolver materiais e métodos de ensino que auxiliem esses estudantes. Bem, para desenvolver esse teste de memória de trabalho, uma “coleta de dados” será necessária.

O que será realizado nessa “coleta de dados”?

Os estudantes que aceitarem e que forem autorizados por seus pais e/ou responsáveis a participarem da pesquisa realizarão seis tarefas nas próprias dependências da escola. Isso tudo ocorrerá durante as aulas de inglês. A realização dessa pesquisa foi autorizada pela Secretaria de Estado da Educação, pela direção da escola, e pela professora de inglês das turmas envolvidas, já que o seu objetivo

geral é o de investigar o papel da leitura em forma de canto na aprendizagem de vocabulário em língua inglesa, bem como o papel da motivação nesse processo. As datas de realização das tarefas serão combinadas com antecedência. Falarei agora sobre cada uma delas.

- A primeira e segunda tarefas serão dois testes de capacidade de memória de trabalho: um teste que já é tradicionalmente usado no Brasil e que foi desenvolvido pela pesquisadora Lêda Maria Braga Tomitch em 1995, e o novo teste, que é esse que estamos desenvolvendo nessa pesquisa. Nos dois testes, os participantes irão ler uma série de frases escritas em português na tela de um computador, e deverão memorizar a última palavra de cada uma delas. Por fim, deverão escrever as palavras lembradas em uma planilha. Cada um dos testes durará aproximadamente 20 minutos e serão realizados em dias separados para evitar cansaço.
- A terceira tarefa será a leitura de um texto de aproximadamente uma página que será retirado de um livro didático de ciências. A duração da leitura será de aproximadamente 10 minutos.
- A quarta tarefa será um questionário de 10 perguntas sobre o texto lido, sem poder consultá-lo. Essa tarefa terá a duração de aproximadamente 20 minutos.
- A quinta tarefa será a leitura de outro texto de aproximadamente uma página que será retirado de um livro didático de geografia. A duração dessa tarefa será de aproximadamente 10 minutos.
- A sexta e última tarefa será um exercício de múltipla escolha. Os participantes lerão perguntas e deverão assinalar, entre 4 alternativas, aquela que apresentará a resposta correta. O texto não poderá ser consultado durante a realização dessa tarefa. Sua duração será de aproximadamente 20 minutos. As tarefas 1 e 2 serão realizadas individualmente, em uma sala separada. As tarefas 3, 4, 5 e 6 serão realizadas em grupo e em sala de aula.

Os resultados obtidos nessas tarefas não serão utilizados para avaliação escolar, ou seja, não gerarão notas.

Os estudantes que não desejarem ou que não forem autorizados a participar dessa pesquisa serão acompanhados pela professora de inglês da turma e realizarão outras atividades em uma sala separada. Assim, não perderão as aulas. Essas atividades, porém, não gerarão notas para não prejudicar aqueles estudantes que estarão participando da pesquisa.

Haverá algum risco envolvido nessa pesquisa?

Na verdade, as tarefas a serem realizadas, com exceção dos dois testes de capacidade de memória de trabalho, são muito parecidas com as tarefas que são feitas na escola e os seus riscos são mínimos. De modo geral, o que poderá acontecer é os participantes ficarem ansiosos, pois essa geralmente é a reação que as pessoas têm quando realizam tarefas que serão avaliadas. Para evitar isso, explicações bem detalhadas sobre o que deverá ser feito serão dadas e os participantes terão o direito de tirar suas dúvidas antes de realizar cada uma das tarefas. Isso lhes ajudará a se sentirem mais tranquilos.

Nos dois testes de capacidade de memória de trabalho, de modo especial, todos os participantes realizarão uma sessão de familiarização, ou seja, uma espécie de “treino” para tirarem todas as dúvidas sobre o que deverão fazer e assim não se sentirem nervosos.

Destaco também que a quebra de sigilo involuntária e não intencional dos dados dos participantes é um risco que precisa ser admitido. No entanto, todas as medidas e cuidados necessários serão tomados para garantir que isso não ocorra. Se ocorrer, os participantes terão o direito legal de indenização nos termos da lei.

