

Sidnei Werner Woelfer

**CONSTRUCTING MEANING FROM CARTOONS:  
THE EFFECTS OF EFL READING PROFICIENCY AND  
WORKING MEMORY CAPACITY ON THE PROCESSING OF  
VERBAL AND PICTORIAL INFORMATION**

Dissertação submetida ao Programa de Pós-Graduação em Inglês da Universidade Federal de Santa Catarina para a obtenção do grau de mestre em Letras: Estudos Linguísticos e Literários.

Orientadora: Prof.<sup>a</sup> Dr.<sup>a</sup>. Lêda Maria Braga Tomitch.

Florianópolis  
2016

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Woelfer, Sidnei Werner

Constructing Meaning from Cartoons: : The effects of  
EFL reading proficiency and working memory capacity on the  
processing of verbal and pictorial information / Sidnei  
Werner Woelfer ; orientadora, Lêda Maria Braga Tomitch -  
Florianópolis, SC, 2016.

95 p.

Dissertação (mestrado) - Universidade Federal de Santa  
Catarina, Centro de Comunicação e Expressão. Programa de Pós  
Graduação em Inglês: Estudos Linguísticos e Literários.

Inclui referências

1. Inglês: Estudos Linguísticos e Literários. 2.  
Compreensão Leitora de Textos Ilustrados Escritos em  
Inglês como Língua Estrangeira (Cartuns). 3. Capacidade da  
Memória de Trabalho. 4. Proficiência em Leitura em Inglês  
como Língua Estrangeira. 5. Compreensão Literal e  
Compreensão Inferencial. I. Tomitch, Lêda Maria Braga. II.  
Universidade Federal de Santa Catarina. Programa de Pós  
Graduação em Inglês: Estudos Linguísticos e Literários. III.  
Título.

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Esta Dissertação foi julgada adequada para obtenção do Título de “Mestre em Letras”, e aprovada em sua forma final pelo Programa de Pós-Graduação em Inglês: Estudos Linguísticos e Literários.

Florianópolis, 16 de março de 2016.

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To my beloved parents, Raimundo  
Woelfer and Carmelita Woelfer, for  
their deep and true love.



## ACKNOWLEDGMENTS

A presente seção foi escrita em língua portuguesa para que todas as pessoas que menciono a seguir possam ter acesso ao significado das palavras que exprimem minha gratidão.

A oportunidade de realizar esse mestrado surgiu em um momento em que eu pedia auxílio a Deus. Entendi a oportunidade como sendo Sua mais original resposta. Quero agradecer a esse Deus maravilhoso por essa oportunidade e por se fazer real através de tantas pessoas, a quem agradeço a seguir.

Inicialmente, aos meus pais Raimundo Woelfer e Carmelita Woelfer, pelo incondicional amor em todos os momentos de minha vida.

À Luciana, Maicon e Patricia, meus amados irmãos, por tantos momentos e tantas memórias de felicidade.

Ao meu ‘Quelido Amalelus’, Marcos Aurélio Pedroso Leandro, pelo companheirismo, paciência e amor durante esse período.

À Prof.<sup>a</sup> Dr.<sup>a</sup> Lêda Maria Braga Tomitch (PPGI/UFSC), por sua brilhante orientação, sensibilidade, profissionalismo, ética e profundo conhecimento.

À Prof.<sup>a</sup> Dr.<sup>a</sup> Viviane Maria Heberle (PPGI/UFSC), Prof. Dr. Celso Henrique Soufen Tumolo (PPGI/UFSC) e Prof.<sup>a</sup> Dr.<sup>a</sup> Luciane Baretta (UNICENTRO/PR), membros da banca examinadora, por suas preciosas contribuições a este estudo.

Ao Prof. Mestre Jeancarlo Visentainer (UNIDAVI) e à Prof.<sup>a</sup> Mestra Célia Ferrarezi Beckedorff (FURB), pela indicação à vaga no PPGI, e por suas imensuráveis contribuições à minha formação acadêmica.

À Roseli Figueiredo, ‘Didi’, por me direcionar ao mais amoroso lar de Florianópolis.

Ao Raymundo e à Livia Lima, por esse amoroso lar e por ‘Pandinha’, minha adorável companheira de quatro patas.

À Wera Lúcia Pacher Schmitz, minha melhor amiga, por sua energia, luz, conhecimento e constantes palavras de otimismo e encorajamento.

À Maria Luisa Baltazar dos Santos, por sua amizade, apoio e exemplo de superação.

Ao Fernando Eugênio Ribeiro Loureiro, por sua inesquecível passagem em minha vida.

Ao Dieter Juergen Thiel e à Marlene Kurz Thiel, pela autêntica amizade, pela arte da boa música e pelas tantas boas conversas.

À Rita de Cássia Neckel Tomasoni, ‘Ela’, por sua força e exemplo de vida.

À Patricia Sofia Krueger Boaventura, por todo o apoio e sincera amizade.

Ao Davi Alves Oliveira, pela singular generosidade, simplicidade e companhia nessa jornada.

Às colegas Tayane de Paula Bastos Santos e Danielle dos Santos Wisintainer, pelos bons momentos de descontração tão necessários para continuar a caminhada.

Às colegas de área, Cyntia Bailer e Leonilda Procailo pelas valiosas contribuições a esta pesquisa.

À Bárbara Maria Feller, minha ‘Bolachinha de Nata’, por sua dedicação nas aulas de estatística. Ontem, minha aluna...hoje, minha professora!

À Prof.<sup>a</sup> Dr.<sup>a</sup> Rosane da Silveira (PPGI/UFSC) e à Prof.<sup>a</sup> Rosane Hackbarth Vuolo (EEB Luiz Bertoli), pelas importantes contribuições na análise estatística.

À Prof.<sup>a</sup> Dr.<sup>a</sup> Martha Lucia Pulido Correa (Universidad de Antioquia), por suas valiosas contribuições ao texto dessa dissertação e por tão preciosa amizade.

À Prof.<sup>as</sup> Nair Selene Alegri e Maria Sionei Farias Setter, então diretoras da EEB Luiz Bertoli de Taió (2015), pela autorização para poder conduzir esse estudo naquela instituição de ensino.

Aos queridos 64 estudantes desta mesma instituição, por sua participação, bem como aos seus pais, pela confiança em meu trabalho.

Aos professores da EEB Luiz Bertoli de Taió, pela cooperação durante a coleta de dados.

À professora Cristiane Schmidt pela especial acolhida, e , de modo muito especial, à Prof.<sup>a</sup> Vânia Fuchter Petris, pelo total apoio durante todo esse processo.

Ao Programa de Pós-Graduação em Inglês da UFSC (PPGI), por todo o suporte durante o mestrado.

À CAPES, pela bolsa de estudos que me possibilitou a realização deste sonho.

E, acima de tudo, a Deus Pai, criador de todas as coisas, por seu misterioso e profundo amor.



One has to accept that the construction of knowledge is a never-ending process so that his mind remains open to any type of new learning. In addition, one has to understand that, sometimes, this construction depends on a process of 'personal deconstruction'. I, myself, found out that the hardest task of this master's course was not the accomplishment of its demanding tasks, but the deconstruction of stereotypes, beliefs, prejudices and fears that were between me and the possibility of becoming better as a professional and as a human being. Sidnei Werner Woelfer, 2016.



## RESUMO

### CONSTRUINDO SIGNIFICADOS NA LEITURA DE CARTUNS: OS EFEITOS DA PROFICIÊNCIA EM INGLÊS COMO LÍNGUA ESTRANGEIRA, E DA CAPACIDADE DA MEMÓRIA DE TRABALHO NO PROCESSAMENTO DE INFORMAÇÕES VERBAIS E PICTORIAIS.

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2016

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Com base em pesquisas anteriores sobre os efeitos facilitadores das ilustrações na compreensão leitora (Schallert, 1980; Fang, 1996; Carney & Levin, 2002 e Pan & Pan, 2009), este estudo investigou a influência da proficiência em leitura em língua estrangeira – inglês (LEI) e da capacidade de memória de trabalho (CMT) (variáveis independentes), na compreensão de cartuns (variável dependente). O estudo foi motivado pela necessidade de se desvendar se o eficaz processamento paralelo de informações verbais e pictoriais associa-se à proficiência de leitura em LEI bem como à CMT. Com base teórica em estudos sobre leitura (Rumelhart & McClelland, 1981; Gagné, Yekovich & Yekovich, 1993; Davies, 1995; Aebersold & Field, 1997; Tomitch, 2011), memória de trabalho (Daneman & Carpenter, 1980; Just & Carpenter, 1992; Cowan, 1999; Heitz, RP, Unsworth, N. & Engle, RW, 2005; Baddeley & Hitch, 1974; Baddeley, 2000) e dupla codificação (Paivio, 1990, 2006), o estudo previu uma correlação positiva entre as duas variáveis independentes acima mencionadas, bem como uma relação positiva de cada uma delas com a variável dependente. Sessenta participantes, estudantes brasileiros do ensino médio de uma escola pública, foram divididos em dois grupos: leitores menos e leitores mais proficientes, de acordo com sua pontuação em um teste de proficiência de leitura em LEI, composto por questões textualmente explícitas e textualmente implícitas (Pearson & Johnson, 1978). Além disso, foram também divididos como leitores com menor e leitores com maior capacidade de memória de trabalho, de acordo com sua pontuação na versão brasileira do Reading Span Test (Daneman & Carpenter, 1980), desenvolvido por Tomitch (2003). Três tarefas adicionais foram também utilizadas como instrumentos de coleta de

dados: (a) um questionário de experiências prévias em LEI, utilizado para melhor retratar a amostra investigada; (b) uma tarefa de compreensão em LEI envolvendo a análise de um cartum em duas etapas: a primeira focada na compreensão de informações verbais, e a segunda, de ambas, informações verbais e pictoriais; e (c) um questionário retrospectivo, usado para observar a percepção dos participantes acerca de seu próprio processo de leitura. A coleta de dados foi realizada em cinco sessões e os dados foram analisados qualitativa e quantitativamente. Os resultados observados se mostraram a favor das três hipóteses levantadas no estudo, mostrando evidências de correlação entre proficiência em LEI e CMT, bem como de associação positiva entre cada uma dessas duas variáveis independentes e a compreensão de cartuns. Quanto às principais contribuições do presente estudo para a grande área, podem ser mencionadas as evidências observadas de que (1) limitações da CMT podem restringir o processamento de textos expositivos não ilustrados; (2) limitações em proficiência em LEI podem restringir a eficiência do processamento de informações pictoriais; e (3) limitações da CMT no processamento de informações pictoriais podem ser compensadas por informações provindas do conhecimento prévio. A principal implicação pedagógica revelada por este estudo reside na possibilidade de que nem todos os aprendizes, devido às diferenças em proficiência em LEI, bem como em CMT, podem igualmente ter sua compreensão leitora beneficiada pelo uso de materiais ilustrados.

**Palavras-chave:** Compreensão leitora em inglês como língua estrangeira. Cartuns. Proficiência em inglês como língua estrangeira. Memória de trabalho.

**Número de páginas:** 95

**Número de palavras:** 32.416

## ABSTRACT

### CONSTRUCTING MEANING FROM CARTOONS: THE EFFECTS OF EFL READING PROFICIENCY AND WORKING MEMORY CAPACITY ON THE PROCESSING OF VERBAL AND PICTORIAL INFORMATION.

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Universidade Federal de Santa Catarina

2016

Advisor: Prof. Lêda Maria Braga Tomitch

Based on previous research on the facilitative effects of illustrations in reading comprehension (Schallert, 1980; Fang, 1996; Carney & Levin, 2002, and Pan & Pan, 2009), this study investigated the influence of EFL reading proficiency and working memory capacity (WMC) (independent variables), on the reading comprehension of cartoons (dependent variable). The study was motivated by the need to unveil whether the effective parallel processing of verbal and pictorial information found in more elaborate illustrated texts would be a function of higher EFL reading proficiency and WMC measures. On the basis of a theoretical framework on reading (Rumelhart & McClelland, 1981; Gagné, Yekowich & Yekowich, 1993; Davies, 1995; Aebersold & Field, 1997; Tomitch, 2011), on working memory (Daneman & Carpenter, 1980; Just & Carpenter, 1992; Cowan, 1999; Heitz, R.P., Unsworth, N. & Engle, R.W., 2005; Baddeley & Hitch, 1974; Baddeley, 2000) and on dual-coding processing (Paivio, 1990, 2006), the study predicted a positive correlation between the two aforementioned independent variables as well as a positive relationship of each of them with the dependent variable. Sixty participants, Brazilian high school students from a public institution, were divided as less proficient readers and more proficient readers, according to their scores in an EFL reading proficiency test composed of textually explicit and textually implicit questions (Pearson & Johnson, 1978), designed for the purposes of this study. Also, as lower spans and higher spans, according to their scores in the Brazilian version of the original Reading Span Test (Daneman & Carpenter, 1980) developed by Tomitch (2003). Three additional tasks, all of them previously tested in a pilot study, were used as data collection tools: (a) an EFL background questionnaire used to gather data to better portrait the sample

investigated; (b) an EFL reading comprehension task involving a two-steps analysis of a cartoon, being the first focused on the comprehension of verbal information, and the second, of both verbal and pictorial information; and (c) a retrospective questionnaire, used to observe participants' perception on their own reading process. Data collection was carried out in five sessions and data was qualitatively and quantitatively analyzed. Based on these analyses, results were found to be in favor of the three hypotheses raised in the study, showing evidence of a correlation between EFL reading proficiency and WMC and of a positive relationship between each of these two independent variables and the reading comprehension of cartoons. As for the main contributions of this study to the larger field, were the observed pieces of evidence suggesting that: (1) WMC limitations may impose constraints to the processing of nonillustrated expository texts; (2) limitations in terms of EFL reading proficiency may hamper the efficiency of pictorial information processing; and (3) background knowledge seems to compensate for WMC limitations in the processing of pictorial information. The main pedagogical implication revealed by this study resides in the possibility that not all learners, due to differences in terms of EFL reading proficiency and WMC, equally benefit by the use of illustrated reading materials.

**Keywords:** EFL reading comprehension. Cartoons. EFL reading proficiency. Working Memory.

**Number of pages:** 95

**Number of words:** 32.416

## LIST OF FIGURES

Figure 1 – Example 1 - Cartoon whose inferential comprehension is a function of the parallel processing of verbal and pictorial information. . 5	5
Figure 2 – The Reading Comprehension Diagram. .... 15	15
Figure 3 – Example 2 - Cartoon whose inferential comprehension is a function of the parallel processing of verbal and pictorial information. 17	17
Figure 4 – Example 3 - Cartoon whose inferential comprehension is a function of the parallel processing of verbal and pictorial information. 19	19
Figure 5 – Example 4 - Cartoon whose inferential comprehension is a function of the parallel processing of verbal and pictorial information. 20	20
Figure 6 – Example 5 - Cartoon whose inferential comprehension is a function of the parallel processing of verbal and pictorial information. 22	22
Figure 7 – Cowan’s WM Model. Model that conceives WM as an activated subset of Long Term Memory (LTM). .... 28	28
Figure 8 – Baddeley’s WM Model. Model that conceives WM a set of interconnected subsystems. .... 32	32
Figure 9 – Baddeley’s speculative WM Model. Structural model that conceives WM as a set of interconnected subsystems. .... 34	34
Figure 10 – Paivio’s model of dual-coding information processing in memory. .... 37	37
Figure 11 – Example 6 - Cartoon whose inferential comprehension is a function of the parallel processing of verbal and pictorial information. 51	51





**LIST OF TABLES**

Table 1 – Design of the study.....	41
Table 2 – Categorical distribution of EFL reading proficiency measures .....	63
Table 3 – Categorical distribution of WM span measures .....	65
Table 4 – 2X2 Contingency table of observed counts and percentages for EFL reading proficiency X reading comprehension.....	69
Table 5 – 2X2 Contingency table of observed counts and percentages for WMC X reading comprehension.....	71



## LIST OF APPENDICES

Appendix A – Participants’ report cards (Sample).....	104
Appendix B – Report – Results of the study (Participants’ parents/guardians) .....	107
Appendix C – EFL background questionnaire .....	110
Appendix D1 – Reading proficiency test (Part I).....	112
Appendix D2 – Reading proficiency test (Part II).....	113
Appendix E1 – The Reading Span Test (RST).....	114
Appendix E2 – The RST – List of words to be recalled.....	123
Appendix E3 – RST – Student’s table.....	126
Appendix F1 – Reading comprehension task – (Researcher’s version) .....	127
Appendix F2 – Reading comprehension task – (Participants’ version) .....	129
Appendix G – Retrospective questionnaire .....	131
Appendix H1 – Institution’s consent letter – (Pilot study).....	133
Appendix H2 – Institution’s consent letter – (Study).....	134
Appendix I1 – Teacher’s consent letter I .....	135
Appendix I2 – Teacher’s consent letter II .....	136
Appendix J – Transcription of all instructions given during data collection .....	137
Appendix K – Data distribution – Descriptive statistics .....	140
Appendix L – Parents/Guardians’ Consent form .....	141
Appendix M – Participants’ assent form .....	146
Appendix N1 – Fleiss’ kappa - Inter-rater analysis .....	151
Appendix N2 – Ratings – Reading comprehension task – Rater 1.....	153
Appendix N3 – Ratings – Reading comprehension task – Rater 2.....	154
Appendix N4 – Ratings – Reading comprehension task – Rater 3.....	155
Appendix N5 – Ratings – Reading comprehension task – (Complete table) .....	156



## LIST OF ABBREVIATURES AND SYMBOLS

- PPGI – Programa de Pós-Graduação em Inglês  
 UFSC – Universidade Federal de Santa Catarina  
 EFL – English as a foreign language  
 H1 – Hypothesis 1  
 H2 – Hypothesis 2  
 H3 – Hypothesis 3  
 WM – Working memory  
 WMC – Working memory capacity  
 DCT – Dual-Coding Theory  
 LTM – Long-term memory  
 STM – Short-term memory  
 TEQ – Textually explicit questions  
 TIQ – Textually implicit questions  
 RST – The Reading Span Test  
 PNLD – Programa Nacional do Livro Didático  
 L1 – First language  
 M-WM – Multicomponent framework of working memory  
 CE – Central executive  
 PL – Phonological Loop  
 VSSP – Visual-spatial sketchpad  
 EB – Episodic buffer  
*M* – Mean  
*N* – Number of participants  
*SD* – Standard deviation  
 MEC – Ministério da Educação e Cultura  
*SE* – Standard error  
 SPSS – Statistical Package for the Social Sciences  
 CEPESH – Comitê de Ética em Pesquisa com Seres Humanos  
 P1, P2, etc... – Participant 1, Participant 2, etc...  
 Min – Minimum value/score  
 Max – Maximum value/score  
 MA – Master  
*K* – Fleiss Kappa measure  
*r<sub>s</sub>* – Spearman correlation coefficient  
 $\chi^2$  – Chi-square for independence  
 $\alpha$  – alpha  
 SAT – Scholastic Aptitude Test  
 p – Probability level  
 w – Cohen's w – Measure of effect size used for chi square tests



## TABLE OF CONTENTS

<b>1</b>	<b>INTRODUCTION .....</b>	<b>1</b>
1.1	PRELIMINARIES .....	1
1.2	SIGNIFICANCE OF THE STUDY.....	6
1.3	OBJECTIVES.....	7
<b>1.3.1</b>	<b>Main Objective.....</b>	<b>7</b>
<b>1.3.2</b>	<b>Specific Objectives .....</b>	<b>7</b>
1.4	HYPOTHESES.....	7
1.5	ORGANIZATION OF THE MASTER’S THESIS .....	9
<b>2</b>	<b>REVIEW OF THE LITERATURE.....</b>	<b>11</b>
2.1	ON READING COMPREHENSION.....	11
<b>2.1.1</b>	<b>The reading models.....</b>	<b>11</b>
<b>2.1.2</b>	<b>The reading comprehension levels.....</b>	<b>14</b>
2.2	ON WORKING MEMORY .....	23
<b>2.2.1</b>	<b>The processing-efficiency view.....</b>	<b>25</b>
<b>2.2.2</b>	<b>The capacity-constrained view.....</b>	<b>26</b>
<b>2.2.3</b>	<b>The levels of activation view.....</b>	<b>27</b>
<b>2.2.4</b>	<b>The controlled-attention view .....</b>	<b>30</b>
<b>2.2.5</b>	<b>The multicomponent conceptual framework of WM .....</b>	<b>31</b>
2.3	THE DUAL-CODING THEORY (DCT).....	36
<b>3</b>	<b>METHOD .....</b>	<b>41</b>
3.1	DESIGN OF THE STUDY.....	41
3.2	PARTICIPANTS .....	42
3.3	INSTRUMENTS FOR DATA COLLECTION.....	44
<b>3.3.1</b>	<b>The EFL background questionnaire .....</b>	<b>45</b>
<b>3.3.2</b>	<b>The EFL reading proficiency test.....</b>	<b>45</b>
<b>3.3.3</b>	<b>The Reading Span Test (RST) .....</b>	<b>47</b>
<b>3.3.4</b>	<b>The reading comprehension task.....</b>	<b>49</b>
<b>3.3.5</b>	<b>The retrospective questionnaire .....</b>	<b>52</b>
3.4	PROCEDURES FOR DATA COLLECTION.....	52
<b>3.4.1</b>	<b>The EFL background questionnaire .....</b>	<b>53</b>
<b>3.4.2</b>	<b>The EFL reading proficiency test.....</b>	<b>53</b>
<b>3.4.3</b>	<b>The Reading Span Test (RST) .....</b>	<b>54</b>
<b>3.4.4</b>	<b>The reading comprehension task.....</b>	<b>55</b>
<b>3.4.5</b>	<b>The retrospective questionnaire .....</b>	<b>55</b>
3.5	PROCEDURES FOR DATA ANALYSIS .....	56
3.6	THE PILOT STUDY .....	57
3.7	THE ETHICS REVIEW BOARD .....	59
<b>4</b>	<b>RESULTS AND DISCUSSION .....</b>	<b>61</b>

4.1	A GENERAL PORTRAIT OF THE SAMPLE INVESTIGATED.....	61
4.1.1	The EFL background questionnaire.....	61
4.1.2	The EFL reading proficiency test.....	62
4.1.3	The Reading Span Test (RST).....	64
4.1.4	The reading comprehension task .....	67
4.2	RESULTS.....	68
4.2.1	Hypothesis 1- Results.....	68
4.2.2	Hypothesis 2- Results.....	69
4.2.3	Hypothesis 3- Results.....	70
4.3	DISCUSSION.....	71
4.3.1	Hypothesis 1 – Discussion .....	71
4.3.2	Hypothesis 2 – Discussion .....	76
4.3.3	Hypothesis 3- Discussion.....	78
4.4	GENERAL DISCUSSION.....	80
4.4.1	Hypothesis 1 – General discussion .....	81
4.4.2	Hypothesis 2 - General discussion.....	82
4.4.3	Hypothesis 3 - General discussion.....	83
5	FINAL REMARKS, LIMITATIONS OF THE STUDY, SUGGESTIONS FOR FURTHER RESEARCH AND PEDAGOGICAL IMPLICATIONS.....	85
5.1	FINAL REMARKS .....	85
5.2	LIMITATIONS OF THE STUDY AND SUGGESTIONS FOR FURTHER RESEARCH .....	88
5.3	PEDAGOGICAL IMPLICATIONS.....	91
	<b>REFERENCES .....</b>	<b>97</b>
	<b>APPENDICES .....</b>	<b>104</b>



# 1 INTRODUCTION

## 1.1 PRELIMINARIES

Reading comprehension consists of an array of cognitive processes whose implementation provides individuals with the necessary conditions for them to successfully react to situations that involve the understanding of written or multi-coded units of meaning. Whether through more traditional tools, such as printed versions of newspapers, magazines and handouts, or through modern ones, such as e-books and podcasts, individuals depend on their reading skills to make sense of the wide variety of reading materials they are presented with.

With regard to format, it is undeniable that, in the present context, the contiguous presentation of verbal information and visuals has become one of the main characteristics of these materials. That could be explained by the easy accessibility to modern graphic design tools that almost everyone involved in some type of text formatting has to modern graphic design tools. While designers make use of them as professionals and in more technical ways, owners of social networking accounts, for instance, may use them as amateurs just for recreational purposes. Disregarding the sophistication of their creations, be it texts containing images that function as hyperlinks in web pages, or simple posts in social networking timelines, the resulting productions constitute a large amount of multi-coded texts that are being offered to individuals everywhere and all the time. For the purposes of this study, focus is going to be directed to one of this type of texts, within a very specific context: cartoons used as reading materials in classes of English as a foreign language (EFL). The choice for this specific type of text was determined by three main factors:(a) the first, my personal interest as a teacher on the cognitive processing of illustrated reading materials;(b) the second, the aesthetic features and humorous approach of this type of text that I believe to be a facilitator to students' EFL learning; (c) and the third, their more elaborate format that demands the generation of inferences from the part of the reader so that their main ideas can be successfully comprehended. Specifically on the basis of the last factor, I would assert that cartoons may present the necessary textual characteristics that allow for the scientific investigation of some cognitive aspects involved in the processing of illustrated texts.

Research on the area of reading comprehension has shown pieces of evidence that the processing of illustrated texts involves distinct memory subsystems, distinct codes, representations and types of

processes (Miyake & Sha, 1999). According to Paivio (1990, 2006), the verbal and pictorial information these texts are composed of, have distinct mental representations, whose traces, according to Baddeley and Hitch (1974), Baddeley and Logie (1999) and Baddeley (2000), are temporarily stored and rehearsed by different components of working memory (WM). Having this discussion in mind, the present study aims at investigating whether individual differences in terms of EFL reading proficiency and working memory capacity (WMC) are predictors of the reading comprehension of cartoons in a population of high school students.

Adolescents form one of the populations whose exposure to multi-coded texts is highly evident in both natural-occurring and school environments. In the latter, as students, this exposure occurs mainly through their contact with pedagogical materials. Among these materials we find illustrated texts, which at first sight may look more attractive than the ones that present verbal information alone. However, not all illustrations serve to only spark the reader's attention in reading. In some cases, they expand the meaning of their accompanying written texts, and written texts many times have similar effects on their accompanying illustrations.

In cartoons, for instance, this is commonly seen if one considers that their gist resides in the interrelationships settled between text and visuals. As defined by Pagliosa (2005), "cartoons are aimed at criticizing customs, and focusing on a generic reality, and therefore, they are atemporal, that is, they are not vulnerable to the limits of time that the criticism of characters, facts and political events impose" (p.166, my translation)<sup>1</sup>. Because this criticism so commonly found in this type of text resides in the subtle relationships established between what is written and what is illustrated, it is possible to assert that the process identifying its main ideas involves an interactive cognitive processing of verbal and pictorial information. Under these circumstances, the reader's comprehension level seems to be determined by the extent to which ideas conceived in the two different codes are integrated, summarized and

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<sup>1</sup> My translation from Pagliosa (2008, p. 116): "(...) o cartum é voltado para a crítica de costumes, focalizando uma realidade genérica e por isso mesmo atemporal, isto é, desconhece os limites do tempo que a crítica a personagens, fatos e acontecimentos políticos impõem". In: Pagliosa, E.L.B. (2005). *HUMOR: um estudo sociolinguístico cognitivo da charge*. Edipucrs. Rio Grande do Sul. Brasil.

elaborated. That is, in the absence of these three reading sub-processes that will be fully discussed later in the chapter Review of the Literature on the basis of Gagné, Yekowich and Yekowich's (1993) framework, inferential comprehension may be hampered. Thus, given its importance, the inferential comprehension of texts consisting of verbal and pictorial information will be the main focus of this research.