E haverá algum benefício?

Sim. Nos testes de capacidade de memória de trabalho os participantes terão a oportunidade de compreender melhor como funcionam o processamento e o armazenamento de informações na memória de trabalho. Poderão verificar sua capacidade de manter o foco da atenção naquilo que estão fazendo no momento presente. Será uma forma de autopercepção sobre a própria capacidade de realizar várias tarefas mentais ao mesmo tempo. Já os textos que serão lidos e as tarefas de compreensão que serão realizadas foram elaborados para desafiar os participantes a fazerem conexões entre diferentes partes do texto, a fim de que possam compreender as ideias que são claramente expostas, bem como as ideias que estão nas famosas “entrelinhas”, e que exigem atenção. A compreensão textual é uma importante ferramenta que permite aos indivíduos o acesso e a compreensão de informações providas de diversas fontes. Esse acesso e compreensão os tornam independentes e capazes de exercerem ativamente seu papel na sociedade e a serem conhecedores de seus deveres e direitos. Quando falamos de educação, porém, temos que entender que os ganhos nem sempre são imediatos: eles dependem do contínuo empenho do estudante, de suas condições de saúde, do apoio da família e do acesso a uma escola que conte com boa estrutura e com uma boa equipe de profissionais, dentre outras coisas.

A identidade dos participantes será revelada?

Não. Os nomes dos participantes serão mantidos sob sigilo em uma planilha à qual somente eu e minha orientadora teremos acesso. Além disso, cada participante receberá um número confidencial e somente esse número será usado para identificá-los nas tarefas que serão realizadas. No futuro, os resultados dessa pesquisa poderão ser divulgados em revistas científicas ou em eventos acadêmicos, porém serão apresentados como um todo, sem revelar nomes, instituições ou qualquer informação relacionada à privacidade.

Haverá acompanhamento aos participantes em caso de necessidade?

Sim. Os participantes terão meu acompanhamento em todas as etapas, pois aplicarei as tarefas pessoalmente. Quaisquer dúvidas ou dificuldades serão atendidas prontamente.

Os participantes, seus pais, ou responsáveis terão acesso aos resultados da pesquisa?

Sim. Após a coleta e a análise dos dados, informarei quais foram as conclusões da pesquisa através da distribuição de um relatório individual que será entregue separadamente à cada participante.

A participação nessa pesquisa é obrigatória?

Não. A participação é totalmente voluntária. Este documento se trata de um convite. Se o (a) estudante não desejar participar, ou seus pais e/ou responsáveis não o (a) autorizarem, suas decisões serão respeitadas e isso não afetará as suas relações com a escola ou com a professora de inglês.

Haverá alguma despesa para quem decidir participar?

Não. Como a coleta de dados ocorrerá na escola e em horário de aula, e como todos os materiais usados serão providenciados por mim, é previsto que os participantes não tenham despesas. Caso ocorra alguma despesa extraordinária, os participantes serão ressarcidos nos termos da lei.

Em caso de danos, haverá alguma forma de indenização?

Sim, caso haja algum dano material ou imaterial em decorrência da pesquisa, é direito do participante solicitar indenização nos termos da lei.

É possível desistir de participar da pesquisa mesmo depois de ter aceitado?

Sim. Mesmo tendo aceitado participar da pesquisa, o participante poderá desistir, e os pais e/ou responsáveis poderão desautorizá-lo (a) a qualquer momento sem prejuízo em notas e sem problemas na relação com a escola ou com a professora de inglês. Peço apenas que me comunique a desistência através do telefone (48) 991850085, ou pessoalmente, na escola.

Em caso de outras dúvidas, com quem se deve entrar em contato?