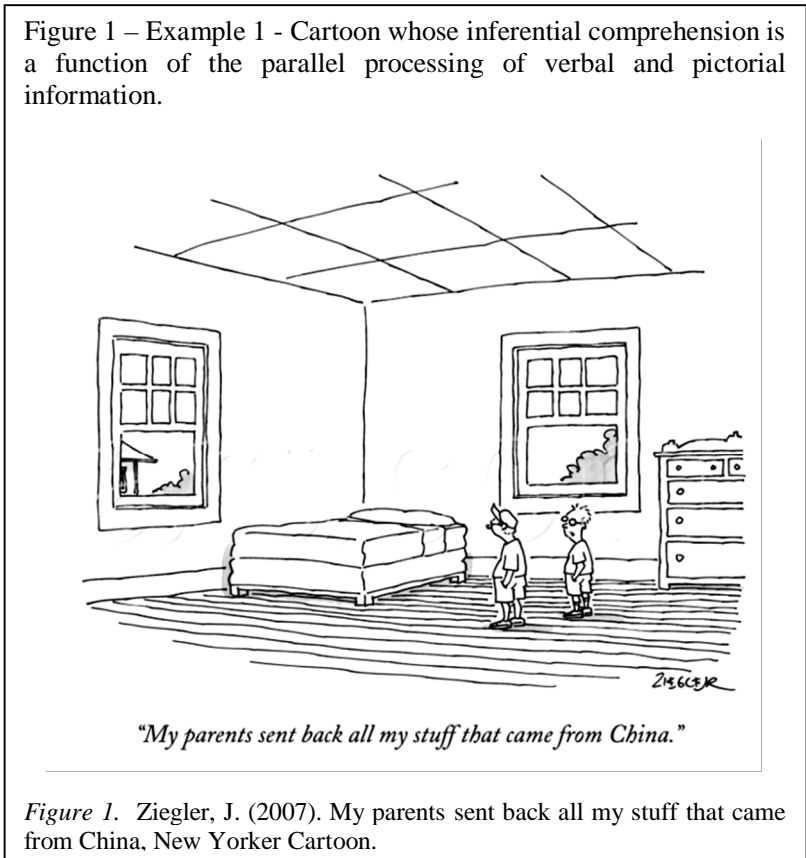
An increasing number of studies on the role of illustrations in reading has been carried out, and based on their findings researchers have supported the general claim that the juxtaposition of verbal and pictorial information is beneficial in various aspects. Schallert (1980), Fang (1996), Carney and Levin, (2002), and Pan and Pan (2009), although working in different experiments, have concluded that, in general, readers exposed to visuals and texts together present considerable improvements in terms of comprehension. With regard to the role of illustrations in text information recall, Mayer et al. (1996) found that captioned illustrations, used as or attached to scientific summaries, help guide the learner's attention, improving the retrieval of more explanative information. In Van Oostendorp and Goldman (1999), Gyselinck and Tardieu reviewed experiments conducted by Mayer and Anderson (1991), Mayer and Sims (1994) and Hegarty and Just (1993), concluding that the conjoint presentation of written texts and illustrations seems to enable the construction of elaborate representations of the text content. Another important study carried out by Levie and Lentz (1982), was a meta-analysis including 55 experiments that compared learning from illustrated texts with learning from texts alone. Results suggested that, "learning is facilitated when illustrations are highly related to the written information" (p. 213). Therefore, the present study aims at expanding these findings, but more specifically on the processing of illustrated texts in EFL reading. With the aim at guiding the rationale to be presented in the body of this master's thesis, operational definitions for *text* and *text illustration* will be initially established to clarify how these constructs will be conceived in this study.

First of all, when dealing with *text*, not only bodies of verbal information are being considered, but also those bodies of information elaborated in different codes that, integrated, form units of meaning (Halliday & Hasan, 1976) with the communicative function to convey messages to readers (Tomitch, 2012). In the same vein, a *text illustration* is understood, in this study, as an external representation in the form of any graphical display that portrays all or some of the content of the text it accompanies (Gyselinck & Tardieu, 1999; Liu, 2004), intended to help readers comprehend factual information (Liu, 2004).

Levin's (1981) taxonomy for the functions of illustrations in texts can deepen our understanding on this latest construct. According to this taxonomy, illustrations can be used to represent, organize, interpret, transform and decorate texts (Liu, 2004; Mayer & Gallini, 1990). As pointed out by Carney and Levin, (2002), the first type, *representational*, has the function of overlapping information from the written text, such as those ones added to depict elements of narrative passages. The second type, *organizational*, has the function of giving the text a better structural framework, such as maps found in handouts intended to present information about location into separate sections. The third, *interpretational*, has the function of enriching the text with clearer information, such as sequences of images that are used to clarify the process of cause and effect in scientific explanations. The fourth type, *transformational*, functions as pictorial mnemonics used to improve the further recall of information from the text. It consists of pictorial symbols that, for a specific reader, are related to a set of information found in the written text. Even though sometimes they do, these pictorial mnemonic devices do not necessarily need to mirror the words found in the written text, but they have to be meaningful to a particular reader, and help him/her activate textual information already stored in memory. The last type, *decorative*, has the main function of embellishing the overall presentation of the text, and it is not directly relevant to its content once it is just used to catch the reader's eye to the reading material. Following Levin's taxonomy for illustrations, this research will focus on illustrated texts that contain the most common type of these pictorial aids: *representational illustrations*.

As already mentioned, the main characteristic of this type of illustration is the fact that it overlaps the content of the written text (Carney & Levin, 2002), helping readers visualize particular events, persons, places, or things (Mayer & Gallini, 1990). However, it is possible to observe that this overlapping sometimes varies. That is, representational illustrations can partially overlap the written text, do not literally depict what is written in it, and even add extra information to it. When that occurs, much of this extra information can only be comprehended if readers are able to draw comprehension inferences, which in their nature go much beyond the surface of the text (Gagné et al., 1993).

Thus, considering the definitions of text and text illustration previously mentioned, it is possible to say that various cognitive processes related to inferential comprehension may be required so that readers succeed in the comprehension of illustrated texts. In order to exemplify that, let us consider the cartoon found in Figure 1.



Following a predominant literal analysis of the given example, the reader may conclude that the kid's room is bare except for a bed and a dresser, and that his parents sent back all his stuff that came from China. However, if the reader also takes into account more subtle pictorial details and elaborates their relationships with the written information, s/he might

implement his comprehension by inferring the idea that, in fact, “almost everything this boy had before, had actually come from China”!

Thus, if according to the studies previously cited, illustrations are assumed to improve one's reading comprehension, readers would be expected to more easily achieve a predominant inferential comprehension while reading cartoons such as the one above. However, instead of functioning as facilitators, its illustration seems to cause the opposite effect and represent an additional challenge to readers since it is not simply double coding written information, nor presenting new information in a very explicit way. As posed by Levie and Lentz (1982) “people often do not notice many of the details shown in pictures, unless they are mentioned in the accompanying text” (p.224), a behavior that may prevent readers to process cartoons more deeply.

Thus, based on the claim that more skilled readers differ from less skilled readers in the processes involved in reading comprehension (Gagné et al., 1993), and also that high spans (high working memory capacity readers) differ from low spans (low working memory capacity readers) in the same (Daneman & Carpenter, 1980; Just & Carpenter, 1992), this research aims at investigating whether EFL reading proficiency and working memory capacity (WMC) may influence the inferential comprehension of cartoons written in English, in a sample of high school students.

## 1.2 SIGNIFICANCE OF THE STUDY

High school students have formed an under investigated population in scientific research with respect to various subjects, including reading comprehension. In addition, to my knowledge, no study has investigated whether high school students' individual differences in terms of EFL reading proficiency and WMC affect the processing of illustrated texts. Considering that, possible findings may contribute to future research on reading comprehension under cognitive perspectives, as well as to studies in multiliteracies. More specifically, this study may provide insights to the development of reading instructions and materials that, eventually, would help EFL teachers improve their pedagogical practices, especially when dealing with illustrated reading materials.

## 1.3 OBJECTIVES

### 1.3.1 Main Objective

To investigate whether high school students who present different EFL reading proficiency and working memory capacity scores, show corresponding differences in their ability to infer meaning from cartoons.

### 1.3.2 Specific Objectives

1. To obtain participants' EFL reading proficiency scores by means of answers to questions about relevant information in expository non-illustrated texts;
2. To obtain participants' WMC scores by means of the Reading Span Test (RST);
3. To obtain participants' EFL reading comprehension scores by means of questions about the main ideas of a cartoon;
4. To examine the correlation between the scores described in specific objectives '1' and '2';
5. To analyse the relationships between the scores described in specific objectives '1' and '3', as well as in specific objectives '2' and '3'.

## 1.4 HYPOTHESES

Assuming a considerable influence of EFL reading proficiency and WMC in the inferential comprehension of illustrated texts, the following set of hypotheses is raised:

- Hypothesis 1 (H1):

There is a positive correlation between EFL reading proficiency as measured by means of answers to questions about important information presented in expository non-illustrated texts, and WMC as measured by means of the Reading Span Test. That is, readers who obtain higher EFL reading proficiency measures are also those who obtain higher WM span measures.

- Hypothesis 2 (H2):

There is a positive relationship between EFL reading proficiency, as measured by means of answers to questions about important information presented in non-illustrated expository texts, and the inferential comprehension of cartoons, as measured by means of answers to questions about the relationships between their verbal and pictorial

information. That is, more proficient readers<sup>2</sup> are more able to infer meaning to texts presented in more than one code, in this study, in the verbal and pictorial codes.

- Hypothesis 3 (H3):

There is a positive relationship between WMC, as measured by means of the Reading Span Test, and the inferential comprehension of cartoons, as measured by means of answers to questions about the relationships between their verbal and pictorial information. That is, higher spans are more able to infer meanings from texts presented in more than one code, in this study, in the verbal and pictorial codes.

The first hypothesis might be related to the aphorism “rich get richer”. It suggests that there will be a positive correlation between EFL reading proficiency and WMC. According to Daneman and Carpenter (1980), more proficient readers are more efficient in comprehending texts, a fact that results in less consumption of the available WMC. For these readers, lower reading subprocesses such as lexical access and parsing, for instance, may be performed automatically. On the other hand, less proficient readers may require more of the processing capacity to perform these same minimal computations. Then, readers may perform differently in the very same language tasks because their reading proficiency will impose different demands on WM, whose processing efficiency varies from individual to individual. Therefore, it is suggested that the participants of this study who will obtain higher EFL reading proficiency measures will be those who will also obtain higher WM span measures.

As stated by Gagné et al. (1993), skillful reading involves the automatization of low-level reading processes (i.e. decoding and literal comprehension). Thus, as inferential comprehension is considered a higher level reading process whose achievement depends on the good execution of lower level reading subprocesses (Tomitch, 2012), H2 suggests that more proficient readers will be more able to construct

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<sup>2</sup> Although hypothesis 2 was theoretically grounded on Gagné et al. (1993), this researcher opted for the terms ‘less proficient readers’ and ‘more proficient readers’, instead of ‘less skilled readers’ and ‘more skilled readers’, as found in the originals of this group, as an attempt to harmonize the lexicon used in this text with lexica used in previous studies who have somehow established the use of the first terms to refer to EFL reading, and of the second one, to L1 reading, which was the case of Gagné and colleagues.



relationships between verbal and pictorial information not literally expressed on the surface of the text, than will be less proficient readers. As a result of this construction, they will perform better at comprehending implicit ideas found beyond the surface of cartoons than will less proficient readers.

With regard to H3, Just and Carpenter (1992) state that “individuals vary in the amount of activation that they have available for meeting the computational and storage demands of language processing” (p.124). In their view of capacity limitation in language processing, individuals have a limited budget of activation in WM that can be allocated flexibly. As explained by Logie (1996), “once all of the available activation has been allocated, any new processing can be accomplished only by reducing the level of activation somewhere else” (p.36). The implication of that in the processing of cartoons, under this view, is that low budgets of activation would consequently hinder their inferential comprehension. That is, since the comprehension of these texts depends on the construction of relationships between verbal and pictorial information not literally expressed on the surface of the text, the reader has to count on enough cognitive resources to go beyond literal comprehension. If s/he counts on few resources, s/he may be limited to the processing of lower level reading subprocesses and then, be unable to construct deeper relationships among them. Thus, in H3 it is suggested that higher spans will be more able to effectively keep activated the information needed to reach an inferential comprehension of cartoons than will be lower spans.

## 1.5 ORGANIZATION OF THE MASTER’S THESIS

In order to logically structure its text, this master's thesis is organized into five different chapters, including this, focused on the context of investigation (Introduction).

On Chapter 2 (Review of Literature), a theoretical framework essentially built on the basis of previous research on reading comprehension, working memory and dual-coding processing is aimed at grounding the rationale that underlies this study.

On chapter 3(Method), a full description of the sample investigated as well as of the tools and procedures involved in data collection and data analysis are presented so that the design of the study can be completely understood.

On chapter 4 (Results and Discussion), descriptive and inferential statistical analyses are proposed in order to verify whether the hypotheses raised were confirmed or not.

Finally, on chapter 5 (Final Remarks) focus is given to the main findings of the study, as well as on some of its limitations. In addition, pedagogical implications are pointed out since its findings may be considered relevant to EFL teaching.

## **2 REVIEW OF THE LITERATURE**

The following chapter presents the theoretical framework that underlies this study. It is organized into three main sections. The first, on reading comprehension, the second, on working memory (WM), and the third, on dual-coding processing. More precisely, the first section describes and discusses widely known reading models and dedicates special attention to the Interactive Reading Model, originally developed by Rumelhart (1977). The same section also presents the framework proposed by Gagné et al. (1993), on the specific processes and subprocesses involved in reading comprehension. The second section goes through the effects of working memory capacity (WMC) on text processing and brings to the fore the models of WM proposed by Daneman and Carpenter (1980), Just and Carpenter, (1992), Cowan, (1999), Heitz., Unsworth, and Engle, (2005), Baddeley and Hitch (1974), and Baddeley (2000). The last section is dedicated to elaborations on the Dual-Coding Theory (DCT) proposed by Paivio (1990, 2006), on the simultaneous processing of verbal and pictorial information. At the very end, a closing paragraph lists and elaborates on the main points that seem to establish relationships among all the aforementioned frameworks.

### **2.1 ON READING COMPREHENSION**

The following section is divided into two parts and will focus on cognitive aspects involved in reading comprehension. The first part deals with the Interactive Reading Model originally developed by Rumelhart (1977), which offers suitable accounts on the processing of illustrated texts. The second part has to do with the framework developed by Gagné et al. (1993), which harmonizes well enough with Rumelhart's assumptions, and also provides us with more detailed information on the specific processes and subprocesses involved in reading comprehension.

#### **2.1.1 The reading models**

Davies (1995) defines reading as a private activity on which an individual, through cognitive processes, gets engaged in a continuous construction of meanings based on the ideas of a “writer who is distant in space and time” (p. 01). We can expand this definition by saying that reading is an active act that involves one's personal responses to the ideas offered by the text, enriching them with the integration of previous knowledge. In this sense, the reader has the freedom and responsibility to

construct his own interpretation. Physiological, sociocultural and affective factors also come into play as regards to this construction and are somehow embodied in the discussions of this master's thesis, but for the purposes of this study, higher focus will be given to cognitive aspects involved in reading.

In order to explain how these processes are executed, researchers from the area of psychology have developed different cognitive theoretical models of reading during the last decades. Even though most of these models were developed to give accounts on the processes involved in L1 reading, Aebersold and Field (1997) state that various authorities in the field agree that they can also be used to explain how EFL reading proceeds. As pointed out by Gagné et al. (1993), it is possible to mention three main perspectives under which reading models were theoretically conceived: the first, the bottom-up perspective, the second, the top-down perspective and the third, the interactive perspective. It is important to say that, chronologically speaking, the top-down theoretical perspective was developed prior to the bottom up. The sequence chosen to present the three perspectives in this text, from the bottom-up to the interactive, was my decision because I considered it easier to guide the reader's rationale.

From the first perspective aforementioned, emerged the *Bottom-up Reading Model* originally proposed by Gough in the 1970's. According to this researcher, reading is data-driven and proceeds in a sequential manner from low-level to high-level processing (as cited in Carell, 1998). According to Aebersold and Field (1997), this model prioritizes the idea that reading comprehension is linear, that is, it emerges from the processing of letters, to words, to phrases, to sentences, etc. Thus, the model does not consider the fact that readers also go on simultaneously guessing what is to appear in the flow of the text, on the basis of information it presents and of information activated from prior knowledge. Overall, this model of reading does not seem to offer a full account for either the reading of cartoons, nor for the reading of illustrated texts in general due to a very basic reason: it does not elaborate on the processing of multiple sources of information, such as illustrations, charts, graphs, etc. On the contrary, as stated by Davies (1995), this model directs its focus on decoding processes, at the expense of other important sources of information a text offers the reader.

From the second perspective listed above, under the influence of psycholinguistics, emerged the *Top-down Reading Model* proposed by Goodman in the 1960's (as cited in Aebersold & Field, 1997). According to this model, and as opposed to Gough's model, reading is believed to

be conceptually-driven, that is, higher order processes are assumed to outweigh decoding processes. In this case, reading is assumed to be guided by one's ability to look at the text just to get cues that enables him/her to make predictions, and then confirm or reconsider those predictions while reading. As stated by Aebersold and Field (1997), the reader uses the details of the text just to confirm expectations derived from prior knowledge; therefore, reading does not begin with the processing of letters, but further back, when readers, based on the cues noticed, activate prior knowledge and start making inferences. Considering that, it is possible to say that under the top-down perspective, reading goes far beyond the mere sequential processing of written verbal information, once the reader makes use of all prominent information that serves as cues to infer meanings, including illustrations. Considering all these aspects, the top down model, at first sight, appears to offer a better account for the processing of illustrated texts. However, it also presents a weakness that, as stated by Davies (1995), is worth considering: it seems to extrapolate reliance on predictions at the expense of important details of the text, that only through low-level reading processes readers are able to notice. It is undeniable that such a weakness has a serious implication in reading comprehension: it may lead readers to believe that they have got the gist of a text, when they actually may have not.

Finally, from the third perspective, emerged the *Interactive Reading Model* originally proposed by Rumelhart in the 1970's (as cited in Rumelhart & McClland, 1981). According to these researchers, the model, overall, contends that reading is neither totally data-driven (bottom-up) nor conceptually-driven (top-down), but driven by a synthesis of the various processes and subprocesses involved in both, that in close cooperation are believed to lead readers to most appropriately interpret a text. The model is of great importance because it represents an alternative to the bottom-up and top-down models once it attributes equal importance to the role of text-based and knowledge-based information in reading comprehension. As mentioned by Aebersold and Field (1997), the processing of these distinct sources of information can occur either alternately or at the same time, whenever they are needed to implement comprehension. From this elaboration we can better predict what the meaning assigned to the term 'interactive', according to this model, actually seems to refer to. It seems to refer to the simultaneous execution of cognitive processes triggered by the text and/or by the reader's prior knowledge. From this perspective, reading takes place within the individual and the reading material is just one source of information that, among others, is involved in this process. From this perspective, the

cartoon can be regarded as an illustrated text that depends on one's activation of visual patterns, orthographic, lexical, semantic, syntactic and life events' schemata that interactively processed, are involved in the construction of its meanings.

Considering the idea proposed in the introduction of this study, that illustrations do not always serve as mere appeal, but as a source of information that has to be appropriately interpreted, this reading model, at my point of view, is the one that better accounts for the parallel processing of verbal and pictorial information, whose relationships seem to determine the core meaning of cartoons. Furthermore, this reading model more coherently matches the conception of 'text' adopted in this study, once nonlinguistic aspects, as posed by Rumelhart and McClelland (1981), are literally described as 'part of the discourse', that together with the linguistic ones, activate the units of knowledge necessary to the achievement of successful reading comprehension.

In sum, this model is being adopted as theoretical reference to discuss the reading comprehension process of cartoons because it neither puts overreliance on bottom-up nor on top-down processes. On the contrary, it gives importance to all low and high-level processes and subprocesses that, according to Carrell (1998), are of equal importance since the first keeps readers sensitive to important novel information presented by the text, and the second, through the activation of relevant prior knowledge, helps them to adequately interpret the given input. In the next section, the low and high level processes aforementioned will be fully described on the basis of the framework developed by Gagné et al. (1993).

### **2.1.2 The reading comprehension levels**

According to Gagné et al. (1993), successful reading comprehension involves two types of knowledge: *declarative knowledge* and *procedural knowledge*. As shown in the diagram designed by Tomitch (2011), Figure 2, the first (top left part of the diagram) consists of knowledge about letters, phonemes, morphemes, words, ideas, schemas and topic or subject matter, that is, conceptual understanding. The latter (top right), consists of knowledge of 'how to' read, and can be broken down into four component processes: decoding and literal comprehension, considered low-level processes, and inferential comprehension and comprehension monitoring, regarded as high-level processes.

Figure 2 – The Reading Comprehension Diagram.

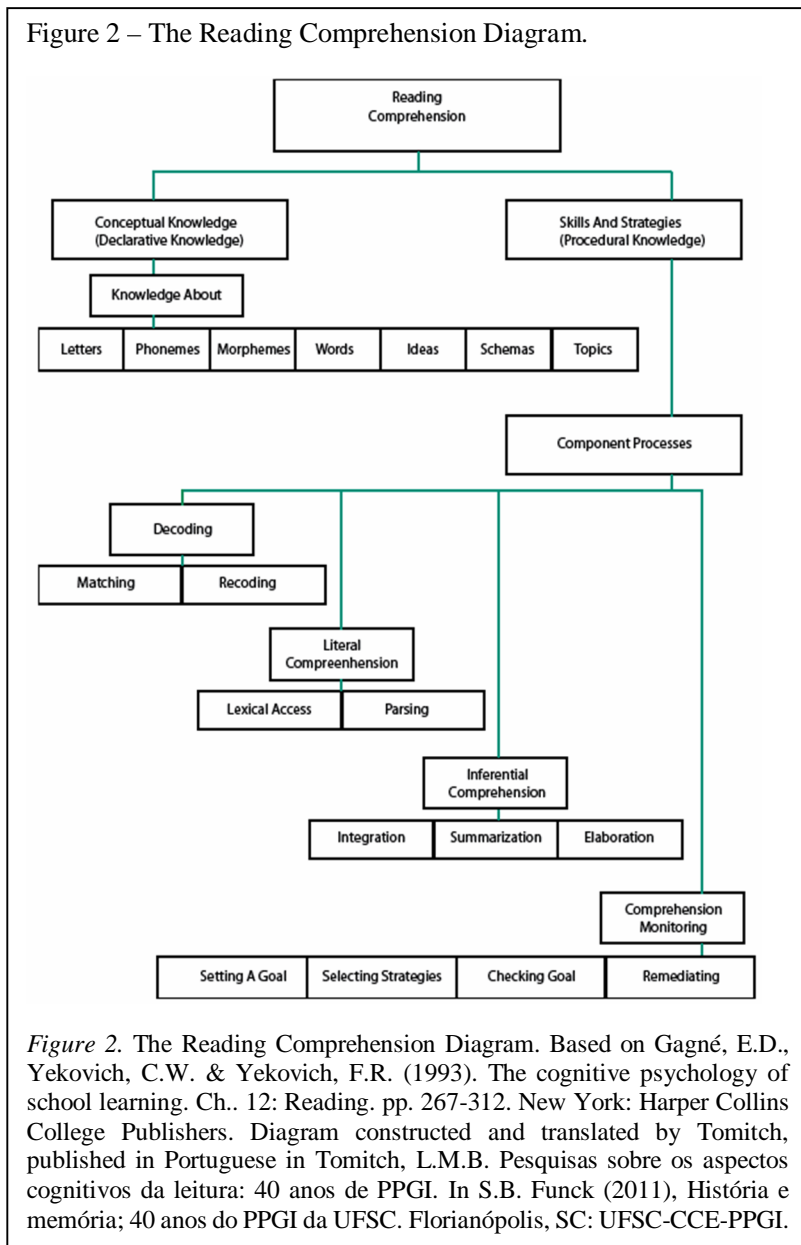


Figure 2. The Reading Comprehension Diagram. Based on Gagné, E.D., Yekovich, C.W. & Yekovich, F.R. (1993). *The cognitive psychology of school learning*. Ch.. 12: Reading. pp. 267-312. New York: Harper Collins College Publishers. Diagram constructed and translated by Tomitch, published in Portuguese in Tomitch, L.M.B. *Pesquisas sobre os aspectos cognitivos da leitura: 40 anos de PPGI*. In S.B. Funck (2011), *História e memória; 40 anos do PPGI da UFSC*. Florianópolis, SC: UFSC-CCE-PPGI.

The first procedural component mentioned by these researchers, namely *decoding*, involves turning printed symbols into meaningful information to the reader. The subprocesses involved in decoding are *matching* and *recoding*.

Matching initially starts at the letter recognition level and evolves to higher chunks when individuals start learning how to read. It is a minimal and basic reading subprocess that is automatically executed in proficient reading. It basically means mapping the written word with its meaning (representation) in memory and involves their recognition without their guessing or sounding out. According to this framework, these words are those ones considered part of one's *sight vocabulary*, that is, the vocabulary composed of those words whose meanings are automatically activated from memory when visualized.

Recoding, on the other hand, happens when readers have to pronounce words out loud so that the listening of their respective sounds can help them make sense of the printed information. Recoding commonly happens when learners are beginning to learn how to read, or even when proficient readers all of a sudden find unfamiliar words in the text and feel the need to stop and listen to their own voices reproducing them, as an attempt to recall their meanings from memory.

Even though the present framework was designed to describe processes and subprocesses involved in the reading comprehension of verbal information, Tomitch (personal communication, November 15, 2015) points out that decoding may also be related to the processing of images and illustrations. One may just describe what the component parts of an illustration are, such as shapes, colors, dimensions, etc, without actually processing the whole context in which it is inserted, that is, without providing inferences and processing higher-level issues like those conveyed by the cartoons used in this study.

Literal comprehension, the second procedural component mentioned in Gagné et al. (1993) framework, is considered a low-level reading process triggered by the sound and appearance of words. It involves the comprehension of the text on its surface, and comprises two subprocesses, namely *lexical access* and *parsing*.

Lexical access, as defined by these researchers, consists of a set of productions that has as basis the products resulted from the decoding process. It is during lexical access that readers assign appropriate meanings to words, according to the context they are inserted in. In the case of the illustrated texts, pictorial information plays an important role in the election of appropriate meanings, an essential condition for



inferential comprehension to take place. Let's observe that, in the following cartoon, shown in Figure 3, below:

Figure 3 – Example 2 - Cartoon whose inferential comprehension is a function of the parallel processing of verbal and pictorial information.



*"Never, ever, think outside the box."*

Figure 3. Cullum, L. (1998). Never, ever, think outside the box. Condé Nast Collection.

[http://www.condenaststore.com/-sp/Never-ever-think-outside-the-box-New-Yorker-Cartoon-Prints\\_i8542964\\_.htm](http://www.condenaststore.com/-sp/Never-ever-think-outside-the-box-New-Yorker-Cartoon-Prints_i8542964_.htm)

The cliché *to think outside the box* is a culturally-bound metaphor that refers to “thinking unconventionally, differently”. Figuratively, the noun *box*, refers to the *limits* one is imposed in terms of elaborating or expressing his/her own ideas. What is interesting in the cartoon above is that the illustration interferes with the process of lexical access, by deconstructing the metaphor. That is, instead of directing the reader to assign a figurative meaning to the word due to its collocation in the popular catchphrase, the illustration redirects him to assign the word its literal meaning of *container*.

Parsing, the other subcomponent process pointed out as part of literal comprehension, according to this framework, involves a set of processes ruled by linguistic and syntactic patterns. Let us use the words

*Never, ever* from the cartoon above to instantiate that. Besides assigning the words the idea of *on no occasion* through lexical access, readers also process their syntactical relationships in the sentence. Thus, it is through parsing productions that these words are identified as adverbs for the verb *think* in the sequence, conjugated in the imperative and used to express the man's command over the little cat.

It is important to emphasize that the subprocesses of lexical access and parsing are continuously automatized as readers become more and more proficient. If they were under the reader's focus of attention during the whole time, the availability of cognitive resources spared for more demanding reading comprehension processes, such as inferential comprehension and comprehension monitoring, would be significantly reduced.

The third procedural component pointed out in this framework is *inferential comprehension*. This procedural component is of major importance to this study because it meets its main purpose: to examine the readers' ability to infer meaning from more elaborate illustrated texts, considering limitations in terms of EFL reading proficiency and WMC. According to Gagné et al., (1993) framework, inferential comprehension is also composed of specific subprocesses, namely, *integration*, *summarization* and *elaboration*.

*Integration* can be understood as 'connecting ideas among propositions' that is, recognizing the relatedness among the idea units of the text within and between sentences. The omission of some words in concise texts, for instance, is only well processed when readers are able to generate minor connective inferences to integrate ideas. Integration may also take place when verbal information and pictorial information are bridged. To better explain that, let us consider the cartoon found in Figure 4, on the next page:

When reading the cartoon, one is just able to know what the determiner *this* and the noun *job* together refer to *the messy room and the displeased children*, in this case, if s/he integrates them with details depicted by the illustration. This occurs because these details seem to substitute what in a non illustrated text would be a previous description of the chores that actually represent the *part-time job* mentioned in the cartoon. We would not realize what the part-time job actually is, without integrating ideas expressed in the two codes. The Dual-Coding Theory (DCT) (Paivio, 1990, 2006), to be presented in the last section of this chapter, provides us with a framework on how this type of integration is processed.

Figure 4 – Example 3 - Cartoon whose inferential comprehension is a function of the parallel processing of verbal and pictorial information.



*"I'm tired of this full-time job. I want a part-time job."*

Figure 4. Farris, J. (1997), I am tired of this full time job. Condé Nast Collection.

[http://www.condenaststore.com/-sp/l-m-tired-of-this-full-time-job-i-want-a-part-time-job-New-Yorker-Cartoon-Prints\\_i8478601\\_.htm](http://www.condenaststore.com/-sp/l-m-tired-of-this-full-time-job-i-want-a-part-time-job-New-Yorker-Cartoon-Prints_i8478601_.htm)

*Summarization*, the next inferential comprehension subprocess, is the result of global inferences derived from connections that are established among ideas found across sentences and paragraphs (Tomitch, 2012). In this case, the reader looks for the core concepts that appear in the body of the text, analyzes their relations and tries to construct a concise and coherent hierarchical set of main ideas.

*Elaboration*, the third and last subprocess pointed out by Gagné et al. (1993) as part of inferential comprehension, involves two basic processes: first, the activation of prior knowledge and second, its integration with text-base productions. As stated by Tomitch (2012), it is during elaboration that comprehension is deepened, broader meanings

constructed and more information left accessible for later recall. In order to exemplify that, let us consider Figure 5, below:

Figure 5 – Example 4 - Cartoon whose inferential comprehension is a function of the parallel processing of verbal and pictorial information.



Figure 5. By Steiner P. (1993), On the Internet, nobody knows you're a dog. [http://www.condenaststore.com/-sp/On-the-Internet-nobody-knows-you-re-a-dog-New-Yorker-Cartoon-Prints\\_i8562841\\_.htm](http://www.condenaststore.com/-sp/On-the-Internet-nobody-knows-you-re-a-dog-New-Yorker-Cartoon-Prints_i8562841_.htm)

Based on the cartoon above, for instance, some probable elaborations would be: (a) “the dog will probably use chat rooms or social networking to pretend he is something he is not”; (b) “chatting on the Internet may be dangerous because you never know exactly to whom you are talking to”; (c) “nowadays, face-to-face relationships are becoming rare because people seem to prefer virtual contact”, etc.

With regard to *Comprehension monitoring*, the fourth and last procedural component process, Gagné et al. (1993) argue that it consists

of a set of processes that involves the readers' self perception of their own reading progression. In other words, it can be regarded as one's continuous control over the efficiency of the cognitive processes involved in reading comprehension. It comprises four basic subprocesses, namely *goal-setting*, *strategy-selection*, *goal-checking* and *remediation* that, according to these researchers, are spontaneously activated in proficient reading.

The first and second subprocesses, goal-setting and strategy-selection, are two intrinsically related subprocesses. According to this framework, the first involves one's defining what the main goal of the reading event will be, prior to actually starting it. For instance, the same text can be read to be more profoundly understood for a college test, or just read to have some of its topics revised for a peer discussion. This self awareness of the goal is what defines how cognitively engaged with the reading process the reader will be. The latter, strategy-selection, is related to the methodical way the reader will carry out his/her reading in order to meet his goals. For instance, s/he can decide to initially skim the text to activate some prior knowledge on its main topics to later on, produce a summary, or if well familiarized with the topic, scan the text straight away to identify its main and secondary ideas.

Goal-checking and remediating are, according to this framework, the other two intrinsically-related subprocesses considered part of comprehension monitoring. They respectively refer to one's self control over the achievement of the reading goal initially set, and the use of new strategies to solve possible deficiencies on the expected achievement. For instance, if one's reading goal is getting prepared to deliver a talk on a specific topic of a certain area, but difficulties to verbalize ideas without just reproducing terms found in the original sources are noticed, changes or adaptations on the strategies being used have to be made. This reader, then, may be in need of writing his own summaries and elaborations in order to feel more confident to express informed opinions on the topic.

Considering all the processes and subprocesses aforementioned, what this study more precisely proposes is that EFL reading proficiency plays a crucial role in the comprehension of more elaborate illustrated texts written in this target language. Because their illustrations do not merely repeat the verbal information, readers may either process the text in an excessive top-down fashion, then losing important details verbally expressed, or they might get limited to literal comprehension since most of their cognitive resources may be spent in low-level reading processes. Let us consider the cartoon shown in Figure 6, next page, to illustrate that.

Figure 6 – Example 5 - Cartoon whose inferential comprehension is a function of the parallel processing of verbal and pictorial information.

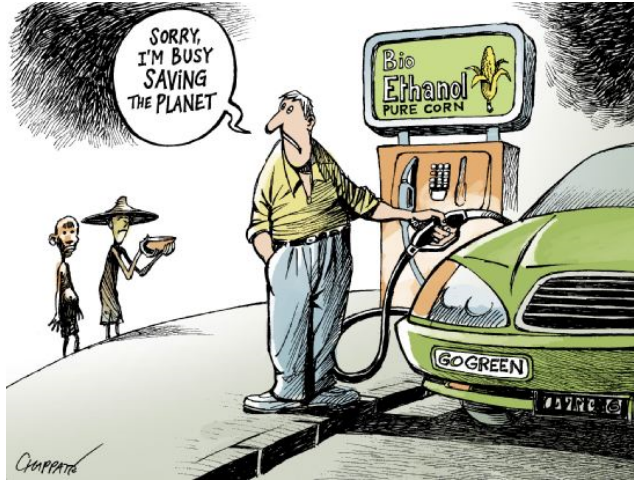


Figure 6. Chappatte (unknown date of publication), Ethanol Cartoon.  
<http://euro-meeting.blogspot.com.br/2010/11/feeding-world.html>

On the one hand, when less proficient readers are presented with texts such as this and are led to process it in an excessive top-down fashion, they might simply say that the cartoon is about “social status differences”. Another possibility would be that, based on a shallow prediction taken out from the highlighted words, *go green* and *ethanol*, they may simply infer the idea that “people should care about environmental issues by putting bio ethanol on their cars”. In this case, the execution of too early elaborations would be prevailing over the execution of low-level reading processes and then important subprocesses involved in literal comprehension would be disregarded. On the other hand, when readers go the other way around, that is, when they are led to process the text in an excessive bottom-up fashion, it might be possible that they would be limited to saying that “the man in the cartoon who is putting bio ethanol on his car cannot help the others because he is too busy doing something to help save the planet”. In this case, due to lack of attention, or excessive use of cognitive resources to process low-level

processes, readers would be limited to the literal comprehension found on the surface of the text, simply reproducing the text-based information. Of course these are just possible interpretations that readers might present and I am not pointing them here as the rule of the game. What I mean is that they are just implying the idea that readers who do not execute minimal reading processes successfully, might tend to guess meanings based on cues given by the illustrations disregarding details of the text, or just the opposite, might get limited to a more literal comprehension due to the use of most of their cognitive resources on the execution of low-level reading processes.

As suggested above, in both cases, text and illustrations would not be sufficiently integrated to obtain what Carrell and Eisterhold (1998) assert as being essential for one's successful reading comprehension: the activation of appropriate schemata. That is, relevant prior knowledge related to the topic of the illustrated text would not be sufficiently activated so that readers could generate the inferences needed to comprehend the text. In that case, readers would possibly lose the main point of the cartoon that ironically "contrasts the use of food on the production of fuel with the aim of saving a planet where sub-nutrition is a serious problem".

Overall, what this framework basically proposes is that the lower the demands for cognitive resources to operate low-level reading processes such as decoding and literal comprehension, the higher their availability to operate the high-level ones, such as inferential comprehension and comprehension monitoring. In other words, one consequence of becoming a skilled reader is the automatization of the low-level subprocesses that allows him/her to derive meanings found between the lines.

Thus, as seen in the sequence of cartoons used as examples in this section, the framework proposed by Gagné et al. (1993) can be considered of relevant importance for this study. It provides it with explanations on many of the processes and subprocesses involved in the reading of cartoons written in EFL that, if not automatized, may seriously hamper their inferential comprehension.

The following section is dedicated to describe the relationship between working memory (WM) and the processing of illustrated texts.

## 2.2 ON WORKING MEMORY

The real time execution of all the aforementioned processes and subprocesses in an interactive manner would appear miraculous if human

beings did not depend on the availability of cognitive resources to do so. Cognitive resources that are limited and have to be managed so that text-based and previous knowledge-based information can be simultaneously maintained and manipulated at the moment the reader is processing the text. This section has to do with the type of memory that is responsible for this real time management of cognitive resources that enables the execution of so many processes and subprocesses: Working Memory (WM). It firstly presents the main framework of views that seems to contribute to better comprehend the processes involved in reading comprehension. These views are (1) the Processing Efficiency View (Daneman & Carpenter, 1980), (2) the Capacity- Constrained View (Just & Carpenter, 1992) , (3) the Levels of Activation View (Cowan, 1999) and (4), the Controlled-Attention View (Heitz, R.P., Unsworth, N. & Engle, R.W, 2005). Afterwards, the chapter describes and gives special focus to the Multicomponent Conceptual Framework of WM (Baddeley & Hitch, 1974, Baddeley 2000) that I considered the WM view which seems to provide clearer accounts for the processing of verbal and pictorial information. However, I decided to present and discuss various WM models because even though they differ in some assumptions, their different focuses end up at contributing to a more profound comprehension of the construct *working memory* as a whole. Furthermore, as admitted by Baddeley (2012) himself, his own view on WM “comprised and still comprises a relatively loose theoretical framework rather than a precise model that allows specific predictions” (p.7), meaning that, WM cannot be regarded as a stable construct yet, but as a construct that continues open to further investigations. In sum, I considered the presentation of different models more enlightening to the construction of this text, than the choice for a single model at the expense of good assumptions proposed by the others.

To start with, let us consider an excerpt from Alan Baddeley’s (2012) talk on his autobiographical article "Working Memory: Theories, Models, and Controversies” written for the 2012 Annual Review of Psychology. In his talk, Baddeley argues that “the term working memory is based on the simple idea that complex thought processes depend on a single system that operates across a wide range of situations” (transcribed from <https://www.youtube.com/watch?v=yL2ul2bR0Ok>, Copyright © 2012 by Annual Reviews. All rights reserved). On the preface, also written for the same annual review aforementioned, this researcher narrows his operational definition on WM, by saying that it consists of a limited capacity system “that provides the temporary storage and manipulation of information that is necessary for performing a wide range



of cognitive activities” (p.7). With that in mind, what would be the reasons for which WM is being included in the theoretical framework of this study?

To answer that, it is necessary to initially consider that there is a considerable deal of previous research suggesting that WMC is important for text comprehension in general (Daneman & Carpenter, 1980; Just & Carpenter, 1992; Tomitch, 2003). Based on the results obtained from these studies and others, it is possible to find strong evidence that WMC imposes a limit to the amount of information individuals are able to process in cognitive activities (Yuan et al., 2006). Second, when reading cartoons, readers apparently seem to be engaged in deeper processing of verbal and pictorial information, whose successful execution is possibly related to the capacity of WM, and to the interplay among its subsystems. If that is the case, deeper processing is demanded because the comprehension of cartoons does not simply depend on the execution of lower level reading subprocesses, such as lexical access and parsing, but also on the execution of higher level ones, such as integration, summarization and elaboration. Given these points, it seems reasonable to assert that the reading of more elaborate illustrated texts such as cartoons is an activity that involves a wide range of complex thought processes whose effective execution demands cognitive resources from WM.

### **2.2.1 The processing-efficiency view**

According to Daneman and Carpenter (1980), WM can be conceptualized as a unitary system with a single capacity that serves as “the site for executing processes and for storing the products of these processes” (p.450). One of these researchers’ main assumptions is that individual differences in reading comprehension may reflect differences in WMC, because some individuals are more efficient in terms of information processing than others. Such a conclusion was reached through the application of a span test developed by these authors, namely *The Reading Span Test* (RST), also used in this study as a tool to obtain a measure of the participants’ WMC .

As will be explained in more details in the chapter Method, this test involves presenting individuals with sequences of unrelated sentences that have to be read out loud and also comprehended. As soon as a complete set of these sentences is read, individuals have to recall the last word from each sentence in the order they were presented. As explained by Miyake and Shah (1999), the rationale behind this test is that it

resembles the WM demands “during the performance of complex cognitive tasks by placing simultaneous demands on both processing and storage” (p. 13). Thus, the accomplishment of a dual task like this is easier if one is efficient in dealing with the amount of information that has to be processed and maintained for later recall. Scores obtained through the RST had a high correlation with participants’ scores in a reading comprehension task in Daneman and Carpenter’s study. According to Logie (1995), this correlation suggests that when given a concurrent memory load, comprehension may be disrupted, depending on the total capacity of WM. This way, individuals who are more efficient in terms of processing would compromise less of the total WMC, sparing cognitive resources to accomplish more complex tasks.

The *Processing-efficiency View* assumes that information can enter WM through two distinct ways: the first via sensory perception of external stimuli, and the second, through retrieval from long-term memory (LTM), if sufficiently activated. Besides that, the view also assumes the limited capacity of the system, by saying that information can be lost from WM through decay, caused by the threshold of time a piece of information can be actively maintained, and also through displacement, caused by the encoding, activation or construction of additional structures that exceed the total capacity of the system (Daneman & Carpenter, 1980).

The importance of the processing efficiency view to the present study regards the assertion that higher spans may be more efficient in low-level information processing, leaving more resources available for higher-level processing such as the binding of multimodal information. Furthermore, while reading illustrated texts, higher spans may be more likely to have information from previous parts, and from different codes available in WM in an active state for processing. As a result, as stated by Daneman and Carpenter (1980), these individuals should be more able to notice the interrelations among these parts because they are readily available for processing.

### **2.2.2 The capacity-constrained view**

The *Capacity-constrained View of WM* (Just & Carpenter, 1992) is a computational theory that holds the basic assumption that “cognitive capacity constrains comprehension, and it constrains more for some people than for others” (p.122). In other words, this view suggests that some people perform better with the task at hand, because their WM system itself has a larger capacity.

In the capacity-constrained view, WM is assumed as a set of processes and resources found within a system that does not include modality-specific components. This system is considered responsible for both processing and storage that are fuelled by the same commodity: activation. According to this model, the term ‘capacity’, itself can be conceived of as the total amount of activation WM can count on to execute either of the two functions.

Similar to Daneman and Carpenter’s (1980) view, information becomes activated through external stimuli, or when it is activated from LTM. This activation, however, is not assumed to be static, but modifiable according to the demands imposed by the elements being processed. For instance, information that demands a low level of activation in the beginning of a sentence may increase its demand later in the same sentence depending on the relationships constructed among the elements in the course of this sentence. Another aspect of this dynamic process is that activation is propagated from one element to another (Just & Carpenter, 1992) in such a way that elements previously activated are less available in WM, because new activation may take their place (Logie, 1995). Furthermore, as advocated by Just and Carpenter (1992), when the total amount of activation is not enough to meet the purposes of a given task in terms of storage and processing, some of the activation is deallocated. These deallocations, then, produce displacement of information, because both, the activation propagated and the activation used for storage, are scaled back to the level within the budget of activation.

In the case of the present study, this effect may be still more visible, considering that participants will be engaged in non proficient EFL reading, which may require deeper processing and consequently, higher allocation of activation. Thus, if the budget of activation is exceeded due to high allocation of resources to lower-level processing, the comprehension of illustrated texts written in EFL may be hampered. If the participants of this study spend too much of the total amount of activation just to process minimal computations, it may be that they will not be able to build deeper relationships between verbal and pictorial information, simply because they will not have available resources to do so.

### **2.2.3 The levels of activation view**

As an attempt to make a proper reference to Cowan’s (1999) *Embedded-Processes View of Working Memory*, I decided to use the noun

phrase ‘The Levels of Activation View’ in this study. Even though this noun phrase does not correspond verbatim to the terms that have been used in the literature up to now, the choice for “levels of activation” is based on one of the main characteristics of the model described by Logie (1995): the existence of two associated levels of activation that are assumed to compose WM, one being the current focus of attention, and the other, a corpus of readily available information, taking into account that the former is embedded within the latter. The model is depicted in Figure 7.

Figure 7 – Cowan’s WM Model. Model that conceives WM as an activated subset of Long Term Memory (LTM).

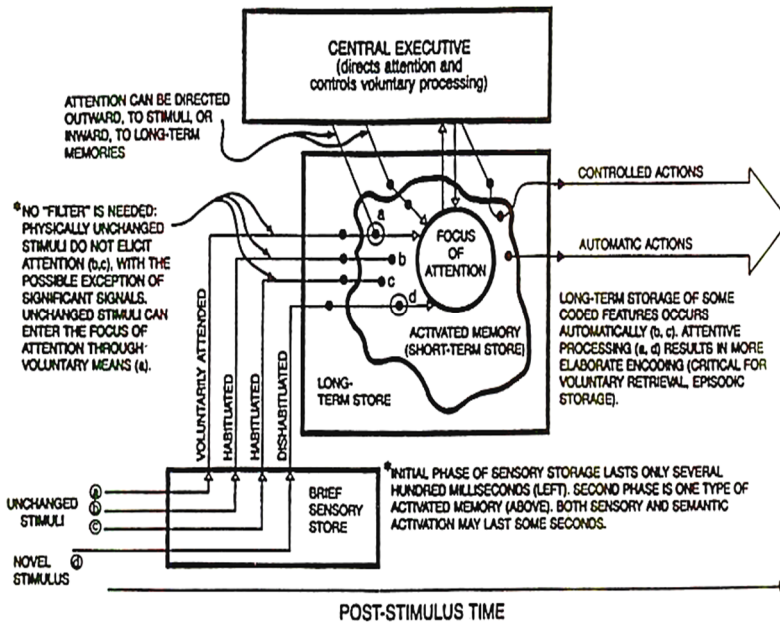


Figure 7. Cowan’s (1988) Model. Reprinted with permission of the American Psychological Association from Cowan (1988, p. 180, Figure 1). Copyright © 1988 by the American Psychological Association. Cowan, N. (1999). An embedded-processes model of working memory. In Akira Miyake & Priti Shah (Eds.), *Models of working memory: Mechanisms of active maintenance and executive control*. New York, NY: Cambridge University Press. pp. 62-10.

According to Cowan's (1999) view, WM refers to a set of cognitive processes "that retain information in an unusually accessible state, suitable for carrying out any task with a mental component" (p.62). As shown in Figure 7, this retention has its origin in the activation of LTM, caused by external stimuli such as written words, shapes and sounds, as represented by the rectangle found in the bottom part of the illustrated diagram. Thus, WM can be seen as a subset of LTM that is currently activated (Postle, 2006), as indicated by the irregular form within the square. Besides that, the model proposes that this activation occurs in different levels depending on the amount of attention given to a specific portion of LTM. That is to say that not all information activated can be consciously experienced even being in WM; only the one which is under the focus of attention, as represented by the circle (Cowan 1999; Myiake & Shah, 1999). In addition, a central executive is pointed as being responsible for directing attention and controlling voluntary processes, as shown in the top of the diagram. Control of attention, however, is said to be shared with involuntary processes in this model.

The model also assumes that the focus of attention is basically capacity limited, whereas the overall activation, time limited. Besides that, it also gives special attention to the role of awareness in terms of perception. While listening to an orchestra, for instance, the different sounds from different instruments tend to be noticed and encoded just if the listener is in a high state of awareness, otherwise they might not be noticed. In terms of memory, the model also proposes that awareness is also influential because it allows new episodic representations to be available for explicit recall. For instance, while processing conceptual illustrations, awareness would allow one to activate information from previous experiences that are related to the objects, forms and colors depicted in them and maybe, strengthen their comprehension.

With regard to this study, the present model can account for the level of processing that occurs between verbal and pictorial information, apparently fundamental to the comprehension of cartoons. If according to Cowan (1999), "the amount of information that can remain activated at one time is greater than the amount that would fit in the focus of attention" (p.76), it may be that readers may fail at focusing on the details that would activate the LTM representations that are necessary for successful comprehension. That is, an individual may shallowly activate the exact features that would really help him identify the cartoon's main ideas.

### 2.2.4 The controlled-attention view

According to Heitz, Unsworth, & Engle, (2005), the control of attention is an effortful cognitive act, whose function is to activate information according to its real relevance to successful comprehension. In addition, these researchers see WMC as an ability that individuals have to control attention, “particularly in situations involving interference from competing information, activated representations, or task demands” (p.64).

Under this view, it is possible to assert that the ability to inhibit or enhance information is not due to individuals’ differences in the total amount of information that can be stored and manipulated in WM, but due to individual differences in their ability to focus attention on what is indeed relevant on a specific reading event. However, this does not necessarily mean that, in this WM model, WM is seen as a non-limited – capacity system. On the contrary, the model assumes that any type of activity that demands heavy processing should tax the attentional system; otherwise some of the information tends to be lost. In this sense, the controlled attention view of WM does not entirely differ from Cowan’s embedded model, considering that, for both of them, information under the focus of attention is a result of higher activation. Maybe, the major difference between these two views resides in the fact that the controlled-attention view literally relates one’s ability to control attention to one’s potential for abstract reasoning (Heitz, Unsworth & Engle, 2005). Besides that, the controlled-attention view sees WM as a domain general system, as opposed to Cowan’s view, that fractionates WM according to levels of activation, under the domain of the central executive.

The main focus of the controlled-attention view amounts to what Gernsbacher (1997) defines as mechanisms of *suppression* and *enhancement* in the *Structure Building Framework*. According to this framework, suppression and enhancement are considered cognitive mechanisms used to help build complex structures of information, which are organized in the form of mental nodes that are continuously updated during reading. Therefore, the controlled-attention view of WM amounts to Gernsbacher’s assumptions in the sense that one’s ability to inhibit what is irrelevant and enhance what is relevant is paramount for the successful comprehension of texts. This consonance can be inferred because for Gernsbacher, coherent mental models are built by the enhancement of information that coheres or relates to previous information, and by the suppression of the ones which are incoherent or irrelevant. Or, in other words, if one is not able to suppress irrelevant

information, that information will be strengthened and incorporated to the mental model.

The main contribution of the controlled-attention view of WM to this study relates to the explanation it gives to one's ability to suppress irrelevant information that may be presented in cartoons. If an individual is not able to inhibit distraction caused by irrelevant features, that is, features that do not necessarily help bridge meanings between pictorial and verbal information, main ideas may be lost. It may be that individuals are led by this superficial processing due to a possible inability to control attention and enhance its focus on relevant verbal and pictorial information.

### **2.2.5 The multicomponent conceptual framework of WM**

According to Baddeley (2012), the *Multicomponent Conceptual Framework of WM*, also known as multicomponent working memory (M-WM), derived from the seminal model of Baddeley and Hitch (1974), which is based on two main essentials. The first would be the assumption that WM is a hypothetical limited capacity system that stores and manipulates information needed for performing complex cognitive activities. The second, that WM is not a unitary system, but a system that comprises multi-specialized components of cognition, including a supervisory component, namely *Central Executive*, and at least three temporary storage systems, namely *Phonological loop*, *Visual-spatial Sketchpad* and *Episodic buffer*. The model is depicted in Figure 8, on the next page.

The Phonological Loop (PL), on the right side, involves acoustic representations, the *Visuo-spatial Sketchpad* (VSSP), on the left, visual-spatial representations and the *Episodic Buffer* (EB), center-positioned, multidimensional episodic or chunks which combine visual and auditory information, and possibly also smell and taste (Baddeley, 2010). Equally important, all of these subsystems are assumed to operate under independent capacity limitations, that is, the total use of resources in one is assumed not to hamper the execution of activities in the others.

Figure 8 – Baddeley’s WM Model. Model that conceives WM a set of interconnected subsystems.

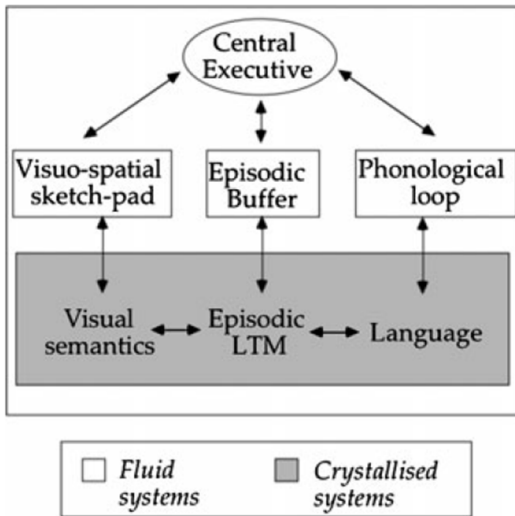


Figure 8. The Multicomponent Conceptual Framework of WM (Baddeley, A. (2012). Working Memory: Theories, Models, and Controversies. Annual Review of Psychology .Vol. 63: 1-29 (Volume publication date January 2012) First published online as a Review in Advance on September 27, 2011 DOI: 10.1146/annurev-psych-120710-100422.

The dark gray area of the diagram comprises the subsystems that are related to Long Term Memory (LTM), namely crystallized systems, whereas the white areas, the subsystems related to WM, namely fluid systems. The arrows indicate the bidirectional interconnectivity among the component parts of the whole system, assumption that is in agreement with the Interactive Reading Model (Rumelhart, 1977), previously presented. The arrows also show that information does not only enter one or more of the subcomponents from the sensory input, but also from LTM (Logie, 1996). Let us move now to elaborations on each of these subsystems and on the interactions among them, on the basis of Baddeley's framework.