Em caso de dúvidas ou sugestões, o contato poderá ser feito através do telefone citado acima, do meu e-mail (sidnei.ww@gmail.com), ou do e-mail de minha orientadora (leda@cce.ufsc.br). Também disponibilizo meu endereço abaixo:

Sidnei Werner Woelfer

Avenida Pioneiros Wacholz, 609

Vila Mariana – Taió – Santa Catarina

CEP 89.190-000 - Fones: (47) 3562-1345 – (48) 99185-0085

Caso restem outras dúvidas sobre a legalidade dessa pesquisa, os participantes poderão contactar o **Comitê de Ética em Pesquisas com Seres Humanos - CEPESH-UFSC**, através de uma das seguintes formas de contato:

Comitê de Ética em Pesquisas com Seres Humanos - CEPESH-UFSC

Prédio Reitoria II

Rua Desembargador Vitor Lima, nº 222, sala 401, Trindade, Florianópolis/SC

CEP 88.040-400 - Telefone: (48) 3721-6094

Página na Internet: <http://cep.ufsc.br/>

E-mail: cep.propesq@contato.ufsc.br

O que é o “Comitê de Ética em Pesquisas com Seres Humanos - CEPESH-UFSC”?

O Conselho de Ética em Pesquisas com Seres Humanos (CEPESH) é um órgão que analisa e autoriza a realização de pesquisas envolvendo seres humanos, e que são conduzidas por estudantes da UFSC. Esse órgão, apesar de ter vínculo com a universidade, é independente na tomada de suas decisões. Seus membros, seguindo resoluções específicas, avaliam os objetivos, justificativas e métodos das pesquisas a serem realizadas, com o objetivo de verificar os seus padrões éticos. Conforme descrito em seu website (<http://cep.ufsc.br/>), o trabalho do CEPESH é muito importante, pois ele defende “os interesses dos participantes da pesquisa em sua integridade e dignidade”.

Esta pesquisa cumpre todas as exigências legais necessárias?

Sim. Declaro para os devidos fins que essa pesquisa cumpre todas as exigências legais necessárias e que cumprirei os termos das Resoluções CNS 466/12 e 510/16 e suas complementares, que são os documentos que normatizam a realização de pesquisas com seres humanos no Brasil.

Assinando este documento de assentimento pós-informação, você estará aceitando participar de livre e espontânea vontade dessa pesquisa.

Duas cópias estão sendo rubricadas e assinadas por você, pelo pesquisador responsável e por sua orientadora. Guarde cuidadosamente a sua cópia, pois é um documento que traz importantes informações de contato e garante os seus direitos como participante da pesquisa.



Sidnei Werner Woelfer
Pesquisador



Lêda Maria Braga Tomitch
Orientadora

Declaração de assentimento:

Declaro que li as informações acima. Quando necessário, fiz perguntas e recebi esclarecimentos. De livre e espontânea vontade, concordo em participar deste estudo.

Nome:

Assinatura do(a) participante

CPF/RG

Assinatura dos Pesquisadores Responsáveis



Sidnei Werner Woelfer
Pesquisador



Lêda Maria Braga Tomitch
Orientadora

Data: 11/09/2019.

APPENDIX V – Parents/Guardians’ consent form – Main study



UNIVERSIDADE FEDERAL DE SANTA CATARINA PROGRAMA DE PÓS-GRADUAÇÃO EM INGLÊS: ESTUDOS LINGUÍSTICOS E LITERÁRIOS

TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO Estudo Principal – Pais ou Responsáveis

Prezados Pais ou Responsáveis:

Eu me chamo **Sidnei Werner Woelfer** e sou estudante de Doutorado da **Universidade Federal de Santa Catarina**. Faço pesquisa na área de leitura e cognição e sou orientado pela Professora Doutora **Lêda Maria Braga Tomitch**.

Estou lhe entregando este documento para convidar seu (sua) filho (a) ou menor pelo (a) qual é responsável a participar voluntariamente da etapa principal da pesquisa intitulada **“Capacidade da Memória de Trabalho e o Papel do Canto na Aquisição de Vocabulário e no Desenvolvimento da Motivação para Aprender Inglês como Língua Estrangeira”**. Nessa etapa inicial, será desenvolvido um teste chamado **“Teste de Capacidade de Memória de Trabalho para Adolescentes Brasileiros”**. Explicarei os detalhes abaixo.

Por que esta pesquisa está sendo realizada?