The CE is considered the most complex component of the M-WM. It is referred to as a limited-capacity subsystem whose function is to



control and regulate the WM system as a whole (Baddeley & Logie, 1999). Some of its specific functions are: (a) coordinating the three slave systems; (b) focusing attention; (c) inhibiting and suppressing irrelevant information; (d) dividing attention; (e) switching attention between tasks; (f) binding visual-spatial and phonological representations held by the episodic buffer; and (g) establishing the interface between LTM and WM (Baddeley 2012; Baddeley & Logie, 1999).

The PL is the most widely investigated subsystem of the M-WM. It is regarded as a slave subsystem of limited-capacity store that serves as a temporary passive store of speech-like memory traces and as an active rehearsal processor of these traces. As described by Baddeley (2010), its first function is to maintain the information available for processing and the later, to refresh information by vocal or subvocal rehearsal in real time so that memory traces do not fade away.

The VSSP is the less explored subsystem of the M-WM up to date. It is also conceived as a slave subsystem of limited capacity whose main function is storing and processing visual-spatial information such as visual material and movement sequences. According to Logie (1995), the VSSP could be fractionated into two functionally separate subsystems namely, *visual cache* and *inner scribe*. The first, serving as a passive visual system and the latter, as an active spatially based system. Nonetheless, for Baddeley (2012), the “precise nature of visual-spatial rehearsal remains unclear” (p.13), a fact that puts the possibility of a division in the VSSP into question.

The EB is essentially a passive modality-free and limited-capacity subsystem that serves to store information in form of multidimensional episodes or chunks (Baddeley, 2012), which are accessible through conscious awareness (Baddeley 2010). As well as the PL and the VSSP, the EB also interfaces perception and episodic LTM with WM (Baddeley, 2010). The EB represents the output in terms of chunks pulled together by the CE into a system of limited capacity (Baddeley, 2012). Figure 9, even being labeled as “speculative” by Baddeley (2012), himself, is being presented as an attempt to establish a different diagrammatic interconnection between the M-WM subsystems:

Figure 9 – Baddeley’s speculative WM Model. Structural model that conceives WM as a set of interconnected subsystems.

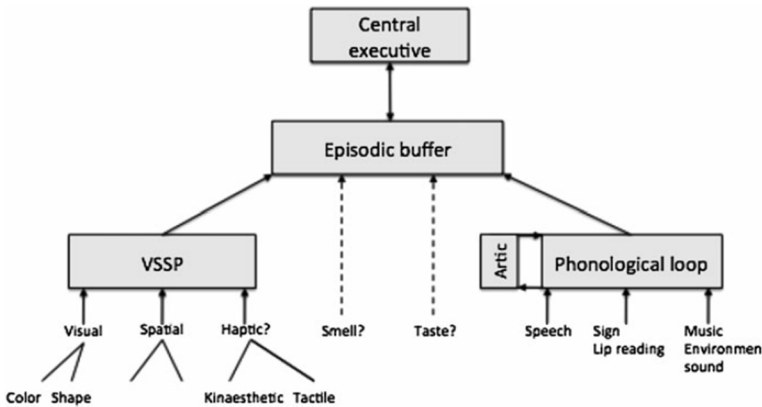


Figure 9. A speculative view of the flow of information from perception to working memory. VSSP, visual-spatial sketchpad (Baddeley, 2012). Baddeley, A. (2012). Working Memory: Theories, Models, and Controversies. *Annual Review of Psychology* .Vol. 63: 1-29 (Volume publication date January 2012) First published online as a Review in Advance on September 27, 2011 DOI: 10.1146/annurev-psych-120710-100422.

As seen above, the PL and the VSSP do not seem to interact with the EB via CE as previously seen in Figure 8, but in a straightforward fashion. Even though there is this diagrammatic change, the EB is still not conceived as an active processor, but still as a passive subsystem responsible for the storage of multidimensional information (Baddeley, 2010). Both diagrams, Figure 8 and Figure 9, also seem to suggest that the CE would be the part of WM responsible for the interconnectivity, and binding of memory traces originated from the verbal and imagery systems mentioned in Pavio’s (1990, 2006) DCT, which will be presented in section 2.3.

Taking into consideration the interactivity among various components proposed by this view, a good metaphor to refer to WM would be that of a *workspace* (Miyake & Shah, 1999; Logie, 1996). A workspace because maintenance and processing of information involves dynamic procedures executed by different segments that can be applied

to a wide range of activities for which WM is important. Because of that, this will be the metaphor used to refer to WM in this study. This choice was made because successful comprehension of texts such as cartoons depends on the implementation of active interrelations between various mental processes: the reader processes the sensory input, activates prior knowledge, predicts meanings based on the input and on prior knowledge, processes the verbal and pictorial codes more literally, makes inferences expanding comprehension, monitors his reading process and takes conclusions. All these processes are attributed to different components of the M-WM, including what is of higher interest in this study: the binding process of verbal and pictorial information accessible to the CE via their multidimensional representation in the EB.

The model to which Baddeley's conceptual framework of WM is more frequently compared with is Cowan's (1999) model. Cowan refers to WM as a temporary activated portion of LTM that fades unless maintained by verbal rehearsal or kept on the focus of attention (Baddeley, 2010). Cowan also assumes the existence of a CE and a brief sensory storage. In general terms, Baddeley (2010), states that Cowan's model could be interpreted as an attempt to specify the interface between the attentionally-limited central executive and the storage-limited episodic buffer. Besides that, I see that Cowan's model also tries to give higher emphasis to the relationship among the CE, the EB and LTM. It seems to me that he tries to demonstrate that the processing in the first, and the storage in the second are influenced by information transferred from LTM, and that this information plays a major role in reading comprehension. An example of that would be one's performance in The Reading Span Test (RST): the higher the preexisting knowledge on the language used in the test (i.e. vocabulary, grammar, phonemes), and also on the themes each sentence presents, the better the performance may be. In sum, according to Baddeley (2012), "WM involves the activation of many areas of the brain involved in LTM" (p.18), but this activation just happens when more complex operations are required by WM, and not necessarily when well-learned habits or schemata are evoked. Overall, Baddeley's and Cowan's views on WM differ in terms of terminology and areas of current focus, but both seem to conceive that processes within WM are dynamic and involve a continuous interplay among different areas and/or parts.

Still related to the overall argument that information from distinct codes are turned into distinct memory traces held and manipulated by specific subsystems of WM, the next section adds to this discussion some assumptions from Paivio's DCT (1990, 2006). Its focus on the benefits

of associating imagery, external visual stimuli and verbal stimuli to recall and to reading comprehension gives raise to some insights on the usefulness of promoting this interplay in order to improve the reading experience in both the native and the foreign language.

### 2.3 THE DUAL-CODING THEORY (DCT)

For Paivio (1990, 2006), “human cognition is unique in that it has become specialized for dealing simultaneously with language and with nonverbal objects and events” (p. 53). Ontologically speaking, he advocates that human beings specialized in the maintenance and manipulation of nonlinguistic representations in memory prior to developing the same ability in relation to linguistic representations. Still according to him, it is the contact that human beings have with concrete objects in the world since birth that justifies such an earlier development. In addition, Paivio (1990) states that the richer these experiences, the better the posterior development of language, once more interconnections would be established in the brain. Interconnections that would lead future readers to develop the ability to verbalize ideas related to concrete objects even in their absence, as well as the ability to elaborate on abstract ideas. In this sense, it is plausible to assert that, according to this framework, the VSSP would come into play much earlier in people’s lives since the maintenance and manipulation of visual representations are assumed to precede the maintenance and manipulation of verbal representations in WM.

The aforementioned arguments gave raise to Pavio’s DCT, whose main assumption, as shown in Figure 10, is that there are two distinct but interconnected subsystems responsible for the processing of information in general: the verbal system and the imagery system.

As suggested by their denominations, the first is pointed out as being responsible for the processing of verbal language memory traces, namely *logogens*, whereas the second, for the processing of nonverbal objects and events memory traces, namely *imagens*.

The functioning of these two distinct systems, as alleged in this framework, is independent from each other, that is, one can be active without the other. In the meantime, the framework also proposes that they are interconnected in the sense that one can trigger activity in the other and then activate parallel processing.

Figure 10 – Paivio’s model of dual-coding information processing in memory.

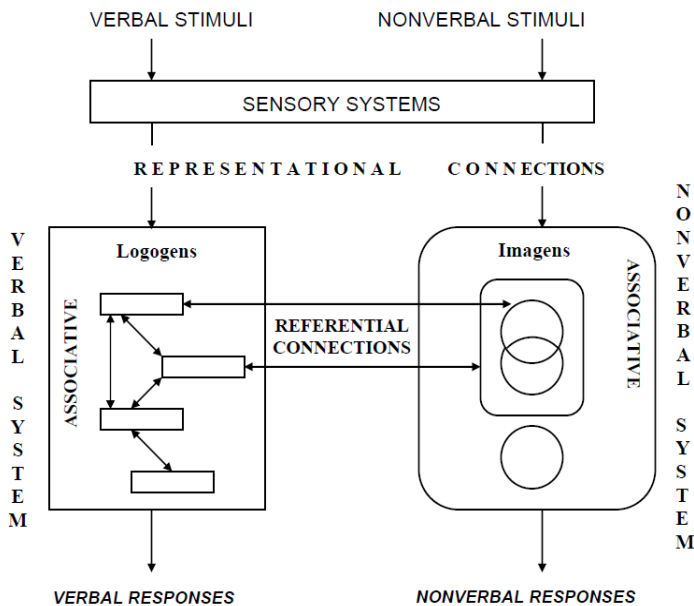


Figure 10. The Dual Coding System Diagram. Sadoski, M. & Paivio, A. (2004, p.15).

Paivio (2006) mentions the solving of jigsaw puzzles and crosswords to instantiate that. In jigsaw puzzles, for example, the imagery system appears to come into play more predominantly. In spite of that, I see that self reflections such as *this piece does not fit here* or *these colored pieces have to be grouped later on* are verbalizations that also guide one's execution of the task. In relation to the second example, verbal representations originated from the processing of sequences of letters, syllables and finally, full words predominate in the execution of the task. However, I also see that individuals are at the same time aided by hints given by the number and position of empty squares of the crossword, which are in fact visual hints.

It is possible to speculate here that the CE of Baddeley's model would be the subsystem responsible for the execution of these

interconnections, considering its assumed function of binding multidimensional information held by the EB (Baddeley, 2010). Besides that, it is also possible to say that the DCT is also in agreement with the Interactive Reading Model (Rumelhart, 1977), since it advocates for the parallel processing of more than one source of information in the construction of meanings. The sequential processing of words in the verbal system would be closely related to bottom-up processes while the generation of inferences triggered by illustrations, to top down processes, both of them, promoting the dual coding of information that is believed to improve recall and reading comprehension.

As pointed out by Paivio, “the most direct evidence of such interactive processing are the acts of reference—for example, naming objects and pointing to named objects” (p. 62). Based on Paivio’s claim that “what is processed in the imagery system is more likely to be evoked and used with objects or pictures as stimuli than with words as stimuli” (p.68), it can be asserted that illustrations, as the ones analyzed in this study may serve as external stimuli that can help one to better recall and understand verbal information. That is, external multimodal stimuli are believed to strengthen the input coding in memory, thus facilitating their recall and promoting the construction of more detailed mental representations.

However, it is important to acknowledge that the degree of transparency that exists between the verbal and pictorial information presented in the text, which is the key factor observed in this study, might facilitate or hamper the dual-coding process. That is, the more an illustration overlaps with the written text it accompanies, the more probable the establishment of associations between them, the faster their parallel processing and the more probable their contributions to promote successful recall and reading comprehension. On the other hand, it seems that the more subtle their overlapping, the higher the need for inferences from the part of reader, the slower their parallel processing, and the less probable their straightforward contributions to recall and reading comprehension. Thus, the DCT is being included in this theoretical framework because it brings clear explanations on what may happen during the processing of verbal and pictorial information and the effects of dual-coding in recall and reading comprehension. More importantly, it may ground the formulation of pedagogical instructions that can aid teachers to help readers deepen their comprehension of more elaborate illustrated texts in EFL reading, such as the ones investigated in this study.

Finally, before closing this chapter, I want to emphasize on a term that appeared often in the body of the text up to now, and that seems to

more completely integrate the various frameworks previously presented. The word I am referring to is *interaction*. In sum, the main idea that all frameworks, even in different ways seem to share, is that from the very first moment readers put their eyes on a text, complex interactive processes involved in the maintenance and manipulation of various sources of information have to start being simultaneously executed within a cognitive system of limited capacity. As posed by Daneman and Carpenter (1980) and Just and Carpenter (1992), possible differences in the output these readers might present in terms of recall and comprehension tend to be closely related to two factors: individual differences in terms of reading proficiency and WMC. Thus, the controlling idea that guides this study is that readers depend on the two aforementioned factors to break the barriers imposed by the metaphors so commonly presented in cartoons in order to construct more appropriate meanings. And, more importantly, to break those barriers, readers depend on the automatization of low-level reading processes, so that more cognitive resources can be devoted to the generation of the necessary inferences that are believed to successfully integrate multimodal memory traces (*logogens* and *imagens*).

Having dealt with the Review of the Literature, in the following chapter I shall describe the method developed to meet the purposes of this study.





### 3 METHOD

The main objective of this study was to investigate whether a sample of high school students who differed in a measure of EFL reading proficiency and in a measure of working memory capacity (WMC) would present corresponding differences in their ability to construct meanings from elaborate illustrated texts. That is, those illustrated texts whose images are needed for inferential comprehension to take place. More precisely, the study investigated the existence of possible relationships among readers' ability to infer meaning from cartoons, their EFL reading proficiency, and their capacity to simultaneously maintain and process verbal and pictorial information in WM.

This chapter is organized in 8 sections and provides details about the method adopted to carry out the study. Section 3.1 presents its design. Section 3.2 describes the participants' profile. Section 3.3 provides details about the instruments used for data collection. Section 3.4 describes the procedures used for data collection. Section 3.5 presents information about the procedures used for data analysis. Finally, section 3.6 provides details about the pilot study conducted prior to the actual study.

#### 3.1 DESIGN OF THE STUDY

The following design was implemented in order to address the main objective above mentioned:

Table 1 – Design of the study

<b>1<sup>st</sup> meeting</b>	<b>2<sup>nd</sup></b>	<b>3<sup>rd</sup></b>	<b>4<sup>th</sup></b>	<b>5<sup>th</sup></b>
Groups of 30 20'	30 40'	Individually 20'	10 15'	30 15'
1.Explan. Talk	1. EFL Back. Quest.	1.Practice RST	1. Reading Compr. Task	1.Feed .Talk
2.Distribution of Informed Consent Forms	2. Reading Proficiency Test	2. RST	2.Retrosop. Questionnaire	

*Note.* Participants: Pilot Study:  $N= 04$  Study:  $N=60$

The design of the study shown in Table 1 comprised 5 meetings of distinct length of time. They were distributed as shown above because some of the tasks were considered more cognitively demanding than others, a factor that could undermine participants' performance.

The same design was used in two distinct stages: in the pilot, and in the actual study. Four high school students took part in the pilot study and 60 high school students composed the sample size of the actual study.

The first meeting (20 minutes), was an explanatory talk about the aim of the study. During the talk, students were allowed to ask questions to clarify possible doubts before accepting to be participants. After that, they received informed consent forms as well as explanations about the voluntary nature of their participation. In the second meeting (40minutes), taken place two days later, those students who presented the consent forms properly signed were required to answer an EFL background questionnaire. Right after that, they took a reading proficiency test. One week later, in the third meeting (20 minutes), participants took the Reading Span Test (RST), preceded by a training session. This test was performed individually and personally monitored by this researcher. In the fourth meeting (15 minutes), four days later, a reading comprehension task and a retrospective questionnaire were administered. This was the last data collection session. In the fifth meeting (15minutes), held four months later, after data analysis, participants received feedback concerning the general results obtained in the study, as well as printed report cards (see a sample in Appendix A) with individual data. These report cards were enclosed in separate envelopes and were separately given to each of the participants in order to ensure data confidentiality. In the same meeting, written reports (Appendix B) were sent to the participants' parents/guardians with the aim at informing them about the results of the study.

Data collection was conducted in the second and third weeks of July 2015, immediately after the pilot study.

## 3.2 PARTICIPANTS

The pool of participants of this study was composed of high school students ( $N=60$ ) regularly enrolled in a public educational institution located in Taió, Santa Catarina, Brazil. All of them were native speakers of Brazilian Portuguese, aged 15-17 years old ( $M= 16.3$ ,  $SD .64$ ), and students of English as a foreign language (EFL).

Initially, all students enrolled in the second year of high school were invited to voluntarily participate in the study. From the 97 students

invited, 67 of them accepted the invitation, that is, most of them (70%) composed the initial sample. This significant percentage revealed the students' willingness to contribute to the study which contributed to increase its representativeness. Their attitude was constantly appraised by this researcher so that they could realize that this openness is not always common in scientific research, and that their participation was extremely important.

During data collection, two students decided to give up on the study. They alleged no special reason for their decision. They were encouraged to continue, but not forced to. Once they decided to stop taking the tasks, they were thanked for their participation and informed that all data collected up to their decision would not be used, and would be protected by the terms of confidentiality mentioned in the consent forms. Besides that, three participants were absent in some of the sessions and could not come to extra meetings that they were offered. Due to their unavailability, these participants were also informed that their data would not be used in the study and would be protected, too. Besides that, data from two participants were considered invalid because as soon as data collection started, it was noticed that they had serious problems with minimal decoding. They could not even understand the written instructions they should follow to respond to the tasks demands. Their difficulty was remarkably noticed during the RST in which they were unable to properly read the sentences shown on the computer screen. Because of that, they did not obtain the minimum score established by the task (2.0). In order to avoid ethical problems, these participants were invited to individual meetings and were politely informed that, at that moment, their data could not be used, due to the difficulties they were presenting. Even though I felt extremely touched by the delicate situation and truly wished to do something to help these participants, their data could not be revealed to teachers, coordinators and principals of the school. The only action taken toward it was to inform the coordinator of pedagogical issues of the institution, that these participants showed extreme difficulties in terms of reading and that they could be in need of special assistance. Further involvement was avoided in order to ensure data confidentiality, and also the accomplishment of the purposes of the study. At the end, the sample was composed by 60 participants.

The choice for these participants was purposive. Despite my interest in focusing the study on a population formed by adolescents, I decided to collect data from students who, in majority, were my EFL students' some years ago. Firstly, this choice was made in virtue by having another opportunity to get engaged in their educational

development. Besides that, it represented an attempt to create a friendly environment for data collection without influences from emotional barriers that sometimes emerge between participants and researchers who are unknown to them. I believed that they would feel comfortable in the presence of their ex-English teacher. A latter reason was to involve adolescents from a city where scientific studies are not commonly carried out, in activities that could expand their academic perspectives. I do believe that by involving students in these types might be a way of boosting their willingness to keep on studying after high school, and maybe, of getting involved in scientific research in the future. Additional details about the population, obtained by means of the EFL background questionnaire, one of the tools used for data collection, will be provided later, in subsection 4.1.1, presented on the chapter of results and discussion. An inferential analysis of the participants' answers in this questionnaire was helpful in the interpretation of the quantitative data obtained in the study.

The next section presents all instruments designed for data collection purposes.

### 3.3 INSTRUMENTS FOR DATA COLLECTION

The instruments used for data collection in this study comprised: one EFL background questionnaire (Appendix C); one reading proficiency test (Appendix D); one test to assess WMC, namely, The Reading Span Task (RST) (Appendix E); one reading comprehension task (Appendix F); and one retrospective questionnaire (Appendix G). These materials were previously tested in the pilot study in order to evaluate whether they were adequate to provide the data needed to meet the purposes of the study.

An important aspect to be considered before describing each of the aforementioned testing materials regards the sample of the study: it was essentially made up of high school students who were still taking EFL classes and were not proficient users of the language. On the basis of these characteristics, the instruments for data collection were specially designed with respect to the participants' age and educational background so that more accurate measurements could be obtained (Yuan et al., 2006). However, in consonance with Linck et al. (2013), an optimal level of the testing materials was also pursued, based on the rationale that tasks have to be difficult enough so that individual differences in relation to reading comprehension and working memory capacity can be found.

### 3.3.1 The EFL background questionnaire

The EFL background questionnaire, adapted from Tomitch (2014), was used to gather some general information about the participants' profile. The questionnaire was written in Portuguese, the participants' native language. They could answer the questions in Portuguese as well. Prior to answering the questionnaire, participants were informed about the number of identification that should be used in all tasks, instead of their names. The questionnaire basically presented questions about the participants' past and more recent experiences concerning the study of and contact with English. It comprised 16 different questions with 5 open-ended questions, 9 multiple-choice questions, and 2 likert scale questions.

Data obtained from this questionnaire were used to better portray the population investigated in the study, as well as to better interpret the results obtained in the statistical tests.

### 3.3.2 The EFL reading proficiency test

An EFL reading proficiency test was especially developed for this study. It was composed of 6 open-ended questions rated 1 point each, whose design was based on Pearson and Johnson's (1978) taxonomy for comprehension tasks.

In this taxonomy, question-answer relations are classified as: (a) *textually explicit*, (b) *textually implicit* and (c) *scriptally implicit*. According to Alptekin and Erçetin (2009), textually explicit questions (TEQ) serve to measure readers' literal comprehension, while textually implicit and scriptally implicit questions (TIQ and SIQ, respectively), on the other hand, serve to measure readers' inferential comprehension.

In the case of TEQ, answers derive directly from information explicitly presented on the page, and demonstrate the readers' "shallow understanding of the text since it does not go beyond the representation of textual meaning as expressed by the author" (p. 629). That is, readers can find the information they look for, in the exact terms presented on the surface of the text, and this type of question-answer relation leads the reader to a literal comprehension. For instance, if a text presented the following information: '*Brazil hosted the 2014 FIFA World Cup*', one respective TEQ about it could be: '*Which country hosted the 2014 FIFA World Cup*'.

In the case of TIQ, answers derive from connective inferences based on the text structure, but not derived from extensive amounts of prior knowledge. In other words, readers can identify information which

is also found on the surface of the text, but not cued by its language. In this type of relation, readers have to generate minor bridging inferences to be able to integrate ideas. For instance, if a text presented the following information: *'The forgetful teacher spent the whole day correcting tests last Saturday'*, one respective TEQ about it could be: *'Why did the students get frustrated with the birthday party they had prepared to their teacher last Saturday?'*

Finally, in SIQ, answers derive from elaborative inferences based on previous knowledge, but still related to the text. Readers must go beyond information found on the surface of the text. In this case, personal schemata have to be activated and inferential comprehension is deeper because text-base information and prior knowledge are simultaneously processed. For instance, if a text presented the following information: *'The British parliament couldn't agree on the new law of social quotas'*, one respective SIQ about it could be: *'Is the disagreement result of disastrous experiences observed in other European countries where social quotas were approved?'*

Thus, textually implicit answers derive from the processing of implicit textual information while scriptally implicit answers, from the processing of both, textual information and prior knowledge. Both of them reveal "the readers' deeper understanding of the text that comes from the integration of the surface code, the textbase, and the reader's relevant knowledge" (p.629). These three types of question-answers relations can also be identified in the Reading Comprehension Chart constructed by Tomitch (2011), based on Gagné et al. (1993), already shown in the review of literature, Figure 2.

In that framework, TEQ would be related to the comprehension of literal meaning from print, involving the subprocesses of lexical access and parsing. TIQ and SIQ, on the other hand, would be related to the comprehension of ideas that go beyond information literally stated in text, involving the subprocesses of integration, summarization and elaboration.

The EFL reading proficiency test used in this study did not contain scriptally implicit questions, considering the fact that personal schemata and background knowledge on the theme of the text used in this test would probably vary from participant to participant and, in the present study, there would be no way to control this variable.

As the main purpose of this test was to check reading comprehension and not knowledge in the target foreign language, the aforementioned types of questions were written in Portuguese, the native language of the participants, who were also allowed to answer them in the same language. Based on Buchweitz (2008), it does not seem to be

reasonable to demand an outcome in English in tasks such like this, because “the objective is to understand the reading processes used in the second language and not to analyze speaking and writing abilities” (p. 87, my translation)<sup>3</sup>. In sum, such a procedure aimed at decreasing an unnecessary cognitive overload imposed to the participants of this study.

The text on which the questions of this test were developed was an adapted version of ‘*David Luiz: I Only Wanted to See People Smiling*’ (Itri B et. al, 2014). The text contained 214 words and was published by *Folha de São Paulo International*, on July 2014. It had as context Brazil’s defeat in the World Cup semifinals, an episode that caused a national commotion and that was widely disseminated by different types of medium. Once soccer is highly influential in the Brazilian culture, it was believed that this text would motivate participants to get interested in its content as well as to focus higher attention while reading. One aspect to be considered is that the text basically contained grammatical topics that were already studied by the participants in the current and in the previous year. These grammatical topics were found in the series *Globetrekker*, 2<sup>nd</sup> edition, (Costa, 2010), which is a series of didactic textbooks distributed by the PNLD ( Programa Nacional do Livro Didático), a Brazilian educational program that aims to subsidize the pedagogical work of teachers by providing collections of textbooks to students in basic education. All textbooks offered by this program are thoroughly analyzed by evaluators from renowned Brazilian educational institutions, who follow very precise criteria before collections are officially approved and distributed by the Ministry of Education (MEC).

### 3.3.3 The Reading Span Test (RST)

Working memory (WM) is assumed to be a system that, under the constraints of its limited capacity, simultaneously executes processes and stores the products of these processes (Baddeley & Hitch, 1974), (Baddeley & Logie, 1999). Based on that premise, Daneman and

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<sup>3</sup> My translation from Buchweitz (2008, p.87): “(...) o objetivo é entender os processos de leitura dos quais se utiliza o LIng2, e não analisar habilidades de fala e escrita”. In: Buchweitz, A. (2008). A Aplicação de um modelo para a compreensão na leitura em primeira e segunda línguas. In: Lêda Maria Braga Tomitch. (Org.). *Aspectos cognitivos e instrucionais da leitura*. 1 ed. Bauru, 2008, v. 1, p. 73-98.

Carpenter (1980) developed this dual task to measure such a limitation: the Reading Span Test (RST). This test was originally used to assess English natives' working memory capacity (WMC), in a study dedicated to the development of a WM measure that could correlate well with reading comprehension performance. Considering that previous simple and more passive span tasks as the digit span failed in attempts to show such a significant correlation, the RST was presented as an alternative to obtain a more marked trade-off between processing and storage.

According to Miyake and Sha (1999), the RST was designed to resemble the WM demands during the performance of complex cognitive tasks, as for instance, reading comprehension. Based on the rationale on which this test was designed, studies have used its original or modified versions as a tool to measure WMC, whose results have been significantly correlated with different aspects of the reading comprehension process in both L1 (Sanchez & Wiley 2006; Tomitch, 2003), and in L2 (Bailer, Tomitch & DEly 2013; Alptekin & Erçetin, 2009; Fontanini & Tomitch, 2009). Because research has shown that the RST has high and consistent correlations with real-world higher-order cognitive abilities (Heitz, Unsworth & Engle, 2005; Yuan et al., 2006), being a tool that provides a measure of WMC that correlates well with reading comprehension, it was believed to be an instrument that would properly assess participants' WMC in this study.

As the RST per se presents heavy processing requirements that decrease the amount of information that can be maintained in WM (i.e. the higher the WMC capacity, the higher the ability to process and store information), selecting its language was a factor that had to be carefully analyzed (Linck et al., 2013). As advocated by Linck et al, if a given WM span task requires the use of a foreign language, it will not purely measure WMC, but also knowledge on this language, resulting in confounds with language proficiency. Thus, in order to provide a purer estimate of WM abilities, the RST used in this study were a Brazilian version of Daneman and Carpenter's (1980) original test, developed by Tomitch (2003). Even being a modified version, the basic dual-task structure remained the same in Tomitch's version. Any version in English would turn out too difficult for high school students of English as a foreign language and as a result, produce floor effects, that is, very low scores caused by an inappropriate level of difficulty.

Tomitch's RST consists of 60 unrelated sentences ended with different words each and ranging from 13 to 17 words in length. These sentences are arranged in three sets of two sentences (trial 1), three sets



of three (trial 2), three sets of four (trial 3), three sets of five (trial 4) and three sets of six sentences (trial 5).

In this test participants are required to read the sentences out loud with the monitoring of the experimenter, to ensure processing. At the end of each set, they are cued to recall the final words of all its sentences. An example of a set in trial 1 would be:

- A mostra Antonio Bandeira reúne um conjunto de sessenta pinturas e desenhos de coleções públicas e **privadas**. ( 17 words - *Nossa História*, edition 33, 2006, p. 86).
- Em uma Olimpíada as regras ajudam a apontar, sem muitas contestações, quem é o **melhor**. ( 16 words – *Veja*, edition 2042, 2008, p.59).

From the examples above, participants would be expected to recall the words *privadas* and *melhor*, in this exact order. After that, two more sets of 2 words would be presented and participants would be also required to recall their respective 2 final words. At the end of these 3 sets, trial 1 would be completed.

Participants' WM span measure in this study was strict, that is, taken in the level at which words were accurately recalled on at least two out of the three sets (Daneman & Carpenter, 1980), in the exact order they were presented (Friedman & Miyake, 2004). In consonance with Masson and Miller (1983), half point was given to the participant who recalled at least 1 set of a certain level (as cited in Tomitch, 2003). For instance, P4 and P47, who recalled all the words in the right order in trial 2 (3 sets of 3 sentences) and just 1 set in trial 3 (3 sets of 4 sentences), were considered span 3,5 (i.e. 3 points obtained from trial 2 and half a point from trial 3). In all cases the test finished when participants failed recalling the exact words in the exact order they were presented in all 3 sets of a certain trial.

### 3.3.4 The reading comprehension task

For Tomitch (2012), comprehension is achieved when one succeeds in constructing a mental representation of a text, including the most important ideas brought by the author, interconnected with his/her own ideas in relation to the topic that is being discussed. Considering that this construction varies from reader to reader due to systematic individual differences in skill and performance (Buchweitz et al., 2009), including differences in terms of activation and suppression of information (Gernsbacher et al., 1997), it is possible to assert that each individual

differs in the way s/he updates the content of memory, that is, in the way s/he continuously constructs his/her mental representation of the text.

Previous research has shown the importance of updating in reading comprehension. Sanchez and Wiley (2006), in a study about the seductive details effects in terms of WMC, for instance, found that if the causal chain of events that is being constructed by the reader as s/he proceeds through the text is broken, the construction of an adequate mental model is disrupted. For Carretti et al. (2005), “given the limits of the WMC, good use of memory involves not only maintaining as much information as possible, but also continuously selecting and updating this information” (p. 47). In a study carried out by these researchers, it was found that updating the mental model of a text was more difficult for poor comprehenders, because they showed higher sensitiveness to the degree of activation of irrelevant information. Thus, based on the premise that the amount of activation available in WM is limited, a continuous management of these cognitive resources is made necessary while reading, in order to guarantee more activation to what is relevant to the construction of an adequate mental model. In addition, Van Oostendorp and Bonebakker (1999), in a study about the updating representation during reading news report, also found that backward inferences and integrations based on new incoming information are not always made, causing an incomplete updating of the mental model in construction. They concluded that this phenomenon may occur by an imposition of WMC on readers who have to construct a mental model by opting among some part of the information presented in the text. As research has shown that there is a limited amount of activation available in WM to update mental models, some information even being relevant, may decay or be displaced during the reading process.

Thus, the task designed to check reading comprehension in this study aimed at identifying individual differences in terms of the construction of meaning from illustrated texts, in this study, cartoons. The effects of EFL reading proficiency and WMC capacity in this process were specifically observed in the participants’ ability to update the mental representation of these texts, evolving from a predominant literal and shallower comprehension to a predominant inferential and deeper comprehension

This task contained a cartoon followed by two open-ended questions written in Portuguese, the participants’ native language. Participants were allowed to answer them in Portuguese, as well. Since what really interested in this research was the participants’ ability to go from literal to inferential comprehension, and to achieve that, vocabulary

knowledge would be paramount, a detailed glossary related to the cartoon was made available to them.

In order to analyze the aforementioned participants' differences in terms of comprehension, a cartoon was presented to them in two stages. In the first stage, only the verbal information was given to the participants, as instantiated below:

OMG!  
I JUST GOT  
BORN!

Based on that, participants were required to write down their overall comprehension on what they read. After that, the very same written information was presented, but being accompanied by its illustration, as shown in Figure 11, below:

Figure 11 – Example 6 - Cartoon whose inferential comprehension is a function of the parallel processing of verbal and pictorial information.



Figure 11. Stevens, M. (2010), I just got born!

[http://www.condenaststore.com/-sp/OMG-I-just-got-born-New-Yorker-Cartoon-prints\\_i10276347.htm](http://www.condenaststore.com/-sp/OMG-I-just-got-born-New-Yorker-Cartoon-prints_i10276347.htm)

As the illustration did not merely represent what was written, it was expected that participants would update their level of comprehension. To verify that, they were required to write down what they consider to be the main idea of the cartoon.

### 3.3.5 The retrospective questionnaire

A retrospective questionnaire adapted from Tomitch (2003) was administered at the end of the comprehension task, aimed to pursue two main purposes. The first was to scrutinize participants' perceptions of their own reading process with regard to the text difficulty upon which the comprehension task was developed, and also about the task itself. The second was to analyze the participants' ability to stipulate relationships between the text and its illustration. The first three questions were designed for achieving the first purpose aforementioned: (1) *Você conseguiu entender o texto do cartum escrito em inglês?*; (2) *Em uma escala de 1 a 6, como você classificaria o grau de dificuldade do texto?*; and (3) *Há alguma palavra do texto que você não entendeu? - Caso sua resposta seja 'sim', faça uma lista dessas palavras.* The last question was designed for achieving the second purpose mentioned above: *Você acha que a ilustração lhe ajudou a entender a moral do cartum? – Por quê?*. A summary of participants' overall responses will be reported verbatim in the chapter Results and Discussion without purposes of quantitative data analysis. As highlighted by Fontanini and Tomitch (2009), results from this type of tasks “describe major tendencies in relation to participants' subjective perception of their behaviors while reading, not exactly representing straightforward measures of these behaviors” (pp. 14, 15). Thus, responses from the retrospective questionnaire were submitted to a subjective analysis and were insightful in the comprehension of the reading process in which the participants of this study were engaged in.

The following section presents the procedures taken to accomplish the purposes of the study. Furthermore, it provides additional details about the series of actions that were directed to the use of the instruments of data collection mentioned above.

## 3.4 PROCEDURES FOR DATA COLLECTION

The first procedure followed before starting data collection was to require the consent to carry out the study in the chosen institution. This procedure was formalized through a consent letter signed by its legal representatives (Appendix H).

As soon as this consent was obtained, all students from the second year of high school were invited to participate in the first meeting so that they could take part in an explanatory talk about the purposes of the study. The talk was separately given to groups of 30 students, and lasted no longer than 20 minutes. In the same meeting, students received their assent forms to express agreement to participate in the study, as well as informed consent forms their parents or guardians would have to sign in order to legalize their participation: Students who presented all the necessary consent forms properly signed in the second meeting were officially considered participants of the study.

Prior to beginning each of the tasks mentioned in section 3.4, participants were provided with thorough instructions to ensure their full understanding. Detailed clarifications were given when necessary.

In agreement with the teachers (see Appendix I), the tasks that involved reading comprehension were done during the English classes. Thus, it was decided that all students would perform those tasks, considering that their contents were intrinsically related to the contents of the discipline. However, only data from students who presented the consent forms properly signed were collected and used in the study.

Procedures involved in the application of each of these tasks will be provided in the subsections below.

### **3.4.1 The EFL background questionnaire**

The EFL background questionnaire was administered in the first 20 minutes of the second meeting, with groups of 30 participants. All participants received the forms and were required to read all the questions silently to check their full understanding. They were authorized to begin answering them after being sure that they had no remaining doubts. After finishing the questionnaire, participants were required to wait for the following task. Instructions were given in Portuguese (see Appendix J, item 1) and students who still had difficulties while answering the questionnaire were helped individually.

### **3.4.2 The EFL reading proficiency test**

The EFL reading proficiency test was administered in the last 20 minutes of the second meeting, as soon as the participants finished answering the EFL background questionnaire.

Participants initially received the first part of the EFL proficiency test containing only the text '*David Luiz: I Only Wanted to See People*

*Smiling*'. They were instructed to read it for 10 minutes and were reminded about the glossary they could make use to help clarify possible doubts regarding vocabulary.

After that, participants received the second part of the test composed of 6 open-ended questions about information explicitly and implicitly presented in the text. They were authorized to start answering the questions only after being sure that there were no remaining doubts. The text was made available to them while answering the questions, but the time to finish the task was limited to 10 minutes. All instructions were given in Portuguese (see Appendix J, item 2), and students who needed help after starting the test were answered individually.

### **3.4.3 The Reading Span Test (RST)**

The RST was administered in the third meeting and lasted no longer than 20 minutes. A computerized version of Tomitch's (2003) RST was used and the same procedures suggested by this researcher were followed.

Prior to that, there were group training sessions. In these sessions nine additional sentences designed by this researcher were presented to the participants. These additional sentences were divided into one set of 2, one of 3, and one of 4 sentences, so that participants could get familiarized with the task, and also to have the opportunity to clarify remaining doubts about it. In this session, participants were told that the number of sentences in each set would gradually increase.

After the training sessions, the RST was individually conducted and personally monitored by this researcher. Participants were instructed to read out loud each of the sentences as soon as they appeared on the computer-screen, with no pauses. If pauses were detected, participants would be reminded of that. Such a procedure aimed at avoiding the use of idiosyncratic strategies (Friedman & Miyake, 2004). Participants were also told that immediately after their reading of each sentence the experimenter would push a button for the next sentence. Participants were required to pay attention to the sentences, trying to understand each of them. In addition, they were told that they had to memorize the last word of each of sentence, because these words would have to be recalled and written down in the order they were presented, at the end of each set.

The RST sentences were arranged in three sets of 2 sentences, three sets of 3, three sets of 4, three sets of 5 and three sets of 6 sentences, as already explained in subsection 3.3.3. Participants were informed that at the end of each set, question marks would be displayed on the screen,

signaling that they would have to write down all final words recalled. At the end of a set of three sentences, for instance, three question marks would be displayed on the computer-screen, whereas in a set of four sentences, four question marks would be displayed, and so forth. Instructions were given in Portuguese (see Appendix J, item 3) and participants just initiated the test after confirming that the computer screen was well positioned and that the font size was good.

#### **3.4.4 The reading comprehension task**

The reading comprehension task was conducted in the first 10 minutes of the third meeting, with groups of 30 participants.

This task was printed on one sheet of paper and was folded in a way that participants were not able to see the content of its second and third parts. To start with, participants were asked to look at its first part, and, for 2 minutes, read the cartoon presented without its illustration, but accompanied by a glossary. Second, for 2 minutes, participants were asked to report the main idea of what they had just read. They were allowed to check the text and the glossary while writing their answers. In the third step, participants were told to unfold the paper to see its second part, and, for more 2 more minutes, reread the very same cartoon but then on its complete version, containing the illustration. In this step, participants were not allowed to check the first part of the task containing the glossary. Afterwards, participants unfolded the third part of the task, and, during 3 minutes, they were asked to report what they considered to be the cartoons' main idea. In this step, they were not allowed to revisit the cartoon and its glossary – first and second parts of the task. All instructions for the comprehension task were given in Portuguese (see Appendix J, item 4), and participants were answered individually when help was needed.

#### **3.4.5 The retrospective questionnaire**

The retrospective questionnaire was administered in the last 5 minutes of the third meeting, right after the reading comprehension task. As soon as all the participants finished reading the questions of the questionnaire and had their doubts elucidated, they were authorized to answer them. Instructions for this task were given in Portuguese (see Appendix J, item 5), and participants who still presented doubts after starting it were answered individually.

### 3.5 PROCEDURES FOR DATA ANALYSIS

In order to test hypothesis 1, descriptive statistics were initially obtained so that data distribution could be verified (see Appendix K, for the complete descriptive statistics output). Results indicated that data did not satisfy the assumptions of parametric tests, given the high kurtosis of -1.32 ( $SE=.60$ ) for EFL Reading Proficiency, and of -1.32 ( $SE=.60$ ) for WMC. In addition to that, the outputs of the Kolmogorov-Smirnov normality test also came out significant ( $p<.001$ ) for both, EFL reading proficiency and WMC. Thus, a Spearman's rho test was used to examine the correlation between the two independent variables of the study: EFL reading proficiency and WMC. It was expected that results would show a positive correlation between the two variables.

In order to test hypotheses 2 and 3, participants' scores obtained in the EFL reading proficiency test (min=1,0/max=6,0) and in the RST (min=1,0/max 6,0), which in nature composed two continuous variables, were initially turned into two independent categorical variables, each of them subdivided into two levels.

In terms of reading proficiency, participants were subdivided as *less proficient readers* and *more proficient readers*. In terms of WMC, as *lower spans* and *higher spans*. The use of the comparative forms *lower/higher spans*, instead of their corresponding adjectives *low/high spans* was a personal choice made by this researcher in order to favor the notion of one's rank position in relation to the others in the specific context of this study. The same can be stated with regard to the use of *more/less proficient readers* instead of *proficient/nonproficient readers*. Moreover, the use of adjectives, especially in the case of *nonproficient*, would be inadequate considering the processual nature of any foreign language acquisition. And, finally, the use of comparative forms instead of categorical adjectives permitted the possibility of expressing my personal acknowledgement that any study may be susceptible to methodological deficiencies in terms of quantitative data collection.

Coupled with the above, this categorization was not informed to the participants. They were only informed about the raw scores they obtained in both tests, through the already mentioned confidential printed report cards.

Essentially, this subdivision was done on the basis of the participants' scores in comparison with the mean of distributions, obtained from both, the EFL reading proficiency test and the RST. All this data will be presented later in the chapter Results and Discussion.



The distribution for the dependent variable (reading comprehension scores) was done on the basis of the participants' answers on the reading comprehension task. These answers were categorized as *literal comprehension*, or as *inferential comprehension*. Considering that this categorization composed two mutual exclusive values, this was also considered a categorical variable. Based on Figure 11, presented in subsection 3.3.4, an example of literal comprehension would be: *the baby is holding a tablet and is saying that he has just got born*. An example of inferential comprehension would be: *nowadays, technology is becoming part of one's routine since very early in life*.

Considered the aforementioned, two Chi-Square Tests for Independence were run in order to test hypotheses 2 and 3, once two categorical variables were involved in the testing of each of them (Larson-Hall, 2010). It was expected that results would show a positive relationship between each of the two independent variables (EFL reading proficiency measures and WM span measures) and the dependent variable (reading comprehension scores).

Data was submitted to statistical tests using SPSS for Windows (version 22.0.0), so that a careful analysis of the results could be carried out.

Answers from the EFL background interview and the retrospective questionnaire did not generate any type of quantitative data, but helped elucidate possible questions related to the overall performance of the participants.

### 3.6 THE PILOT STUDY

A pilot study was carried out in the first week of July 2015, as soon as its approval was issued by the CEPESH-UFSC. Its pool of participants was composed by 4 high school students regularly enrolled in a public school located in Taió, Santa Catarina, Brazil - the same institution where the main study was conducted. All participants were high school students, aged 15-17 years old and native speakers of Brazilian Portuguese. As well as in the main study, all participants and parents signed consent forms, as determined by Resolution 466/12. Results from this pilot study served as basis to optimize some aspects related to the methodological choices and testing materials posteriorly used in the main study.

The first contributions brought by the pilot study were given by the participants in the first meeting. They reported that the 10 minutes previously established in the design of the study were sufficient for them to read and make notes in the text used in the EFL reading proficiency

test. However, they reported that the glossary could be expanded with some additional words. This inclusion was made considering that this was a common agreement among all participants.

The pilot study was also important to adapt some of the procedures to be subsequently used in the RST. The first adaptation was related to the explanations given in the training session, and the second, to the conduction of the main session. As participants in the pilot study reported feeling extremely nervous and fearing *to fail* in the RST, it was considered important to reinforce to participants of the main study that there is no *failure* in terms of RST results. Besides that, it was decided to emphasize that even though WM plays a fundamental role in the accomplishment of cognitive activities, people are able to develop strategies to deal with its limitations. The main goal of emphasizing these aspects was an attempt to demystify the idea that WM high scores would exempt participants of doing the best to learn at school, and also that people should also be acknowledged by their attempts to overcome limitations, and not only by the scores they obtain in tasks. These comments were made during the presentation of the RST in the training session of the main study. The second adaptation was related to the inclusion of an extra set of two sentences before participants started the RST. This inclusion was made because participants in the pilot study reported having difficulties to recall all instructions given in the training session. As there was a gap of at least one day between the training and the actual sessions, it was decided to include this extra set of sentences just to make sure participants would remember what they had to do. Students, however, were not scored on the basis of this extra set.

Finally, the pilot study contributed to evaluate whether the time given to each of the steps of the reading comprehension task was sufficient or not to their full accomplishment. All participants reported that instead of 3 minutes, steps 1 and 2 of the task could be easily done in no more than 2 minutes. Considering that all participants really finished these steps on an average of 1:40 to 2 minutes, this reduction was made. Besides that, Participant 2 (P2) reported that the last question of the comprehension task could be clearer. The question was originally presented in the following terms: *Em sua opinião, o que o texto está informando ao leitor?*. P2 said that she was not sure whether she had to write about the cartoon without the illustration, or about its complete version. I could notice that P2 clearly understood that the illustration was playing an important role in the comprehension of the cartoon and that writing about the main idea presented by the written information only was not the same as writing about it plus the illustration. Based on the

suggestion given by P2, I asked P1, P3 e P4 whether changing the question to *Em sua opinião, o que o cartum que você acabou de ler está informando ao leitor?*, would clarify what the question was really about. As all participants agreed that comprehension would be benefited by this change, the question was adapted.

### 3.7 THE ETHICS REVIEW BOARD

In order to guarantee the compliance of Resolution 466/12 on ethics in research with human beings, this study was firstly submitted to the approval of the CEPESH-UFSC (Comitê de Ética em Pesquisa com Seres Humanos da Universidade Federal de Santa Catarina). Its approval, under the number 45350315.1.0000.0121, was issued on June 15<sup>th</sup> 2015. No data collection was conducted before obtaining approval.

In order to comply with all the ethical requisites of the resolution, participants under the age of 18 were also required to take the consent form to their parents/guardians (see Appendix L) and bring it back signed in case of acceptance. Participation in the study also depended on the participants' own assent (see Appendix M).

Having presented the method developed to carry out this study, the chapter Results and Discussion will follow.



## **4 RESULTS AND DISCUSSION**

The following chapter is aimed at presenting and discussing the results obtained in this study. It is structured into four sections: the first dedicated to present a general portrait of the sample investigated, the second, focused on the literal description of the results obtained by means of the statistical tests (i.e. descriptive statistics), the third, designed to propose a subsequent discussion of the results (i.e. inferential statistics) and the fourth, set apart to readdress the hypotheses raised in the study.

This chapter was structured on the basis of a predominant quantitative data analysis. Nevertheless, its initial section has to do with a more qualitative data overview on the expectation that relevant characteristics of the sample investigated could shed some light on the interpretation of the numerical measurements.

### **4.1 A GENERAL PORTRAIT OF THE SAMPLE INVESTIGATED**

This section consists of an inferential analysis of information obtained by means of the following instruments used for data collection: (a) the EFL background questionnaire; (b) the reading proficiency test; (c) The Reading Span Test (RST); and (d), the reading comprehension task. This analysis resulted on a general portrait of the sample investigated in this study. The outputs are presented below, into separate subsections.

#### **4.1.1 The EFL background questionnaire**

Initially, the EFL background questionnaire showed that, in the period of data collection, all participants were taking 3 EFL classes of 45 minutes a week. It also revealed that 50% of the sample had been studying English from 6 to 8 years, while 30%, from 9 to 11 years. Just 20% of them had been studying English from 3 to 5 years. On the whole, it is possible to say that the big majority (80%) had been exposed to the language in the school environment since they were 10 years old, on average. Since participants usually count on specialized teachers, equipped classrooms, computer labs and textbooks containing reading, writing, listening and speaking activities that are freely distributed to all of them, it is possible to presuppose (not necessarily guarantee) that they had been provided with the basic conditions and time necessary for satisfactory EFL learning.

The EFL background questionnaire also revealed that just a few students (11,6%) were attending courses in language institutes in the

period of data collection. The great majority of the sample (88, 4%) reported that their contact with the language, under the monitoring of specialized teachers, had never happened anywhere else but at regular schools. The questionnaire did not investigate further details that could provide explanations to that.

Finally, the background questionnaire showed relevant data regarding how much time participants had been studying English at home during the period of data collection. In a likert scale question in which 1 represented *I do not study English at home* and 6 represented *I dedicate much time to study English at home*, more than a half of the participants (68%) answered from 1 to 3, while the rest of them (32%), from 4 to 6. Also, 20% of these participants answered 1, that is, they literally admitted to be dedicating no time at all to studying English at home. Considering the above, it was not very surprising to observe that the great majority of these participants (P18, P25, P28, P31, P35, P37, P41, P50, P52 and P60), that is 77% of them, got scores from '1' to '3' in the EFL reading proficiency test, the lowest scores of the whole sample.

Besides being meaningful to this research, this data also says much to the participants' teachers and parents because, as evidenced by their own performances, the lack of commitment to their studies may be putting their learning at risk.

#### **4.1.2 The EFL reading proficiency test**

Considering the scores obtained by the participants in the EFL reading proficiency test (min=1.0/max=6.0), less proficient readers constituted 55% (min=1.0/max=3.0), while more proficient readers 45% (min=4.0/max=6.0) of the total number of participants ( $M = 3.66$ ,  $SD = 1.56$ ). As fully explained in subsection 3.3.2, less proficient readers were those who were able to answer textually explicit, but not textually implicit questions (TEQ and TIQ, respectively), and more proficient readers, those who were able to answer both types. As pointed out by Pearson and Johnson (1978), while the answering of the first is "explicitly cued by the language of the text" (p. 163), the same task depends on the generation of text inferences in relation to the latter, since in that case "there is no logical or grammatical cue tying the question to the answer and the answer given is plausible in light of the question" (p.163). The categorical distribution for EFL reading proficiency is shown in Table 2 below:

Table 2 – Categorical distribution of EFL reading proficiency measures

<b>Less Prof. Readers</b>	<b>Scores</b>	<b>More Prof. Readers</b>	<b>Scores</b>
P12	1	P11	4
P39	1	P23	4
P50	1	P38	4
P1	2	P45	4
P2	2	P16	4.5
P18	2	P44	4.5
P24	2	P57	4.5
P28	2	P7	5
P30	2	P10	5
P31	2	P19	5
P33	2	P49	5
P41	2	P54	5
P43	2	P17	5.5
P52	2	P20	5.5
P56	2	P21	5.5
P 60	2	P27	5.5
P14	2.5	P34	5.5
P53	2.5	P58	5.5
P3	3	P59	5.5
P4	3	P8	6
P5	3	P9	6
P6	3	P22	6
P13	3	P26	6
P15	3	P29	6
P25	3	P42	6
P32	3	P47	6
P35	3	P55	6
P36	3	-	-
P37	3	-	-
P40	3	-	-

P46	3	-	-
P48	3	-	-
P51	3	-	-
Mean	2.39		5.22
Standard Deviation	.64		.71
Minimum	1.0		4.0
Maximum	3.0		6.0

The fact that more than a half of the sample showed low proficiency would be surprising if we disregarded a relevant piece of information provided in the previous section: the fact that 68% of the participants reported dedicating a few or no extra hours to studying the target foreign language. Another important piece of information provided by this data regards its standard deviation ( $SD = 1.56$ ). This data, intrinsically related to the cumulative frequency that points out 33 participants (55%) with different scores below the mean ( $M=3.66$ ) and 27 (45%) with scores above it, reveals heterogeneity among participants in relation to EFL reading proficiency. The fact that these values were found to be a bit away from the mean of the data set may reflect a very common characteristic of Brazilian public schools: the grouping of too many students who present distinct levels and needs, under the conduction of only one teacher who has to manage most issues concerning their learning.

#### 4.1.3 The Reading Span Test (RST)

Considering the scores obtained by the participants in RST (min=2.0/max=6.0), lower spans represented 58.4% (min=2.0/max=2.5), while higher spans 41.6% (min=3.0/max=3.5) of the total number of participants ( $M = 2.59$ ,  $SD = .43$ ). As fully explained in subsection 3.3.3, the WM span measure was strict, that is, based on the level at which words were precisely recalled on at least two out of the three sets (Daneman & Carpenter, 1980), in the identical order they were presented (Friedman & Miyake, 2004). In addition, as suggested by Masson and Miller (1983), half point was attributed to those participants who recalled at least 1 set of a certain level (as cited in Tomitch, 2003). Even though there is not much agreement among researchers with regard to



standardized measurements that might be used to classify participants as lower or higher spans, in studies such as those carried out by Tomitch (2003) and Bailer, Tomitch and D'Ely (2013), participants who obtained score 3.0 and below were considered lower spans, and those ones who obtained score 3.5 and above, higher spans. For the purposes of this study, it was decided to classify the sample on the basis of the participants' scores in comparison with the mean of distribution ( $M = 2.59$ ). Thus, the classification adopted took into consideration the minimum and the maximum scores obtained by this specific sample. The categorical distribution for the WM Span is shown in Table 3:

Table 3 – Categorical distribution of WM span measures

<b>Lower Spans</b>	Scores	<b>Higher Spans</b>	Scores
P1	2	P7	3
P3	2	P10	3
P12	2	P11	3
P19	2	P14	3
P20	2	P16	3
P24	2	P17	3
P28	2	P22	3
P30	2	P23	3
P31	2	P25	3
P33	2	P32	3
P39	2	P34	3
P40	2	P35	3
P48	2	P37	3
P50	2	P38	3
P52	2	P41	3
P55	2	P42	3
P2	2.5	P44	3
P5	2.5	P46	3
P6	2.5	P49	3
P8	2.5	P53	3
		P56	3

P9	2.5	P59	3
P13	2.5	P60	3
P15	2.5	P4	3.5
P18	2.5	P47	3.5
P21	2.5	-	-
P26	2.5	-	-
P27	2.5	-	-
P29	2.5	-	-
P36	2.5	-	-
P43	2.5	-	-
P45	2,5	-	-
P51	2,5	-	-
P54	2,5	-	-
P57	2,5	-	-
P58	2,5	-	-
Mean	2.27		3.0
Standard Deviation	.25		.13
Minimum	2.0		3.0
Maximum	2.5		3.5

As observed above, more than a half of the sample (35 participants) obtained WM span measures between 2 and 2.5, while the others (25 participants), measures between 3 and 3.5. Overall, it caught my attention the fact that this sample, composed by adolescents aged 15 to 17 years old ( $M= 16.3$ ,  $SD .64$ ) did not obtain much WM span measures above 3.5, measure that, actually, was obtained by only 2 out of the 60 participants. Personally speaking, I was expecting higher measures since I believed that earlier ages and faster real time processing and storage of information were associated. Furthermore, the low standard deviation ( $SD .43$ ) revealed that scores were close to the mean of the data set, suggesting homogeneity among participants, meaning that the sample did not differ much in terms of WM span.