Estudos indicam que uma boa aprendizagem depende de nossa capacidade de simultaneamente processar e armazenar informações em tempo real em nossa memória. Essa memória que simultaneamente processa e armazena informações em tempo real é conhecida como “memória de trabalho”, e é bastante limitada. Apesar dessa limitação, dependemos dela para aprender matemática, português, línguas estrangeiras e música, por exemplo. Assim, na etapa inicial dessa pesquisa, temos como objetivo desenvolver um teste para medir a capacidade da memória de trabalho de adolescentes brasileiros. Essa ferramenta poderá ser muito importante para futuras pesquisas científica que investigam o funcionamento da memória de adolescentes e também para os profissionais que atuam na área da educação. Ela poderá ajudar professores e orientadores pedagógicos a verificarem se as dificuldades que alguns estudantes apresentam podem estar relacionadas à uma baixa capacidade de memória de trabalho. Com essa verificação, será possível desenvolver materiais e métodos de ensino que auxiliem esses estudantes. Bem, para desenvolver esse teste de memória de trabalho, uma “coleta de dados” será necessária.

O que será realizado nessa “coleta de dados”?

Os estudantes que aceitarem e que forem autorizados por seus pais e/ou responsáveis a participarem da etapa inicial dessa pesquisa realizarão seis tarefas nas próprias dependências da escola. Isso tudo ocorrerá durante as aulas de inglês. A realização dessa pesquisa foi autorizada pela Secretaria de Estado da Educação, pela direção da escola, e pela professora de inglês das turmas envolvidas, já que o

seu objetivo geral é o de investigar o papel da leitura em forma de canto na aprendizagem de vocabulário em língua inglesa, bem como o papel da motivação nesse processo. As datas de realização das tarefas serão combinadas com antecedência. Falarei agora sobre cada uma delas.

- A primeira e segunda tarefas serão dois testes de capacidade de memória de trabalho: um teste que já é tradicionalmente usado no Brasil e que foi desenvolvido pela pesquisadora Lêda Maria Braga Tomitch em 1995, e o novo teste, que é esse que estamos desenvolvendo nessa pesquisa. Nos dois testes, os participantes irão ler uma série de frases escritas em português na tela de um computador, e deverão memorizar a última palavra de cada uma delas. Por fim, deverão escrever as palavras lembradas em uma planilha. Cada um dos testes durará aproximadamente 20 minutos e serão realizados em dias separados para evitar cansaço.
- A terceira tarefa será a leitura de um texto de aproximadamente uma página que será retirado de um livro didático de ciências. A duração da leitura será de aproximadamente 10 minutos.
- A quarta tarefa será um questionário de 10 perguntas sobre o texto lido, sem poder consultá-lo. Essa tarefa terá a duração de aproximadamente 20 minutos.
- A quinta tarefa será a leitura de outro texto de aproximadamente uma página que será retirado de um livro didático de geografia. A duração dessa tarefa será de aproximadamente 10 minutos.
- A sexta e última tarefa será um exercício de múltipla escolha. Os participantes lerão perguntas e deverão assinalar, entre 4 alternativas, aquela que apresentará a resposta correta. O texto não poderá ser consultado durante a realização dessa tarefa. Sua duração será de aproximadamente 20 minutos. As tarefas 1 e 2 serão realizadas individualmente, em uma sala separada. As tarefas 3, 4, 5 e 6 serão realizadas em grupo e em sala de aula.

Os resultados obtidos nessas tarefas não serão utilizados para avaliação escolar, ou seja, não gerarão notas.

Os estudantes que não desejarem ou que não forem autorizados a participar da etapa inicial dessa pesquisa serão acompanhados pela professora de inglês da turma e realizarão outras atividades em uma sala separada. Assim, não perderão as aulas. Essas atividades, porém, não gerarão notas para não prejudicar aqueles estudantes que estarão participando da pesquisa.

Haverá algum risco envolvido nessa pesquisa?