As I personally monitored all 60 participants during the RST, I could observe that even though all of them received detailed instructions

and could count on training sessions to get used with its procedures, most of them seemed to be very anxious during its conduction. Despite my attempts to make them feel comfortable and aware that all data would be totally confidential, I could notice that participants tended to get intimidated when they felt like having their limitations somehow exposed. Besides that, it is undeniable that the no acquaintance with methodical data collection procedures of scientific studies was an additional intimidating factor. Despite all attempts to maintain a friendly and calm atmosphere, I do believe that emotional aspects may have influenced the results of the RST. Further analysis on these outputs will be presented in the discussion of hypothesis 1, found in subsection 4.4.1.

#### **4.1.4 The reading comprehension task**

As already described in subsection 3.3.4 this task aimed at obtaining reading comprehension measures from the sample. It involved a two-step presentation of a cartoon. In the first step, participants just read the verbal information and were asked to report its main idea. In the second step, they read the same cartoon containing the verbal and the pictorial information, and then, by means of a free recall task, they were requested to report their final conclusion on the main idea, considering the additional information provided by the illustration.

In order to obtain more reliable measures, three MA candidates from the Federal University of Santa Catarina, including this researcher, separately read and rated participants' answers in the reading comprehension task. Based on the evaluations, answers were categorized as 'literal' or 'inferential' comprehension. Afterwards, a Fleiss' Kappa statistical analysis was performed to determine the proportion of agreement above what would be expected to occur by chance among the evaluations. The result was found to be statistically significant,  $K=0,93$ , which meant the interrater reliability was considered excellent (see Appendix N, for the complete Fleiss' Kappa computations). Given that, the null hypothesis that the agreement would be no different from  $K=0.0$  was rejected, and indeed, the three raters agreed in 162 out of 180 ratings. In those cases in which there was no agreement among raters, it was opted for the category that was pointed out by two out of the three raters, so that hypotheses 2 and 3 could be tested.

Results showed that 24 participants (40%) were evaluated as reporting a predominant literal comprehension, while 36 (60%) of them, a predominant inferential comprehension. These percentages suggest that the majority of the sample was able to infer meanings from the cartoon

used in the task. Considering that 56 participants (93,3%) reported being used to reading cartoons on newspapers, magazines and over the Internet in the EFL background questionnaire, it is possible to say that they may be somehow acquainted with this type of text. Even though this research does not provide specific measures on that, just from experience, it is possible to say that adolescents have been extensively exposed to cartoons, illustrated jokes and more recently, to illustrated ‘memes’ published in social networking, mainly. It might be that despite differences in terms of EFL reading proficiency and WMC, participants, influenced by this contextual condition, have developed strategies to process illustrated texts that demand the generation of inferences so that they can be more deeply understood.

## 4.2 RESULTS

The following section presents the results of the study, obtained by means of the statistical tests. In hypothesis 1 (H1) the correlation between the two independent variables of the study, EFL reading proficiency and WM span measures, was examined. In hypotheses 2 and 3 (H2 and H3, respectively), the relationship between the dependent variable of the study, reading comprehension measures, and each of its two independent variables aforementioned, was tested. As pointed out in the introduction of this chapter, this section will present results (descriptive statistics) apart from their respective discussion (inferential statistics), which is left to the following section.

### 4.2.1 Hypothesis 1- Results

Since descriptive statistics revealed that data distribution did not meet the assumptions of parametric tests, a Spearman’s rho test was used to test H1 (Larson-Hall, 2010). The test itself was run to examine the correlation between the two independent variables of the study: EFL reading proficiency and working memory capacity (WMC).

Results revealed a weak, but still statistically significant correlation between the aforementioned variables ( $r_s(58) = .321, p = .012$ , two tailed). Considering these results, the null hypothesis was rejected and H1 was confirmed, that is, those participants who obtained higher scores in terms of WMC also tended to obtain higher scores in terms of EFL reading proficiency.

### 4.2.2 Hypothesis 2- Results

In order to test H2, a two way group-independence Chi-square test ( $\chi^2$ ) was performed so that the relationship between EFL reading proficiency and EFL reading comprehension could be assessed (Field, 2009). The test was run on the basis of the number of participants classified in each level of the two categorical variables: less proficient readers and more proficient readers, in terms of EFL reading proficiency, and literal and inferential comprehension in terms of EFL reading comprehension. Table 4 summarizes the observed frequencies.

Table 4 – 2X2 Contingency table of observed counts and percentages for EFL reading proficiency X reading comprehension

		Comprehension			
		Lit.	Infe.	Total	
Proficiency	Less	Count	19	14	33
	Proficient	% within Profic.	57,6%	42,4%	100,0%
		% within Compr.	79,2%	38,9%	55%
		% of total	31,7%	23,3%	55%
	More	Count	5	22	27
	Proficient	% within Prof.	18,5%	81,5%	100,0%
% within Compr.		20,8%	61,1%	45%	
% of total		8,3%	36,7%	45%	
Total	Count	24	36	60	
	% within Profic.	40,0%	60,0%	100,0%	
	% within Compr.	100,0%	100,0%	100,0%	
	% of total	40,0%	60,0%	100,0%	

According to the observed counts and percentages shown in Table 4, 40% of the sample achieved literal comprehension, being 31,7 % of this total, composed of less proficient readers, and 8,3%, of more proficient readers. The remaining 60% of the sample achieved inferential comprehension, being 36, 7% composed of more proficient readers and 23, 3%, of less proficient readers. Within the percentages of EFL reading proficiency, 81,5% of all more proficient readers achieved inferential comprehension, while the same was achieved by 42,4% of all less proficient readers. Overall, the counts and percentages presented by this contingency table showed that inferential comprehension was highly superior among more proficient readers. Indeed, 22 out of the 27 more

proficient readers achieved a predominant inferential comprehension, while only 5 of them did not. Among less proficient readers the difference was balanced. As observed above, 14 out of 33 participants achieved a more predominant inferential comprehension, while 19 of them did not.

In addition to the above, results were found to be statistically significant ( $\chi^2 (1) = 9.4, p = .002$ ), with an effect size of  $w = .39$ . Furthermore, the  $\chi^2$  had a significant associated probability value of  $< 0.05$ , indicating that the relationship between the two variables have not arisen as a result of sampling error. Besides that, the medium to large effect size revealed that the strength of the relationship between the two variables was found to be from moderate to strong. Considering these results, the null hypothesis was rejected and H2 was confirmed: the achievement of inferential comprehension in the reading of cartoons was found to be positively associated with EFL reading proficiency.

### 4.2.3 Hypothesis 3- Results

In order to test H3, a two way group-independence Chi-square test ( $\chi^2$ ) was performed so that the relationship between WMC and EFL reading comprehension could be assessed (Field, 2009). The test was run on the basis of the number of participants classified in each level of the two categorical variables: lower and higher spans in terms of WMC, and literal and inferential comprehension in terms of EFL reading comprehension. Table 5, on the next page, summarizes the observed frequencies.

According to the observed counts and percentages shown in Table 5, 40% of the sample achieved literal comprehension being 30% of this total, composed of lower spans, and 10%, of higher spans. Likewise, 60% of the sample achieved inferential comprehension, being 28,3%, composed of lower spans and 31,7%, of higher spans. Within the percentages of WMC, 76% of all higher spans achieved inferential comprehension, while the same was achieved by 48,6 % of all lower spans. Overall, the counts and percentages presented by the contingency table above showed that the relationship among WMC and EFL reading comprehension was clearly visible among higher spans. Indeed, 19 out of the 25 higher spans achieved inferential comprehension, while only 6 of them did not. But the same conclusion could not be straightforwardly taken in relation to the lower spans. This is because even though 18 out of the 35 lower spans did not achieve inferential comprehension, and that this number represents more than a half of all lower spans, the rest of the participants, that is, 17 of them did reach inferential comprehension.

Table 5 – 2X2 Contingency table of observed counts and percentages for WMC X reading comprehension

			Comprehension		Total	
			Lit.	Infer.		
WMC	Lower Spans	Count	18	17	35	
		% within WMC	51,4%	48,6%	100,0%	
		% within Compr.	75,0%	47,2%	58,3%	
		% of total	30,0%	28,3%	58,3%	
	Higher Spans	Count	6	19	25	
		% within WMC	24,0%	76,0%	100,0%	
		% within Compr.	25,0%	52,8%	41,7%	
		% of total	10,0%	31,7%	41,7%	
		Total	Count	24	36	60
		% within WMC	40,0%	60,0%	100,0%	
% within	100,0%	100,0	100,0%			
Comprehension	40,0%	%	100,0%			
% of total		60,0%				

Despite this fact and in addition to all the above, results were found to be statistically significant ( $\chi^2(1) = 4.57, p = .033$ ), with an effect size of  $w = .27$ . Additionally, the  $\chi^2$  had an associated probability value of  $< 0.05$ , indicating that the relationship between the two variables was unlikely to have arisen as a result of sampling error. Furthermore, the small to medium effect size revealed that the strength of the relationship between the two variables was found to be weak to moderate. Considering these results, the null hypothesis was rejected and H3 was confirmed: the achievement of inferential comprehension in the reading of cartoons was found to be positively associated with WMC.

### 4.3 DISCUSSION

#### 4.3.1 Hypothesis 1 – Discussion

As shown in section 4.2.1, results from the Spearman's rho test revealed a statistically significant correlation between EFL reading Pproficiency and WMC at  $\alpha = .05$ . Even though results confirmed H1, they are worth being discussed since the correlation was found to be not

more than weak, strength that, somehow, went against the expectations of this study.

First of all it is important to consider that two types of measures were involved in testing of H1: participants' scores in the EFL reading proficiency test designed on the basis of Pearson and Johnson's (1978) framework, and participants' scores in the Brazilian version of Daneman and Carpenter's (1980) original Reading Span Test (RST), developed by Tomitch (2003). Since the EFL reading proficiency test, at my point of view, showed evidence of efficiency in the specific case of this study (more details will be presented in the next section), I would assert that the weak correlation may be attributed to two aspects related to the RST. The first aspect relates to external factors that possibly affected data collection, and the second, to the version of the RST used in this study. Let us start talking about the external factors.

As described in the method section, all participants participated in group training sessions so that they could get familiarized with the RST. Besides that, my observations in the pilot study showed the need of inserting extra training sentences in the actual test so that participants could again recall how to proceed, before actually starting it. That was important because even though the ideal procedure would be a subsequent conduction of both sessions, the second session was individually taken by each of the 60 participants and that took four days. Thus, I found it important that participants could practice twice because in most cases there were gaps of 1 to 2 days between the training session and the actual RST. But, besides all these efforts to ensure the good conduction of the test, it was impossible to create all the ideal structural conditions so that the test could in fact provide highly reliable measures. Different from what occurs when data is collected in laboratories, my participants took the tests at school, in some inappropriate conditions. Even though I tried to arrange the most comfortable and silent room to collect data, I have to admit that it was impossible to avoid environmental interferences such as noise from the building operations that were being executed in the institution, from the displacement of students in the corridors from classroom to classroom when changing classes. But, since those were the conditions to carry out data collection, the best to be done in that situation was done. Despite all of that, all my efforts seemed to be not enough and such a context may have influenced participants' performance in the RST, contributing to weaken the correlation found between the two independent variables involved in the testing of H1.

The second factor that may have weakened the correlation, as pointed out in the introductory paragraph of this section, was the version



of the RST used in this study. Daneman and Carpenter's (1980) developed the original RST to collect data from twenty participants enrolled in an introductory Psychology course at Carnegie Mellon University. Similarly, Tomitch (2003) developed the Brazilian version of the test to collect data from twelve participants enrolled in the Language Degree Program, and in the Medical school of the Federal University of Santa Catarina. That is, both studies investigated samples composed by undergraduate students, and indeed, their tests proved to be efficient tools in those contexts. While Daneman and Carpenter (1980) found statistically significant correlations among WM span measures and reading comprehension measures from the Verbal Scholastic Aptitude Test (SAT) and "tests involving fact retrieval and pronominal reference" ( p.450), Tomitch (2003), similarly, observed "real differences in the performance of better (higher span) and weaker (lowers span) readers while processing complete and distorted texts" (p.151). However, at my point of view, since the original sentences of the Brazilian RST were maintained in this study, it is possible to contend that differences in terms of preexisting vocabulary knowledge may have disrupted the outputs presented by this sample composed by high school students.

Evidence to base such a contention comes from Bailer, Tomitch and D'Ely (2013), who in a study on WMC and attention to form and meaning, used a modified version of Tomitch's (2003) RST version, by changing 8 out of 60 sentences (sentences 3, 6, 8, 10, 14, 25, 37 and 59) of the test. As pointed out by Bailer (2011), these sentences were considered to be out of the participants' context, and as far as I could interpret that, they could impose them an unnecessary overload in terms of processing, breaking apart their WM span measures. And, in fact, while in this study the higher scores were measured between 3 and 3.5, in their study they were measured between 3.5 and 6.0. Also, while only 2 out of the 60 participants from this study obtained WM span 3.5, which was the highest score of the whole sample, in their study, 11 out of 61 participants obtained the same measure, which was not the highest one. Considering that the sentences changed in Bailer, Tomitch and D'Ely's study were mainly concentrated among the sets of sentences that corresponded to WM span measures between 2 and 5, and that their sample, also composed by high school students, visibly outperformed participants of this study, it is possible to assert that those modifications may have influenced the outputs.

This contention may be grounded on an assumption shared among all WM models presented in the chapter Review of the Literature of this study: that the trade-off between storage and processing in WM is

affected by information retrieved from LTM. And in this case, I would say that it seems to make no difference if one conceives WM and LTM as different systems, being consistent with Daneman and Carpenter (1980), Just and Carpenter (1992), Heitz, Unsworth, & Engle, (2005), and Baddeley (2000), or as embedded systems, being consistent with Cowan (1999). What seems to make a difference is the possibility that preexisting knowledge can account for better performances in more demanding cognitive verbal tasks, (Hambrick & Engle, 2002).

According to these researchers, preexisting knowledge does not necessarily compensate for the difficulties lower spans present in demanding cognitive tasks, but that in the case of higher spans, it does. These researchers found that higher spans were able to maintain information in an activated state in WM for longer periods, and that this higher length of activation permitted the retrieval of crystallized knowledge<sup>4</sup> from LTM. In sum, they found that higher spans benefited more from preexisting knowledge and improved their performance in the cognitive task used in their experiment than did lower spans.

I see that it seems reasonable to propose a relationship between this finding and the results obtained by the participants of this study in the RST. This relationship may reside in the possibility that the version of the RST used was too difficult for this specific sample. In other words, what I mean is that the level of difficulty of the RST should have taken into account the participants' preexisting vocabulary knowledge so that the observed differences between the obtained WM span measures could show a stronger correlation with the obtained EFL reading proficiency measures. Unfortunately, no adaptation was done in the test given its frequent use and high acceptability in the field, factor that led me to believe its applicability would perfectly fit the requirements of this study.

As I personally monitored the test, there is an example which I would like to use to illustrate that. As soon as a considerable number of participants had already taken the RST, I started noticing that the great majority of them were having difficulties with the very same sentences. Sentence 23, inserted in a set of sentences that corresponded to WM span 4, just to mention one, was among them: *Pesquisadores descobrem que o antílope das pradarias norte-americanas é o mais resistente dos*

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<sup>4</sup> As defined by Baddeley (2012), the term refers to more stable knowledge an individual has already stored in LTM which is continuously enlarged during his/her lifetime as a result of learning.

*mamíferos terrestres* (*Superinteressante*, julho de 1992, p.37). When reading the words *antilope* and *pradarias*, most of the participants tended to slow down reading, signaled reactions of weirdness and, probably because of an excessive use of cognitive resources to match and recode the aforementioned words, tended to forget the last words of previous sentences. That was observed among 24 out of the 25 higher spans who could not properly recall the set or words in which sentence 23 was inserted in. Furthermore, 20% of all higher spans (P11, P35, P44, P49 and P59) could not recall any of the last words from the previous sentences, after reading sentence 23. Probably due to the displacement of previous information from WM (Daneman & Carpenter, 1980) participants could not go ahead in the test because they were struggling in their attempts to understand what they were reading. In that case, did the inability to recall the previous words really reflect their WM span, or just showed lack of preexisting knowledge on those specific words from sentence 23? Overall, it seems to me that the percentages mentioned above suggest that it is important to insert sentences within an optimal level of difficulty in any version of the RST because they would present the basic requirements for the simultaneous processing, manipulation and maintenance of verbal information in WM.

However, even though this assertion suggests that any version of the RST should be adapted for the specific population being investigated, I do admit that such a task would be extremely difficult since controlling preexisting knowledge from large samples on all words from 60 sentences would be a complex task. In spite of that, this difficulty could be eased by the use of word frequency databases which are available to researchers who carry out studies of this nature.

In sum, we cannot disregard the possibility that the sample investigated in this study was mostly composed of lower spans, a factor that would be in favor of the effectiveness of the RST that in such a context would not necessarily capture considerable differences among participants. Also, we cannot disregard the possibility that the cognitive overload triggered by the processing of unknown words may have created confounds between WM span measures and preexisting knowledge on those specific words. If the objective of the RST, as stated by Daneman and Carpenter (1980) is to provide a measure that taxes “both the processing and storage functions (p. 451), processing cannot be hampered by limitations in terms of basic preexisting vocabulary knowledge, otherwise the objective of the test may be lost. In that case, it may be that the same individuals, mainly higher spans, would get higher scores if all

words were part of their sight vocabulary, allowing for the flow of processing.

Just to conclude, even rejecting the null hypothesis and confirming H1, some evidence raised the possibility that environmental factors and the lack of necessary adaptations in the RST used in this study may have weakened the correlation between WMC and EFL reading proficiency.

### 4.3.2 Hypothesis 2 – Discussion

Taking into account the comparison between the critical value expected at  $\alpha = 0.05$ , ( $\chi^2(1) = 3,83$ ), and the obtained value, ( $\chi^2(1) = 9.4$ ,  $p = .002$ ), the Chi-square test for independence revealed that, indeed, there was a positive relationship between EFL reading proficiency and the reading comprehension of cartoons.

Having confirmed H2 with a medium to large effect size that revealed a moderate to strong relationship between the two variables, it is possible to assert that successful reading comprehension of more elaborate illustrated texts written in English as a foreign language is positively associated with higher levels of EFL reading proficiency.

Moreover, as briefly mentioned in section 4.3.1, these results also suggest that the taxonomy for comprehension tasks proposed by Pearson and Johnson's (1978) proved to be an effective theoretical framework for the designing of EFL reading proficiency tests. And indeed, as observed, those participants who were able to answer questions which demanded deeper levels of comprehension in the test designed on the basis of this taxonomy were those who were able to infer meanings from the cartoon used in the comprehension task of this study. Two examples, just to mention some, were randomly chosen to illustrate that.

Participant 8 (P8), who was among those participants who obtained 6, the maximum score in the EFL reading proficiency test, reported the following answer before processing the pictorial information of the cartoon: *Celulares podem causar câncer? Eu tenho que enviar mensagem para os meus amigos sobre esse perigo (Ele está querendo alertar os amigos.)*. It is possible to see that P8 initially translated the written information of the cartoon and then added an extra comment at the end in order to summarize its main idea. Up to this point, P8 showed evidence of having no problems in the execution of lower-level reading comprehension processes involved in decoding and literal comprehension (Gagné et al. 1993). After being allowed to reread the cartoon containing its pictorial information, P8 answer showed evidence from an assumption from Paivio's (2006) Dual Coding Theory (DCT) which says that

“sensory components of multimodal objects are functionally independent” (p.6). His/her answer was as follows: *Que não pode [sic] dirigir e ficar mexendo no celular, pois pode acontecer um acidente, que nem mostrado[sic]no cartum. Pois se o câncer mata, acidentes também.* As implied in the answer, the illustration added additional and independent information to the text that, due to the level of proficiency of P8, could trigger its deeper processing. Evidence that is consistent with Sadoski and Pavio (2004) in that “meaning in this instance consists of this coherent network of activated verbal and nonverbal representations. The richer the elaboration of activated mental representations and their defining interconnections the more meaningful our response” (p.19). In addition, since the DCT does not provide specific accounts for the role of WM in dual-coding processing, it is possible to predict that such a meaningful response may be the result of information that is stored in the episodic buffer (Baddeley,2003), and that represents the output of multimodal information pulled together by the central executive (Baddeley, 2012).

The second and last example of association between EFL reading proficiency and inferential comprehension of cartoons came from Participant 47 (P47). This participant initially reported the following answer: *Celulares podem causar câncer? Eu tenho que enviar mensagens para meus amigos sobre este perigo. Dá a entender que o vício é maior que o próprio perigo. O vício de estar sempre conectado*”. In the case of P47, we can see that since the beginning, top-down reading processes influenced his/her text interpretation. As well as P8, P47 also started by translating the verbal information and showed no problems with the execution of lower-level reading processes. However, differently from P8, before actually visualizing the illustration, s/he started predicting what was to appear in the cartoon. Such a behavior was clearly consistent with Rumelhart (1984) in that readers play the role of detectives by looking for clues on the text in order to unveil unobserved events that may or may not be confirmed up to the end of the text. In this case, predictions were confirmed, as implied in his/her answer reported after processing the illustration: *Que a falta de atenção, e o vício, podem ser mais perigosos que uma notícia. Algo que possa te causar espanto pode ocasionar acidentes por ocupar sua ‘memória’. Não tente fazer muitas coisas ao mesmo tempo.* It was amazing to observe that besides going beyond literal comprehension and reporting a more ample interpretation, P47 added inferences based on information participants from this study received in the first meeting in which I explained the purposes of this research and gave them some funny examples to explain the construct

*working memory!* All the above just endorses Rumelhart's view on reading in which schema activation plays a central role. According to this researcher, the set of schemas, better termed *schemata*, represents "our knowledge about all concepts: underlying objects, situations, events, sequences of events, actions, and sequences of actions" (p.2). "Driving and talking on cell phones" is one of these events that have been widely debated on TV, on the Web and also at school these days. Besides that, tragic news about car accidents spread from all types of media, probably add more and more information to this schema, progressively enlarging crystallized knowledge on this theme in LTM. Thus, in the case of P47, we may assert that the activation of a promising schema inherent to this theme from LTM possibly took place during the processing of verbal information in the phonological loop. Afterwards, as soon as the illustration was shown to him/her, his/her predictions were confirmed, and, as a result, the activated schema related to "driving and talking on cell phones" was accepted, allowing the participant to elaborate on the predominant literal comprehension initially reported.

Overall, we could see that it is possible to explore participants' outputs on the basis of various assumptions provided by the theoretical framework of this study. Additionally, we could see that these assumptions seemed to endorse our view that a text is this unit of meaning formed by a body of multi-coded information (Halliday & Hassan, 1976) that has the function of communicating ideas to the reader (Tomitch, 2012). Ideas, which are constructed via lower and higher-level reading comprehension processes (Gagné, 1993) interactively executed under the limitations of WM (Daneman & Carpenter, 1980; Just & Carpenter, 1992).

### 4.3.3 Hypothesis 3- Discussion

Taking into consideration the comparison between the critical value expected at  $\alpha=0.05$ , ( $\chi^2(1) = 3.83$ ), and the obtained value, ( $\chi^2(1) = 4.57$ ,  $p = .033$ ), the Chi-square test for independence revealed that, indeed, there was a positive relationship between WMC and the reading comprehension of cartoons. However, even though this measurement was found to be statistically significant, it was possible to observe that the strength of such a relationship was not more than weak to moderate.

This result may be intrinsically related to the fact that seventeen out of the thirty-five lower spans (P3, P5, P6, P8, P9, P15, P19, P20, P24, P26, P27, P36, P43, P45, P48, P57 and P58) surprisingly reported inferential comprehension of the cartoon used in this study. Two

examples from the aforementioned sample (P5 and P36) were randomly chosen to demonstrate that.

Participant 5 (P5) reported the following answer after reading the complete version of the cartoon: *Enquanto ele avisava seus amigos sobre o que os celulares causam, ele acaba sofrendo um acidente. Afinal ele se preocupou com os amigos, mas não se preocupou com si [sic] mesmo, das consequências usando [sic] o celular.* Even though P5 scored 2.5 in the RST, being considered a lower span, it was evident that s/he was able to go beyond literal comprehension in the first sentence by adding an elaboration in the second, resulted from the integration of verbal and pictorial information. Participant 5, despite being a lower span, showed clear evidence that the automatization of processes involved in literal comprehension enabled him/her to infer deeper meanings from the cartoon.

The other example came from Participant 36 (P36), who also scored 2,5 in the RST, and reported a similar answer: *Está informando ao leitor que além de câncer o celular tira a atenção e causa acidentes, tem[sic] o ponto positivo de informar os amigos e o negativo de se[sic] distrair e viciar.* From the very beginning of the answer, P36, despite his/her relatively low score in the RST, also showed no problems with regard to the execution of higher-level reading comprehension processes, being able to generate inferences that enabled him to grasp the cartoon's main ideas.

A plausible explanation for the fact that a considerable number of lower spans achieved inferential comprehension, affecting the strength of the relationship between the variables involved in H3, may reside in the level of complexity imposed by the pictorial information presented in the cartoon. As pointed out by Baddeley and Logie (1999), the visuospatial sketchpad (VSSP) is a WM subsystem which is responsible for the processing of visual patterns and sequences of movements, whose operations are constrained by its limited capacity (as cited in Miyake and Shah, 1999). Visual complexity, according to the author “may constitute additional limitations on the capacity of the system” (p.37), which does not seem to be the case of the cartoon used in this study. Before selecting the cartoon, it was not taken into consideration that the *danger of driving and using cell phones* is a highly explored topic nowadays, as already mentioned in section 4.3.2. Maybe, the processing of the pictorial information from the cartoon used in the reading comprehension task was not so demanding to the participants, once its main ideas are widely debated nowadays at schools as well as through televised and web campaigns, providing them with large schemata on the topic. That is,

students probably could count on prior knowledge that possibly decreased the load of information to be exclusively processed in WM. It may be that more complex and less known themes would impose higher demands during real time processing, showing WM constraints more evidently.

The aforementioned conclusion is somewhat endorsed by Craik and Lockhart (1972). According to these researchers, the level of cognitive processing of a word is inherently related to one's past experiences with it and, the deeper its processing, the greater its degree "of semantic or cognitive analysis" (p. 675). Considering the assumption adopted in this study that pictorial information constitute an inseparable part of the whole body of a text, it is possible to assert that the level of processing of an illustration, triggered by one's past experiences with its visual patterns, may also affect the consumption of WM resources in the VSSP. Craik and Lockhart, still on the same study, state that "highly familiar, meaningful stimuli are compatible, by definition, with existing cognitive structures" (p.676). That is, familiar visual patterns possibly have the potentiality to promote schema activation and improve text comprehension mainly because predictions have their origins in the activation of LTM. Thus, as stated by Rumelhart and McClelland (1981), and in agreement with the *Interactive Reading Model*, the nonlinguistic aspects involved in the reading context, such as the illustrations found in the cartoon used in this study, have probably boosted the generation of predictions that facilitated text comprehension, especially in the case of lower spans. The same effect probably would not have happened if a cartoon about the habits of an unknown tribe from a remote island faraway from Brazil had been used.