Na verdade, as tarefas a serem realizadas, com exceção dos dois testes de capacidade de memória de trabalho, são muito parecidas com as tarefas que são feitas na escola e os seus riscos são mínimos. De modo geral, o que poderá acontecer é os participantes ficarem ansiosos, pois essa geralmente é a reação que as pessoas têm quando realizam tarefas que serão avaliadas. Para evitar isso, explicações bem detalhadas sobre o que deverá ser feito serão dadas e os participantes terão o direito de tirar suas dúvidas antes de realizar cada uma das tarefas. Isso lhes ajudará a se sentirem mais tranquilos.

Nos dois testes de capacidade de memória de trabalho, de modo especial, todos os participantes realizarão uma sessão de familiarização, ou seja, uma espécie de “treino” para tirarem todas as dúvidas sobre o que deverão fazer e assim não se sentirem nervosos.

Destaco também que a quebra de sigilo involuntária e não intencional dos dados dos participantes é um risco que precisa ser admitido. No entanto, todas as medidas e

cuidados necessários serão tomados para garantir que isso não ocorra. Se ocorrer, os participantes terão o direito legal de indenização nos termos da lei.

E haverá algum benefício?

Sim. Nos testes de capacidade de memória de trabalho os participantes terão a oportunidade de compreender melhor como funcionam o processamento e o armazenamento de informações na memória de trabalho. Poderão verificar sua capacidade de manter o foco da atenção naquilo que estão fazendo no momento presente. Será uma forma de autopercepção sobre a própria capacidade de realizar várias tarefas mentais ao mesmo tempo. Já os textos que serão lidos e as tarefas de compreensão que serão realizadas foram elaborados para desafiar os participantes a fazerem conexões entre diferentes partes do texto, a fim de que possam compreender as ideias que são claramente expostas, bem como as ideias que estão nas famosas “entrelinhas”, e que exigem atenção. A compreensão textual é uma importante ferramenta que permite aos indivíduos o acesso e a compreensão de informações provindas de diversas fontes. Esse acesso e compreensão os tornam independentes e capazes de exercerem ativamente seu papel na sociedade e a serem conhecedores de seus deveres e direitos. Quando falamos de educação, porém, temos que entender que os ganhos nem sempre são imediatos: eles dependem do contínuo empenho do estudante, de suas condições de saúde, do apoio da família e do acesso a uma escola que conte com boa estrutura e com uma boa equipe de profissionais, dentre outras coisas.

A identidade dos participantes será revelada?

Não. Os nomes dos participantes serão mantidos sob sigilo em uma planilha à qual somente eu e minha orientadora teremos acesso. Além disso, cada participante receberá um número confidencial e somente esse número será usado para identificá-los nas tarefas que serão realizadas. No futuro, os resultados dessa pesquisa poderão ser divulgados em revistas científicas ou em eventos acadêmicos, porém serão apresentados como um todo, sem revelar nomes, instituições ou qualquer informação relacionada à privacidade.

Haverá acompanhamento aos participantes em caso de necessidade?

Sim. Os participantes terão meu acompanhamento em todas as etapas, pois aplicarei as tarefas pessoalmente. Quaisquer dúvidas ou dificuldades serão atendidas prontamente.

Os participantes, seus pais, ou responsáveis terão acesso aos resultados da pesquisa?

Sim. Após a coleta e a análise dos dados, informarei quais foram as conclusões da pesquisa através da distribuição de um relatório individual que será entregue separadamente à cada participante.

A participação nessa pesquisa é obrigatória?

Não. A participação é totalmente voluntária. Este documento se trata de um convite. Se o (a) estudante não desejar participar, ou seus pais e/ou responsáveis não o (a) autorizarem, suas decisões serão respeitadas e isso não afetará as suas relações com a escola ou com a professora de inglês.

Haverá alguma despesa para quem decidir participar?

Não. Como a coleta de dados ocorrerá na escola e em horário de aula, e como todos os materiais usados serão providenciados por mim, é previsto que os participantes não tenham despesas. Caso ocorra alguma despesa extraordinária, os participantes serão ressarcidos nos termos da lei.

Em caso de danos, haverá alguma forma de indenização?

Sim, caso haja algum dano material ou imaterial em decorrência da pesquisa, é direito do participante solicitar indenização nos termos da lei.

É possível desistir de participar da pesquisa mesmo depois de ter aceitado?

Sim. Mesmo tendo aceitado participar da pesquisa, o participante poderá desistir, e os pais e/ou responsáveis poderão desautorizá-lo (a) a qualquer momento sem prejuízo em notas e sem problemas na relação com a escola ou com a professora de inglês. Peço apenas que me comunique a desistência através do telefone (48) 991850085, ou pessoalmente, na escola.

Em caso de outras dúvidas, com quem se deve entrar em contato?

Em caso de dúvidas ou sugestões, o contato poderá ser feito através do telefone citado acima, do meu e-mail (sidnei.ww@gmail.com), ou do e-mail de minha orientadora (leda@cce.ufsc.br). Também disponibilizo meu endereço abaixo:

Sidnei Werner Woelfer
Avenida Pioneiros Wacholz, 609
Vila Mariana – Taió – Santa Catarina
CEP 89.190-000 - Fones: (47) 3562-1345 – (48) 99185-0085

Caso restem outras dúvidas sobre a legalidade dessa pesquisa, os participantes poderão contactar o **Comitê de Ética em Pesquisas com Seres Humanos - CEPESH-UFSC**, através de uma das seguintes formas de contato:

Comitê de Ética em Pesquisas com Seres Humanos - CEPESH-UFSC
Prédio Reitoria II
Rua Desembargador Vitor Lima, nº 222, sala 401, Trindade, Florianópolis/SC
CEP 88.040-400 - Telefone: (48) 3721-6094
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O que é o “Comitê de Ética em Pesquisas com Seres Humanos - CEPESH-UFSC”?

O Conselho de Ética em Pesquisas com Seres Humanos (CEPSH) é um órgão que analisa e autoriza a realização de pesquisas envolvendo seres humanos, e que são conduzidas por estudantes da UFSC. Esse órgão, apesar de ter vínculo com a universidade, é independente na tomada de suas decisões. Seus membros, seguindo resoluções específicas, avaliam os objetivos, justificativas e métodos das pesquisas a serem realizadas, com o objetivo de verificar os seus padrões éticos. Conforme descrito em seu website (<http://cep.ufsc.br/>), o trabalho do CEPESH é muito importante, pois ele defende “os interesses dos participantes da pesquisa em sua integridade e dignidade”.

Esta pesquisa cumpre todas as exigências legais necessárias?

Sim. Declaro para os devidos fins que essa pesquisa cumpre todas as exigências legais necessárias e que cumprirei os termos das Resoluções CNS 466/12 e 510/16

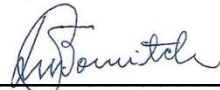
e suas complementares, que são os documentos que normatizam a realização de pesquisas com seres humanos no Brasil.

Assinando este documento de consentimento pós-informação, você estará de livre e espontânea vontade autorizando seu (sua) filho (a) ou menor pelo (a) qual é responsável a participar da etapa inicial dessa pesquisa.

Duas cópias estão sendo rubricadas e assinadas por você, pelo pesquisador responsável e por sua orientadora. Guarde cuidadosamente a sua cópia, pois é um documento que traz importantes informações de contato e garante os direitos dos participantes da pesquisa.



Sidnei Werner Woelfer
Pesquisador



Lêda Maria Braga Tomitch
Orientadora

Declaração de consentimento:

Declaro que li as informações acima. Quando necessário, fiz perguntas e recebi esclarecimentos. De livre e espontânea vontade, autorizo meu (minha) filho (a) ou menor pelo (a) qual sou responsável a participar da etapa inicial dessa pesquisa.

Nome: _____

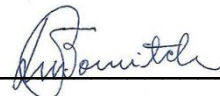
Assinatura do pai/mãe e/ou responsável

CPF/RG

Assinatura dos Pesquisadores Responsáveis



Sidnei Werner Woelfer
Pesquisador



Lêda Maria Braga Tomitch
Orientadora

Data: 11/09/2019.