In sum, even in considering the statistical significance that rejected the null hypothesis, it is possible that the cartoon chosen in the reading comprehension task possibly did not impose the necessary cognitive load to WM that could produce more remarkable differences among the outputs of lower and higher spans.

#### 4.4 GENERAL DISCUSSION

Having presented the previous sections on descriptive and inferential statistics, the set of hypotheses raised in this study are now readdressed.



#### 4.4.1 Hypothesis 1 – General discussion

Hypothesis 1 was elaborated on the basis of the two independent variables of this study: EFL reading proficiency and WMC, and proposed a correlation between them:

**H1: There is a positive correlation between EFL reading proficiency as measured by means of answers to questions about important information presented in expository non-illustrated texts, and WMC as measured by means of the Reading Span Test. That is, readers with a higher EFL reading proficiency are also those with a higher WMC.**

As reported in subsection 4.2.1, results from a Spearman rho correlation test revealed a weak, but still statistically significant correlation between the aforementioned variables ( $r_s(58) = .321, p = .012$ , two tailed) at  $\alpha = 0.05$ , partially confirming H1.

These results were found to be in agreement with one of the main assumptions of the processing efficiency view of WM, proposed by Daneman and Carpenter (1980), as well as with one of the main assumptions of the capacity-constrained view, proposed by Just and Carpenter (1992). In relation to the first, Daneman and Carpenter (1980) proposed that “the better reader might have more efficient processes so that s/he effectively would have more capacity for storing and maintaining information” (p. 451). And indeed, participants who obtained higher WM span measures in this study showed evidence to be more able to answer both, textually explicit and textually implicit questions (TEQ/TIQ) (Pearson & Johnson, 1978) of which was consisted the EFL reading proficiency test. Such ability may be explained by the fact that they were possibly more efficient in the execution of lower level reading processes, thus, allocating remaining resources to the generation of connective inferences. In other words, efficiency in terms of processing decreased the consuming of cognitive resources which consequently were spared for more demanding processes. Now, in relation to the capacity-constrained view of WM, results of this study were in agreement with Just and Carpenter (1992) in that “capacity limitations would affect performance only when the resource demands of the task exceed the available supply” (p.124). Under this view, the observed differences in terms of EFL reading proficiency measures may be attributed to individual differences in terms of total amount of activation available in WM, or as explained by Logie (1996), determined “by an available budget of activation” (p.36). That is, as opposed to the answering of TIQ,

lower and higher spans were equally able to answer TEQ, probably because this type of questions do not impose heavy demands on WM, considering that they are aimed at measuring just literal understanding (Alptekin & Erçetin, 2009). In other words, it is possible that the higher spans of this study were more likely to obtain better EFL reading proficiency measures because they could count on a larger available budget of activation that allowed them to identify ideas found beyond the propositions explicitly identifiable on the surface of the text.

#### 4.4.2 Hypothesis 2 - General discussion

Hypothesis 2 was elaborated on the basis of the first independent variable of this study, EFL reading proficiency, and its dependent variable, EFL reading comprehension, and proposed a positive relationship between them:

**H2: There is a positive relationship between EFL reading proficiency, as measured by means of answers to questions about important information presented in non-illustrated expository texts, and the comprehension of cartoons, as measured by means of answers to questions about the relationships between their verbal and pictorial information. That is, more proficient readers are more able to infer meaning to texts presented in more than one code, in this study, in the verbal and pictorial codes.**

As reported in subsection 4.2.2, results from a Chi-square test for independence revealed a moderate to strong relationship between the two variables ( $\chi^2(1) = 9.4, p = .002$ ) at  $\alpha = 0.05$ , thus, confirming H2.

These results showed evidence that, as advocated by Paivio (1996), pictorial and verbal information interactively trigger each other's processing, thus helping readers to make sense of illustrated reading materials. However, this study found evidence that the depth to which pictorial information is processed seems to be constrained by the EFL reading proficiency level. Under Baddeley's (2010, 2012) conceptual framework of WM, verbal information in the phonological loop (PL) and non-verbal information in the visuospatial sketchpad (VSPP) do not compete for the same source of cognitive resources, that is, for the common total amount of activation available for their real time storage and processing. Since each of the aforementioned subsystems is assumed to store and process distinct types of memory traces with resources from their exclusive supplies, it is possible to contend that high consuming of cognitive resources to execute low level reading processes in the PL, as a function of low proficiency, does not necessarily decrease the total

amount of activation available to the execution of the functions inherent to the VSPP. In that case, less proficient readers, even consuming more resources from the total amount of activation available in the PL to make sense of verbal information, would not compromise the total amount of activation available in the VSSP. Nevertheless, it seems plausible to assert that a possible overload imposed by low EFL reading proficiency in the PL may ‘hamper the efficiency’ of processes operated by the VSSP. That is, the extent to which pictorial information is processed by the VSPP may be restricted by the depth verbal information is processed in the PL. Thus, individual differences in terms of pictorial information processing, such as those observed in the participants’ answers to the reading comprehension task of this study, may be considered predictors of individual differences in terms of EFL reading proficiency.

#### 4.4.3 Hypothesis 3 - General discussion

Hypothesis 3 was elaborated on the basis of the second independent variable of this study, WMC, and its dependent variable, EFL reading comprehension, and proposed a positive relationship between them:

**H3: There is a positive relationship between WMC, as measured by means of the Reading Span Test, and the comprehension of cartoons, as measured by means of answers to questions about the relationships between their verbal and pictorial information. That is, higher spans are more able to infer meanings from texts presented in more than one code, in this study, in the verbal and pictorial codes.**

As reported in subsection 4.2.3, results from a Chi-square test for independence revealed a weak to moderate relationship between the two variables ( $\chi^2(1) = 4.57, p = .033$ ) at  $\alpha = 0.05$ , partially confirming H3.

As already proposed in the discussion of H3, found in section 4.3.3, previous schematic knowledge possibly compensated for limitations WM imposed to participants in the processing of pictorial information. Logie (1996) somehow endorses this rationale by defining WM as a “capacity-constrained system acting as a workspace for information processing and temporary storage, but whose operation can be supplemented by contributions from LTM” (p.39). In other words, very familiar visual patterns possibly facilitated comprehension and processing could be managed within the total amount of activation available in the VSSP. Considering that, even lower spans, who could count on the activation of previous knowledge from LTM, were able to execute the task and

benefited from the processing of the illustration to generate inferences and improve reading comprehension. If that is the case, it is possible to assert that background knowledge compensates for WMC limitations in the processing of pictorial information.

Having all the previous discussions taken into account, it is possible to say that this study, within the advantages and deficiencies of its own design, had its 3 hypotheses confirmed. In addition, statistical tests showed that each of them presented distinct levels of significance, showing clearer evidence in favor of a positive relationship between the processing of verbal and pictorial information and EFL reading proficiency. Nevertheless, the same was not so clearcut in relation to WMC, possibly for the reasons already proposed in the discussion of H3, found in subsection 4.3.3.

In light of the results and discussion proposed in this chapter, some final considerations, acknowledged limitations, suggestions for further research and pedagogical implications will follow.

## **5 FINAL REMARKS, LIMITATIONS OF THE STUDY, SUGGESTIONS FOR FURTHER RESEARCH AND PEDAGOGICAL IMPLICATIONS**

This chapter presents closing considerations on the study, whose results, due to its nature, are to be taken as suggestive rather than conclusive. Having that in mind, it also suggests ideas for further research on some aspects which were not predicted in its initial design, but that were noticed during its conduction. Furthermore, it presents some pedagogical implications since all conclusions were taken on the basis of data gathered from a sample of Brazilian high school students.

### **5.1 FINAL REMARKS**

The main goal of this study was to investigate whether high school students who differed in a measure of EFL reading proficiency and in a measure of WMC would show corresponding differences in their ability to infer meaning from cartoons.

In order to achieve the main goal, the study initially tried to accomplish the following specific objectives: (a) to measure EFL reading proficiency of participants by means of answers to questions about relevant information in expository non-illustrated texts; (b) to measure WMC level of participants by means of the Reading Span Test (RST); (c) to measure EFL reading comprehension of participants by means of questions about the main ideas of a cartoon; (d) to examine the correlation between the measurements described in specific objectives 'a' and 'b'; (e) to analyse the relationships between the measurements described in specific objectives 'a' and 'c', as well as in specific objectives 'b' and 'c'.

The method used to meet the above mentioned purposes included the following tools of data collection, previously tested in the pilot study: (a) the EFL background questionnaire, whose answers revealed the participants' involvement with activities that could influence the development of their EFL reading skills; (b) the reading proficiency test, used to obtain EFL reading proficiency measures; (c) the RST, used to obtain WM span measures; (d) the reading comprehension task, used to obtain reading comprehension measures; and (e) a retrospective questionnaire, used to analyze participants' monitoring on their own reading process.

It was assumed that data gathered by means of these tools would confirm the hypotheses readdressed in section 4.4, showing evidence of a correlation between WM span measures and EFL reading proficiency

measures. In addition, it was assumed that data would reveal a positive relationship between these measures, and the inferential comprehension of cartoons.

With the aim at achieving all the above mentioned goals, and checking the hypotheses raised, data was predominantly interpreted on the basis of a quantitative analysis. Nevertheless, an initial qualitative overview on the participants' answers on the EFL background questionnaire and on the measures obtained by means of the EFL reading proficiency test and the RST was used to get a better portrait the sample investigated.

With regard to this qualitative overview, data somehow narrowed the findings of this study since it revealed that the sample investigated was composed of high school students who, in its great majority, reported low commitment to their studies. However, such a narrowing has not necessarily weaken its representativeness, but quite the opposite, by revealing issues related to the scenario of Brazilian public schools, has evidenced relevant aspects of a large population which is worth being focused on future studies.

In relation to the quantitative analysis, results from a Spearman's rho test and Chi-square tests for Independence, overall, confirmed the three hypotheses raised, showing evidence that:

**WMC limitations impose constraints to the processing of expository texts.** As reported in subsections 4.2.1 and 4.4.1, a Spearman's rho test revealed a weak, but still statistically significant correlation ( $r_s(58) = .321, p = .012$ , two tailed) between the two independent dependent variables of the study (WMC and EFL Reading Proficiency) at  $\alpha = 0.05$ , revealing that readers who obtained higher WM span measures were those who obtained higher EFL reading proficiency measures. Participants' answers to questions about an expository non-illustrated text, suggested that higher spans were more able to answer both, textually explicit questions (TEQ) and textually implicit questions (TIQ) (Pearson & Johnson, 1978). As opposed to what happens in relation to the answering of the first type of question, readers are not cued by textual elements when answering the latter. In that case, they depend on the generation of connective inferences to do so. Given that, it is possible to contend that in order to answer TIQ readers need to count on sufficient cognitive resources to simultaneously maintain text-based information while processing their subtle relationships. Contention which is consistent

with the results of this study in which higher spans were in fact more able to execute such a task.

**Pictorial information processing is constrained by limitations in terms of EFL reading proficiency.** As reported in subsections 4.2.2 and 4.4.2, a two way group-independence Chi-square test revealed a statistically significant relationship ( $\chi^2(1) = 9.4, p = .002$ ) between EFL reading proficiency (independent variable), and EFL reading comprehension (dependent variable), revealing that readers who obtained higher EFL reading proficiency measures were, in great majority, those who reported a predominant inferential comprehension of the cartoon. In addition, such a relationship was found to be moderate to strong at  $\alpha = 0.05$ , given the observed effect size ( $w = .39$ ). As explained in the procedures for data analysis, section 3.5, participants' answers to this task were categorically distributed as literal and inferential comprehension. This criterion was adopted from Alptekin and Erçetin (2009), who contend that "reading comprehension as a variable, should be operationalized and measured in terms of its principal components of literal and inferential comprehension rather than being treated as a holistic entity" (p. 635). By following this criterion, it was possible to observe that indeed, more proficient readers were those who were more able to successfully infer meanings from the cartoon used in the task.

**Background knowledge compensates for WMC limitations in the processing of pictorial information.** As reported in subsections 4.2.3 and 4.4.3, a two way group-independence Chi-square test revealed a statistically significant relationship ( $\chi^2(1) = 4.57, p = .033$ ), between WMC (independent variable), and EFL reading comprehension (dependent variable) at  $\alpha = 0.05$ , revealing that readers who obtained higher WM span measures were, in great majority, those who reported a predominant inferential comprehension of the cartoon. However, the strength of this relationship was found to be not more than weak to moderate, given the observed effect size ( $w = .27$ ).

Overall these conclusions speak in favor of H1, showing evidence of a correlation between WMC capacity, as measured by means of the RST, and EFL reading proficiency, as measured by means of answers to questions about important information in expository non-illustrated texts. Furthermore, these conclusions also seem to sustain hypotheses 2 and 3 that assumed a positive relationship between EFL reading proficiency, WMC and the inferential comprehension of cartoons. Taking into special consideration the weak correlation observed in the testing of H1 and the

weak to moderate relationship observed in the testing of H3, it is acknowledged that future studies might find results that may diverge from the results presented in this study. Therefore, it would be interesting if these studies turned their attention to the influence of preexisting vocabulary knowledge in the RST outputs, so that it could be evaluated if adaptations on its design are in fact necessary depending on the sample investigated, as proposed by this study. Furthermore, investigations on the effects of complexity in the processing of visual patterns depicted by pictorial information are also encouraged, since this was an aspect that could not be elucidated by this study due to limitations of its design

## 5.2 LIMITATIONS OF THE STUDY AND SUGGESTIONS FOR FURTHER RESEARCH

Despite a series of steps designed on the basis of procedures already taken in previous studies in the field, this study had its own limitations. These limitations were related to three main aspects: (a) procedures for data collection; (b) procedures for data analysis; and (c) criteria used for the selection of the reading material. A discussion on these three main aspects will follow:

**Procedures for data collection.** As previously argued in subsections 4.1.3 and 4.3.1, both found in the chapter Results and Discussion, structural conditions may have disrupted the RST outputs. Even with all my efforts, it was not possible to provide an adequate classroom for data collection where interferences common to school environments could be avoided. In future studies involving the collection of WM span measures from students during regular school time, it is advisable to ensure the allocation of classrooms that may satisfy the requirements of the test used, mainly with respect to silence. Besides, the RST itself showed to be somehow deficient for the specific sample of this study. As already mentioned, the outputs of the test suggested that limitations in terms of preexisting vocabulary knowledge may have hampered participants' performance. As demonstrated by the study of Hambrick and Engle (2002), preexisting knowledge tends to compensate for the difficulties higher spans present in demanding cognitive tasks. Thus, in the case of the RST, participants who counted on more cognitive resources to maintain information in an activated state in WM, while retrieving preexisting vocabulary knowledge from LTM, would possibly obtain higher scores. However, since the test presented them with too many unknown words, it may be that even counting on more cognitive



resources, these participants could not obtain higher scores since they were using much of their WMC to execute low level reading processes. In sum, the Brazilian version of the RST (Tomitch, 2003) originally developed to obtain WM span measures from undergraduate students possibly did not present an optimal level for the sample of this specific study. Thus, further research on EFL reading that intend to involve quantitative analyses of WM span measures could investigate to which extent preexisting vocabulary knowledge may affect the outputs of the RST, before submitting them to statistical tests.

**Procedures for data analysis.** As fully described in the procedures for data analysis, found in section 3.5, H2 and H3 were tested by means of Chi-square for independence tests, considering that each of these hypotheses involved two categorical variables (Larson-Hall, 2010). However, the categorization of the reading comprehension measures as literal comprehension and inferential comprehension somehow prevented a more ample analysis on the relationships between EFL reading proficiency, WMC and types of cognitive reading processes participants were engaged in while reading. Linderholm and van den Broek (2002), on a study within this realm, for instance, found that lower and higher spans differ in their adjusting of reading processes and strategies as a function of reading purpose. Likewise, Gerber and Tomitch (2008) corroborated these findings, by identifying that individuals' distinct reading purposes also influence the amount and types of inferences generated in the reading of expository and narrative texts.

Even though effects of different reading purposes in inference making were not within the investigations of this study, taxonomies for reading processes, strategies and inferences such as those developed by van den Broek et al. (2001) and Narvaez et al. (1999), would permit a deeper analysis on what specific types of cognitive processes participants from this study were actually engaged in.

And indeed, in two examples, just to mention some, it was possible to identify differences in terms of type and depth of inferences participants reported after reading the cartoon used in the reading comprehension task. Participant 45 (P45), for instance, reported the following inference, after reading the cartoon: (...) *hoje em dia todo mundo quer se expor na internet, toda hora falando sobre sua vida*. Since P45, influenced by information from text, reported information from previous experiences to compare the text with something s/he probably observes in his/her everyday life, it is possible to say that she made what both, Narvaez et al. (1999) and van den Broek et al. (2001) categorize as

*association*. Still based on these taxonomies, it was possible to more carefully analyze an inference reported by Participant 6 (P6): *Que os telefones de hoje em dia ocupam muito o tempo do ser humano*. In this case, it was possible to observe that, even shallowly, P6 reported an *elaborative inference*, as categorized by van den Broek et al. (2001), or an *explanative inference*, as categorized by Narvaez et al. (1999), since s/he not only tried to simply make a mere association with life events, but tried to summarize the cartoons' main idea by activating previous knowledge about the actual abusive use of cell phones people make everywhere and every time!

Considering all the above, it may be that in the case of this study, there was an oversimplification in the categorical distribution of the reading comprehension measures. That is, procedures adopted to satisfy the assumptions of the statistical test chosen to examine H2 and H3 possibly blurred relevant information with regard to the types and depth of inferences reported by the participants. Thus, further research on the inference making process involved in the reading comprehension of more elaborate illustrated texts, such as cartoons, is also suggested.

**Criteria used for the selection of the reading material.** As soon as the purposes of the study were defined, four main criteria were adopted for selecting the type of illustrated reading material that would be used in the reading comprehension task: (a) the text should present linguistic aspects already studied by the participants; (b) pictorial information should be clear in terms of visual patterns in order to allow processing; (c) better comprehension of the text should be a function of inference making; and (d) inference making should be a function of verbal and pictorial information parallel processing. In order to meet these criteria, a wide search on the Web was performed and after various analyses, it was decided for the use of cartoons, for the reasons already presented in section 1.1, where the preliminaries of the study were presented. Having decided that, another wide search over websites was conducted, and finally, the cartoon created by Gary Markenstein in 2011, *Cellphones may Cause Cancer* posted in the “English Blog” retrieved from <http://jeffreyhill.typepad.com/english/2011/06/cartoon-cell-phones-may-cause-cancer.html#>. VUOBhiFViko, was chosen. However, despite all the attempts to meet the four criteria previously defined, the study somehow failed at not considering illustrated reading materials already published in EFL textbooks currently used in Brazil. That is mainly because even though EFL teachers are free to make use of any type of supplemental texts they consider effective for the development of their students'

reading skills, such as the cartoons used in the body of this master's thesis, it is undeniable that EFL textbooks, in the case of Brazilian public schools, are one of the main sources of reading materials currently used in EFL teaching. Thus, considering that since the beginning it was assumed that this study aimed at contributing to the development of reading instructions and materials that would eventually help EFL teachers improve their pedagogical practices, it would be essential to consider what in fact "is to be developed". Thus, further studies that present similar pedagogical interests should consider illustrated reading materials published in currently used EFL textbooks, so that investigations could adequately address their purposes to address real deficiencies eventually found.

### 5.3 PEDAGOGICAL IMPLICATIONS

As for pedagogical implications there are three main aspects to be reported: (a) the first, with respect to the average low reading proficiency scores obtained by the participants of this study; (b) the second, to the observed influence of EFL reading proficiency in the processing of pictorial information; and (c), to teachers' beliefs in relation to the role of pictorial information in EFL reading and in learning in general.

**Low reading proficiency scores.** The low commitment to studying English overtime to the hours of regular classes, as reported by the participants of this study, is continuously being mentioned in the body of this master's thesis. The explanation for this regular mentioning is found on the statistically significant results obtained in the testing of H2, in which it was found a moderate to strong relationship between EFL reading proficiency and the comprehension of cartoons at  $\alpha = .05$ . Cognitively speaking, this low commitment may have quite alarming pedagogical implications, if we consider Baddeley's (1999) general assumption that long-term memory (LTM) is a separate cognitive system (as cited in Miyake & Shah, 1999) that consists of crystallized knowledge (Baddeley, 2012) whose construction undeniably depends on one's continuous processing of external stimuli. Once participants literally admitted such a low commitment, it may be that relevant information from contents taught at school are merely being turned into weak and temporary traces whose fleeting duration prevents their successful transfer to LTM ( Craik & Lockhart, 1972). That is, instead of progressively turning those memory traces into crystallized semantic structures to be retrieved when needed, the great majority of participants

of this study may be submitting the stimuli they receive, to very low levels of processing, thus, losing information which is possibly just kept for short periods of time in short-term memory (STM). In an attempt to adjoin Baddeley's (2009; 2012) and Craik and Lockhart's (1972) assumptions, it is possible to speculate that one of the factors that might be preventing participants of this study to improve their performances in terms of EFL reading comprehension, as suggested by the scores they obtained in the EFL reading proficiency test, is the lack of transfer of information from STM to LTM. Taking these cognitive aspects into account, the sample investigated in this study showed evidence to be in need of pedagogical and family assistance. Furthermore, political representatives should be aware of eventual deficiencies of the Brazilian public educational system that might underlie some of the causing-factors of that.

**Low EFL reading proficiency and the processing of pictorial information.** A comparison between data gathered from Participant 7 (P7) and Participant 12 (P12), just to mention some, seem to reveal another relevant pedagogical implication, being this, with respect to the effects of EFL reading proficiency in the processing of pictorial information. Participant 7, who scored 5 in terms of proficiency, being considered a more proficient reader in this study, reported the following answer with regard to the cartoon's main idea: *Está informando que as pessoas dão muito valor para o fato de que o celular possa[sic]causar câncer, mas não se preocupam com os acidentes que ele possa[sic]causar.* Besides, when answering the retrospective questionnaire, P7 reported that *yes*, the illustration indeed helped him/her to fully comprehend the text: *Por que a ilustração mostra uma situação que é irônica no texto.* Thus, besides providing evidence that the level of proficiency seemed to have allowed P7 to achieve a predominant inferential comprehension of the cartoon, s/he also showed to be aware of the role of the illustration in the process of meaning construction. As opposed to that, P12, who scored 1 in terms of proficiency, being considered a low proficient reader in this study, reported the following with regard to the cartoon's main idea: *Eles estavam informando aos amigos de [sic]que a estrada estava quebrada.* In addition, P12 interestingly also reported being able to identify the role of the illustration in the text: *por quê[sic]com o desenho pude ver o que o texto estava expressando.* Data from P7 is one example from the 36,7% of the sample who simultaneously obtained high EFL reading proficiency scores and achieved a predominant inferential comprehension in the task involving the cartoon, while P12, one example from the 31,7% of the sample who

obtained low EFL reading proficiency scores and reported a predominant shallow comprehension in the same task. In sum, data from P12 showed that his/her knowing on role of the illustration in the text was definitely constrained by hi/her low level of EFL reading proficiency, being consistent with Gagné's et al. (1993), in that automated basic reading skills consist one essential element of expertise involved in successful reading comprehension. Much probably, P12's mere literal description of the cartoon's illustration was the maximum s/he could report with regard to the cartoon's main idea because subprocesses involved in decoding (matching and recoding) were not fully automated in that occasion. And in fact, before seeing the full version of the cartoon, P12 reported the following with regard to his/her comprehension on the verbal information: *No meu celular tenho[sic] que enviar mensagem de perigo aos meus amigos: [sic]isso que eu entendi*". This answer clearly reflects P12's difficulties to access a minimum inferential comprehension of the cartoon since everything s/he could report was a sequence of terms constructed on the basis of the vocabulary list participants were provided with. Thus, one of the pedagogical implications implied by the above is that if EFL reading proficiency imposes limits to the depth pictorial information is processed, it may be that not all students will equally benefit from illustrations while reading, as one might expect. Therefore, EFL teachers have to be attentive to those illustrated reading materials whose inferential comprehension is dependent on the parallel processing of verbal and pictorial information, in order to detect which students might be in need of assistance to actually benefit from them.

**Teacher's beliefs on the role of illustrations in reading and learning.** The third and last pedagogical implication of this study was built on the basis of my own prior knowledge constructed in the last fifteen years in which I have been involved with EFL teaching in public schools. My experience has shown that teachers (including me), are many times too influenced by empirical knowledge that is built on the basis of ready-made concepts uncritically adopted and believed to be the ultimate truth in terms of teaching and learning. In the case of this study, influences of empirical knowledge on the functions of illustrations in EFL reading comprehension, as well as in learning in general, seems to be the central issue. To start this discussion, let us consider Tomitch and Tumolo's (2011) definition on empirical knowledge:

It is superficial in that it is satisfied with the appearance, that is, does not require deep

analyses; it is sensitive because it refers to what we experience in everyday life; it is subjective because it is organized by the subjects themselves; it is unsystematic by the fact that, although there is an organization of experiences accumulated by the subject, this organization does not aim at a systematization of ideas; and it is uncritical since, in most cases, there is no critical reflection on the veracity of this knowledge (p. 31, my translation).

Tomitch and Tumolo do not disregard the importance of empirical knowledge, but by providing such a complete definition, they point out to the existence of different types of knowledge, such as theological, philosophical, artistic, scientific, (see Tomitch & Tumolo, 2011, for a more detailed review). Having that in mind, we, teachers, have to turn our attention to the extent our practices are exclusively conducted and influenced by the limitations of empirical knowledge. That is, as teachers, we have to be in constant search of scientific evidence for each piece of information empirically constructed, so that it can be accepted, disregarded or adapted, otherwise prejudices, stereotypes and shallow concepts may drive the direction of our pedagogical practices.

With respect to this specific study, it was argued that not all types of illustrations serve as mere embellishments used to catch the readers' eye *in the beginning* of the reading event. As opposed to that, depending on the depth of their relationships with the verbal information, illustrations have to be kept in processing *from the beginning to the end of this event*. If teachers, influenced by empirical knowledge, are induced to put into question the usefulness of pictorial information in the reading process, as I have been observing in some of my professional and academic experiences, it may be that the effects of students' individual differences in terms of WMC and EFL reading proficiency in the processing of illustrated texts will be simply unnoticed and students, cognitively speaking, considered all equal. Thus, even though schools do not make use of WMC tests or EFL reading proficiency tests to obtain a more detailed portrait of the students they are responsible for, it is paramount to provide with monitoring and the necessary support, all those who present difficulties in terms of reading comprehension so that they can possibly overcome their difficulties. By doing that, students such as Participant 1 (P1) who obtained a low EFL reading proficiency score

(2,0), a low WM span measure (2,0), and who reported the following with regard to the cartoon's main idea: *Ele quer dizer que temos que avisar os amigos que os celulares podem causar câncer*, will no longer have their difficulties unnoticed due to lack of scientific knowledge on the cognitive aspects involved in reading. By the way, this is a matter of commitment and love for all those who depend on our help, as educators, to become better as students, citizens and human beings.

Just to sum it up, this study has provided statistically significant measures in favor of a correlation between the two independent variables of the study, WMC and EFL reading proficiency. Also, it has provided significant measures in favor of positive relationships between the two aforementioned independent variables and the dependent variable of the study, EFL reading comprehension of illustrated texts (cartoons). Considering that, it seems that all pedagogical implications pointed out in this section, as well as others that I probably did not notice, are worth being acknowledged by all those involved in the educational development of students from Brazilian public schools.





## REFERENCES

- Alptekin, C., & Erçetin, G. (2009). *Assessing the relationship of working memory to L2 reading: Does the nature of comprehension process and reading span task make a difference?* *System*, 37, 627–639
- Annual Reviews (2012) (Producer). Copyright 2012 Annual Review of Psychology. A Lecture in Psychology: Working Memory: Theories, Models, and Controversies by Alan Baddeley. Retr. from <https://www.youtube.com/watch?v=yL2ul2bR0Ok>.
- Baddeley, A. D., & Hitch, G. (1974). Working memory. In G.H. Bower (Ed.), *The psychology of learning and motivation: Advances in research and theory* (Vol. 8, pp. 47–89). New York: Academic Press.
- Baddeley, A.D. & Logie, R.H. (1999). The multiple-component model. In Akira Miyake & Priti Shah (Eds.), *Models of working memory: Mechanisms of active maintenance and executive control*. New York, NY: Cambridge University Press, pp. 28-61.
- Baddeley, A. D. (2000). The episodic buffer: A new component of working memory? *Trends in Cognitive Sciences*, 4, (11): 417-423.
- Baddeley, A. D. (2003). Working memory: Looking back and looking forward. *Nature Reviews: Neuroscience*, 4, 829–839.
- Baddeley, A. D. (2010). Working memory. *Current Biology*, 20(4), 136-140
- Baddeley, A. D. (2012). Working Memory: Theories, Models, and Controversies. *Annual Review of Psychology*. Vol. 63: 1-29 (Volume publication date January 2012) First published online as a Review in Advance on September 27, 2011  
DOI: 10.1146/annurev-psych-120710-100422
- Bailer, C. (2011). *Working memory capacity and attention to form and meaning in EFL reading* (Master's Thesis). Retrieved from <https://repositorio.ufsc.br/>.

- Bailer C., Tomitch L.M.B. & D'Ely R. C. (2013). Working memory capacity and attention to form and meaning. *Letras de Hoje*, 48(1), 139-147.
- Buchweitz, A. (2008). A Aplicação de um modelo para a compreensão na leitura em primeira e segunda línguas. In: Lêda Maria Braga Tomitch. (Org.). *Aspectos cognitivos e instrucionais da leitura*. 1 ed. Bauru, 2008, v. 1, p. 73-98.
- Carney, Russel N. & Levin, Joel R. (2002). Pictorial illustrations Still Improve Students' Learning From Text. *Educational Psychology Review*, 14 (1), Pages 5-26.
- Carrell, P. L., Devine, J., & Eskey, D. (Eds.). (1998). *Interactive Approaches to Second Language Reading*. Cambridge: Cambridge University Press. Ch. 5.
- Carretti, B., Cornoldi, C., De Beni, R. & Romanò, M. (2005). Updating in working memory: A comparison of good and poor comprehenders. *Journal of Experimental Child Psychology*, 91, 45-66.
- Craik, F.I.M., & Lockhart, R.S. (1972). Levels of processing. A framework for memory research. *Journal of Verbal Learning and Verbal Behaviour*, 11, 671-684.
- Costa, M. B.(2010) *Globetrekker: inglês para o ensino médio*. São Paulo: Macmillan.
- Cowan, N. (1999). *An embedded-processes model of working memory*. In Akira Miyake & Priti Shah (Eds.), *Models of working memory: Mechanisms of active maintenance and executive control*. New York, NY: Cambridge University Press, pp. 62-10.
- Daneman, M., & Carpenter, P. A. (1980). Individual differences in working memory and reading. *Journal of Verbal Learning and Verbal Behavior*, 19(4), 450-466.
- Davies, F. (1995). *Introducing reading*. London: Penguin.

- Fang, Z. (1996). *Illustrations, Text, and the Child Reader: What are Pictures in Children's Storybooks for?* Reading Horizons. Volume 37, (2).
- Field, A. (2009). *Descobrendo a ESTATÍSTICA usando o SPSS*. Porto Alegre RS. Artmed Editora.
- Fontanini, I., & Tomitch, L.M.B. "Working Memory Capacity and L2 University Students: Comprehension of Linear Texts and Hypertexts." *International Journal of English Studies* 9.2 (2009): 1-18. DOI 10.3758/s13423-013-0565-2.
- Friedman, N. P., & Miyake, A. (2004). The relations among inhibition and interference control functions: A latent-variable analysis. *Journal of Experimental Psychology: General*, 133, 101-135
- Gagné, E., Yekovich, C. & Yekovich, F. R. (1993). *The cognitive psychology of school learning*. New York: Harper Collins. College Publishers.
- Gerber, R. M., & Tomitch, L. M. B. Leitura e cognição: propósitos de leitura diferentes influem na geração de inferências? *Revista Acta Scieniarum*, Maringá: v.30, n.2, p.139-147, 2008. DOI: 10.4025/actascilangcult.v30i2.6001
- Gernsbacher, M.A. (1997). Two decades of structure building. *Discourse Processes*, 23, 265-304.
- Gyselinck, V., & Tardieu, H. (1999). The role of illustrations in text comprehension: What, when, for whom, and why? In van Oostendorp, H., and Goldman, S. R. (eds.), *The Construction of Mental Operations During Reading*, Erlbaum, Mahwah, NJ.
- Halliday, M. & R. Hasan. (1976). *Cohesion in English*. London: Longman.
- Heitz, R.P., Unsworth, N. & Engle, R.W.(2005). Working memory capacity, attention control, and fluid intelligence. In Oliver Wilhelm & Randall W. Engle (Eds.), *Handbook of understanding and measuring intelligence*. Sage Publications, Inc.

- Hambrick, D. Z., & Engle, R. W. (2002). Effects of Domain Knowledge, Working Memory Capacity, and Age on Cognitive Performance: An investigation of the Knowledge-Is-Power Hypothesis. *Cognitive Psychology*, 44, 339-387.
- Just, M.A. & Carpenter, P.A. (1992). A capacity theory of comprehension: Individual differences in working memory. *Psychological Review*, 99(1), 122-149.
- Itri B., Maisonavve F., Rizzo M. & Rangel S. (2014). Davi Luiz: I only wanted to see people smiling. Folha de São Paulo Digital, from the website:  
<http://www1.folha.uol.com.br/internacional/en/sports/worldcup/2014/07/1483313-david-luiz-i-only-wanted-to-see-people-smiling.shtml>
- Larson-Hall J. (2010). *A guide to doing statistics in second language research using SPSS*. New York, NY: Routledge .
- Levie W. H. & Lentz R. (1982) Effects of Text Illustrations: A Review of Research. *Educational Communication and Technology*, 30 (4), 195-232. Springer.
- Levin, J. R. (1981). Pictures as prose-learning devices. In A. Flammer & W. Kintsch (Eds.), *Discourse processing* (pp. 412- 444). Amsterdam: North-Holland.
- Linck, J.A., P. Osthus, J.T. Koeth & M.F. Bunting, (2013). Working memory and second language comprehension and production: A meta-analysis. *Psychonomic Bulletin & Review*: 1-23.
- Linderholm, T., & van den Broek, P. (2002). The effects of reading purpose and working memory capacity on the processing of expository text. *Journal of Educational Psychology*, Vol 94(4), 778-784. <http://dx.doi.org/10.1037/0022-0663.94.4.778>
- Liu, J. (2004). Effects of comic strips on L2 learners' reading comprehension. *TESOL Quarterly*, 38(2), 225-243.
- Logie RH (1995) *Visual-spatial working memory*. Hove, UK: Erlbaum.
- Logie, R.H. (1996). The seven ages of working memory. In J.

- Richardson, R. Engle, L. Hasher, R. Logie, E. Stoltzfus & R. Zacks (Eds.), *Working memory and human cognition*. New York: Oxford University Press.
- Mayer, R.E., & Anderson, B. (1991). Animations Need Narrations: An Experimental Test of a Dual-coding Hypothesis. *Journal of Educational Psychology*, 83(4), 484-490. DOI 10.1037/0022-0663.83.4.484.
- Mayer, R. E., & Gallini, J. K. (1990). When is an illustration worth ten thousand words? *Journal of Educational Psychology*, 82, 715-726
- Mayer, R.E., Bove, W., Bryman, A., Mars, R., & Tapangco, L. (1996). When less is more: Meaningful learning from visual and verbal summaries of science textbook lessons. *Journal of Educational Psychology*, 88, 64-73
- Miyake, A. & Shah, P. (1999). (Eds.) *Models of working memory: Mechanisms of active maintenance and executive control* (pp. 442-481). New York: Cambridge University Press.
- Narvaez, D., van den Broek, P. & Ruiz, A.B. The influence of reading purpose on inference generation and comprehension in reading. *Journal of Educational Psychology*, Arlington, 91, n.3, p.488-496, 1999.
- Pagliosa, E.L.B. (2005). *HUMOR: um estudo sociolingüístico cognitivo da charge*. Edipucrs. Rio Grande do Sul. Brasil.
- Paivio, A. (1990). *Mental Representations: A Dual Coding Approach*. New York; Oxford University Press.
- Paivio, A. (2006). *Dual coding theory and education*. Draft chapter for the conference on “Pathways to Literacy Achievement for High Poverty Children,” The University of Michigan School of Education, September 29-October 1.
- Pan, Y., & Pan, Y. (2009). The effect of pictures on the reading comprehension of low-proficiency Taiwanese English foreign language college students: An action research study. *VUN. Journal of Science, Foreign Language*, 25, 186-198.

- Pearson, P.D.; Johnson, D.D. (1978) *Teaching reading comprehension*. New York: Holt, Rinehart and Winston.
- Postle, B.R. (2006)- WM as an emergent property of the mind. *Neuroscience*, 139, 23– 38.
- Rumelhart D.E & McClelland J.L. (1981). Interactive processing through spreading activation, in C. Perfetti & A. Lesgold (Eds.), *Interactive processes in reading*, Hillsdale NJ: Erlbaum.
- Rumelhart, D. E. (1984). Understanding understanding. In J.. Flood (Ed.), *Understanding reading comprehension*: Newark, DE: International Reading Association.
- Sadoski, M. & Paivio, A. (2004). A dual coding theoretical model of reading. In R. B. Ruddell & N. J. Unrau (Eds.), *Theoretical models and processes of reading (5th ed.)* (pp. 1329-1362). Newark, DE: International Reading Association.
- Sanchez, C.A. & Wiley, J. (2006). An examination of the seductive details effect in terms of working memory Capacity. *Memory & Cognition*, 34(2), 344-355.
- Schallert, D. L. (1980). The role of illustrations in reading comprehension. In Spiro, R. J., Bruce, B. C., and Brewer, W. F. (eds.), *Theoretical Issues in Reading Comprehension: Perspectives from Cognitive Psychology, Linguistics, Artificial Intelligence, and Education*, Erlbaum, Hillsdale, NJ, pp. 503–524
- Tomitch, L. M. B. (2000). Designing reading tasks to foster critical thinking. *Revista Ilha do Desterro*, 38, 83-90.
- Tomitch, L.M.B. (2003). *Reading: text organization perception and working memory capacity*. Florianópolis, SC: PGI/UFSC, ARES - Advanced Research in English Series.
- Tomitch, L.M.B. & Tumolo C. H. S. (2011). *Pesquisa em Letras Estrangeiras* . UFSC/CCE/LLE.

- Tomitch, L. M. B. (2012). *7º período : Produção Textual Acadêmica*. Florianópolis: UFSC/CCE/LLE.
- Tomitch, L.M.B. (2014) *Memorial de Atividades Acadêmicas*. Memorial apresentado ao Departamento de Língua e Literatura Estrangeiras da Universidade Federal de Santa Catarina como requisito parcial para inscrição ao Concurso de Professor Titular da Carreira do Magistério Superior.
- van den Broek, P., Lorch, R. F., Jr., Linderholm, T., & Gustafson, M. (2001). The effects of readers' goals on the generation of inferences. *Memory & Cognition*, 29, 1081–1087.
- Van Oostendorp, H. & Bonebakker, C. (1999). Difficulties in updating mental representations during reading news reports. In H. Van Oostendorp & S.R. Goldman (Eds.), *The construction of mental representations during reading*. New Jersey, USA: LEA.
- Yuan et al (2006). Working memory, fluid intelligence and science learning. *Educational research review*, 1, 83-98.

## APPENDICES

### Appendix A – Participants’ report cards (Sample)



**UNIVERSIDADE FEDERAL DE SANTA CATARINA  
PROGRAMA DE PÓS-GRADUAÇÃO EM INGLÊS:  
ESTUDOS LINGÜÍSTICOS E LITERÁRIOS**

Florianópolis, 01/12/2015.

Pesquisa de Mestrado

**“Construindo Significados na Leitura de Cartuns:  
os efeitos da proficiência em inglês como língua estrangeira e da  
memória de trabalho no processamento de informações verbais e  
pictoriais”**

Resultados das Tarefas Realizadas

**Querido participante:**

Seguem abaixo seus resultados pessoais obtidos através da realização das 3 tarefas envolvidas na coleta de dados dessa pesquisa.

Tais informações lhe foram entregues em envelope lacrado a fim de assegurar sua confidencialidade, procedimento que procura atender as exigências da Resolução 466/12.

<b>Participante</b>	<b>Teste de Proficiência</b>	<b>Teste de Memória de Trabalho</b>	<b>Tarefa de Compreensão</b>
<b>‘X’</b>	<b>4</b>	<b>3</b>	<b>Inferencial</b>

**Interpretando os dados:**

- Teste de proficiência

Aos testes de proficiência de leitura em inglês como língua estrangeira foram atribuídos valores numéricos de 0 a 6. Quanto mais alto esse valor, maior a proficiência apresentada na ocasião do teste.

Avalie o valor numérico que você obteve e procure verificar se ele de fato reflete seu desempenho da disciplina de inglês. Caso você esteja



tendo dificuldades, procure conversar com seu professor para que vocês possam elaborar estratégias para tentar superá-las. Você é capaz, porém isso dependerá de sua ‘atitude’ e ‘força de vontade’. Vamos lá!

- Teste de Memória de Trabalho

Aos testes de memória de trabalho também foram atribuídos valores numéricos de 0 a 6. Neste caso, quanto mais alto esse valor, maior o nível da memória de trabalho apresentado na ocasião do teste.

Avalie o valor que você obteve e procure verificar se de fato ele reflete sua atual habilidade de processar diferentes informações simultaneamente com êxito. Também procure avaliar sua habilidade de manter a atenção voltada àquilo que você está estudando, ou ao que os professores estão explicando durante as aulas. Lembre-se de que o valor numérico que você obteve nesse teste não é sinônimo de sua capacidade de aprender. Ele nada mais é do que uma medida que mostra a sua atual capacidade de processar e armazenar várias informações em tempo real.

Caso perceba alguma dificuldade com relação a isso, procure conversar com seus pais, com seus professores ou mesmo com o coordenador pedagógico de sua escola. Eles poderão lhe auxiliar a buscar soluções para quaisquer dificuldades que por ventura venham a ser identificadas.

- Tarefa de Compreensão

Às tarefas de compreensão foram atribuídos dois tipos de avaliações categóricas:

(1) Compreensão Literal e (2) Compreensão Inferencial. Compreensão literal significa ‘identificação mais superficial de ideias que são visíveis no corpo do texto’. No caso dessa pesquisa, ideias que são expressas através do texto escrito, e das ilustrações. Compreensão inferencial significa ‘abstração mais profunda de ideias, que se constrói com base nas ideias que se encontram no corpo do texto, nas suas entrelinhas e no conhecimento prévio do leitor’.

É muito importante compreender os textos mais profundamente, pois nossa relação com o mundo é muitas vezes determinada por nossa habilidade de abstrair ideias que nos são apresentadas em materiais escritos. Além do mais, também nossa aprendizagem escolar é beneficiada quando os textos que estudamos são processados dessa forma.

Caso você perceba ter algum tipo de dificuldade em compreender textos escritos em língua inglesa (e mesmo os escritos em língua portuguesa), procure conversar com seus professores para que vocês possam juntos elaborar um plano de leitura e de estratégias que lhe possam auxiliar a superá-la.

- Considerações finais

Gostaria de lhe agradecer mais uma vez pela participação nessa pesquisa. Se eu consegui finalizá-la com êxito, deve-se muito a sua colaboração.

No mais, desejo que você tenha uma ótima caminhada escolar e lhe aconselho a se dedicar com muita disciplina aos estudos. Se assim o fizer, com certeza um futuro repleto de conquistas lhe será reservado! Muito obrigado.

Um abraço,

Sidnei Werner Woelfer

Appendix B – Report – Results of the study (Participants' parents/guardians)



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**“Construindo Significados na Leitura de Cartuns:  
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pictoriais”**

Resumo dos Resultados

**Senhores pais e/ou responsáveis**

Quero inicialmente agradecê-los pelo consentimento dado a seu (sua) filho (a), ou menor sob sua guarda, de participar dessa pesquisa de mestrado. Foi uma grande alegria poder retornar à Taió, minha cidade natal, e poder coletar os dados necessários para a conclusão desse estudo.

O êxito dessa pesquisa deve-se à participação desses jovens, e à colaboração das então diretoras dessa entidade, Sras. Nair Selene Alegri e Maria Sionei Farias Setter. Além disso, também se deve à calorosa receptividade das professoras de inglês, Vania Fuchter Petris e Cristiane Schmidt, que muito contribuíram para com a coleta de dados. E finalmente, à colaboração dos demais professores e funcionários da escola, que foi de fundamental importância para que todas as etapas do estudo fossem realizadas com sucesso.

Apresento, a seguir, um resumo dos resultados gerais da pesquisa, pois considero importante que os senhores sejam informados sobre dados que por ventura possam contribuir para com a formação educacional dos participantes. Procurei utilizar uma linguagem bastante informal a fim de evitar que termos técnicos específicos de minha área pudessem dificultar a compreensão das informações aqui relatadas.

### **Objetivo Geral da Pesquisa**

O objetivo geral da pesquisa foi o de analisar se a compreensão de textos ilustrados escritos em inglês (cartuns) seria influenciada pelos níveis de proficiência em leitura e de memória de trabalho<sup>5</sup> dos participantes.

### **Hipóteses**

Em linhas gerais, as hipóteses levantadas sugeriram que haveria uma correlação positiva entre os níveis de memória de trabalho e de proficiência em leitura. Também, de que a compreensão dos cartuns apresentaria uma relação positiva com tais níveis.

### **Resultados**

Os testes estatísticos confirmaram as hipóteses levantadas.

Assim:

- Participantes que apresentaram maiores níveis de memória de trabalho foram também os que apresentaram maiores níveis de proficiência;
- Participantes que apresentaram maiores níveis de memória de trabalho e de proficiência foram também os que apresentaram uma mais profunda compreensão dos textos ilustrados (cartuns) escritos em inglês.

### **Conclusões**

- De modo geral, pôde-se concluir que a compreensão de textos ilustrados mais elaborados, tais como os cartuns explorados nesse estudo, está positivamente associada aos níveis de memória de trabalho e de proficiência. Quanto maiores esses níveis, maior a compreensão de tais textos.

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<sup>5</sup> Memória de Trabalho refere-se à memória que utilizamos para processar e armazenar informações em tarefas motoras ou cognitivas realizadas em tempo real. Dirigir numa pista sinuosa num dia chuvoso ou estudar para um teste escolar são exemplos de tarefas que realizamos contando com recursos desse tipo de memória.

- Textos ilustrados são ferramentas utilizadas para o ensino dos mais diversos tipos de conteúdos, cuja compreensão depende inteiramente da habilidade de integrar e informações verbais e visuais. Assim considera-se importante que os estudantes desenvolvam tal habilidade para que possam usufruir de tais ferramentas no processo de aprendizagem.
- No caso de aprendizado de inglês como língua estrangeira, textos ilustrados mais elaborados, tais como os cartuns, podem ser usados como ferramentas para auxiliar os alunos a desenvolver a habilidade de identificar ideias mais sutis no processo de leitura. Ou seja, ideias que estão relacionadas ao texto, mas que para serem acessadas, dependem da ativação de informações relacionadas às experiências de vida do indivíduo, e também da identificação de informações que se encontram ‘ligeiramente escondidas’ nas entrelinhas do texto.
- Recomendação aos pais e/ou responsáveis:

Considerando tais resultados e conclusões, recomendo aos senhores que:

- Incentivem os estudantes, participantes dessa pesquisa à leitura de materiais (ilustrados ou não) que lhes exijam maior atenção e concentração. Materiais que despertem sua curiosidade, que os cativem, e que os conduzam a desenvolver a habilidade de fazer conexões entre aquilo que lhes é novo, e aquilo que já aprenderam em experiências anteriores. Incluem-se aqui, é claro, leituras para entretenimento, como também leituras para o enriquecimento cultural e intelectual.
- Acompanhem o desempenho desses estudantes na escola, para que junto com os docentes, suas dificuldades possam ser identificadas e superadas.

Muito obrigado: Sidnei Werner Woelfer

## Appendix C – EFL background questionnaire

Participante número: \_\_\_\_\_

Este questionário é parte da pesquisa intitulada “Construindo Significados na Leitura de Cartuns”. As informações aqui reportadas serão confidenciais.

1. Há quanto tempo você estuda inglês?
2. Quantas aulas de inglês por semana são oferecidas em sua escola no momento?
3. Quantos minutos duram essas aulas?
4. Em uma escala de 1 a 6: quanto tempo você se dedica a estudar inglês em casa?  Não estudo em casa      Dedico bastante tempo 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) 6 ( )
5. Como você classificaria seu conhecimento em língua inglesa?  Pouco conhecimento      Bastante conhecimento 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) 6 ( )
6. Você faz algum curso de inglês no momento? ( ) Sim      ( ) Não
7. Caso sua resposta para a pergunta anterior tenha sido "sim", responda: em qual nível você está neste curso?
8. Você já fez algum curso de inglês no passado? ( ) Sim      ( ) Não
9. Caso sua resposta para a pergunta anterior tenha sido "sim", responda: em qual nível você estava quando terminou/deixou o curso?

<p>10. Você tem contato com a língua inglesa em outras atividades do seu dia a dia? Por exemplo, através de filmes, seriados, músicas, games, internet, TV, rádio?</p> <p><input type="checkbox"/> Sim      <input type="checkbox"/> Não</p>
<p>11. Caso sua resposta para a pergunta anterior tenha sido "sim": quantas horas por dia (em média) você se envolve em atividades nas quais acontece esse contato com a língua inglesa?</p> <p><input type="checkbox"/> Até 1 hora      <input type="checkbox"/> Até 2 horas      <input type="checkbox"/> Mais de 2 horas</p>
<p>12. Você costuma ler charges, cartuns ou tirinhas em jornais, revistas, internet, etc, escritos em português?</p> <p><input type="checkbox"/> Sim      <input type="checkbox"/> Não</p>
<p>13. Caso sua resposta para a pergunta anterior tenha sido "sim": quantas horas por dia (em média) você se dedica a ler esse tipo de textos?</p> <p><input type="checkbox"/> Até 1 hora      <input type="checkbox"/> Até 2 horas      <input type="checkbox"/> Mais de 2 horas</p>
<p>14. Você costuma ler textos escritos em inglês além daqueles estudados na escola?</p> <p><input type="checkbox"/> Sim      <input type="checkbox"/> Não</p>
<p>15. Caso sua resposta para a pergunta anterior tenha sido "sim": que tipos de textos escritos em inglês você costuma ler?</p> <p><input type="checkbox"/> Histórias em quadrinhos;</p> <p><input type="checkbox"/> Charges, cartuns, tirinhas cômicas;</p> <p><input type="checkbox"/> Notícias de revistas e jornais impressos ou na internet;</p> <p><input type="checkbox"/> Postagens no Facebook, Instagram, Twitter, Blogs;</p> <p><input type="checkbox"/> Romances;</p> <p><input type="checkbox"/> Manuais de instrução;</p> <p><input type="checkbox"/> Artigos científicos.</p>
<p>16. Caso sua resposta para a pergunta 14 tenha sido "sim": quantas horas por dia (em média) você se dedica a ler esses textos escritos em inglês:</p> <p><input type="checkbox"/> Até 1 hora      <input type="checkbox"/> Até 2 horas      <input type="checkbox"/> Mais de 2 horas</p>

Muito obrigado pela sua atenção ☺!

Data: \_\_\_\_/\_\_\_\_/2015

## Appendix D1 – Reading proficiency test (Part I)

01. Leia o texto abaixo com atenção. Perceba que logo abaixo dele há um glossário no qual dúvidas de tradução podem ser esclarecidas.

### **“I Only Wanted to See People Smiling”**

Pain and humiliation: these were the two words mostly used by Brazilian players as they exited the changing rooms for the bus, back to Rio de Janeiro.

David Luiz, the team's defender and the captain of the Tuesday's match, July 8th, was the only player to be applauded by the crowd as he left the pitch at Estádio Mineirão. The worst thing about this defeat, he said, was letting Brazil's fans down: "I'm sorry, everyone. I apologize to all Brazilians. All I wanted was to see everyone smiling. God knows how much I wanted Brazil to be happy for the football, but the Germans were better, they prepared themselves better, they played a better game, we took four goals in six minutes”.

The Brazilian defender said that the worst thing was to cut the link with the fans established when Brazil won the 2013 Confederations Cup. "I hope the Brazilian people use the national team to fight for other things in life, not just things related to football", the defender concluded.

Suspended because of a yellow card, the defender Thiago Silva also commented the unexpected result: The pain is so strong I cannot even cry”. Thiago Silva used the word ‘humiliation’ to define the defeat to Germany.

Glossary:

- |                                |                               |
|--------------------------------|-------------------------------|
| 1. Pain: Dor                   | 13. Better: Melhor            |
| 2. Mostly: Mais                | 14. Thing: Coisa              |
| 3. As: Assim que               | 15. To cut: Cortar            |
| 4. Changing rooms: Vestiários  | 16. Link: Ligação             |
| 5. Match: Jogo                 | 17. To Establish: Estabelecer |
| 6. Crowd: Multidão             | 18. To hope: Esperar          |
| 7. Pitch: Campo                | 19. To fight: Lutar           |
| 8. Worst: O/a pior             | 20. Unexpected:               |
| 9. Defeat: Derrota             | Inesperado(a)                 |
| 10. To let down: Enrriestecer  | 21. Even: Mesmo               |
| 11. To apologize: Desculpar-se |                               |
| 12. To smile: Sorrir           |                               |



## Appendix D2 – Reading proficiency test (Part II)

Participante número: \_\_\_\_\_

Data: \_\_\_\_\_/\_\_\_\_\_/2015

01. De acordo com informações do texto:

1. Qual foi o único jogador a ser aplaudido pela multidão após a partida?

.....  
 .....  
 .....

2. Quantos gols o Brasil levou em seis minutos de jogo?.....

.....  
 .....

3. O que Thiago Silva disse a respeito da dor que sentiu após a derrota do Brasil?

.....  
 .....  
 .....

4. De acordo com o texto, por quais motivos o Brasil foi derrotado pela Alemanha?

.....  
 .....  
 .....

5. Por que confiança dos torcedores brasileiros em seu time estava tão fortalecida?

.....  
 .....  
 .....

6. Por que a seleção brasileira não pôde contar com todos os seus jogadores de defesa?

.....  
 .....  
 .....

## Appendix E1 – The Reading Span Test (RST)

Training session:

**First set (2 sentences)**

1 – Os benefícios das redes sociais corporativas são sentidos pelos profissionais de mais alto nível de **qualificação**. (16 palavras, *Exame*, 15 de abril de 2015, p.87).

2- O Brasil está se atrasando na oportunidade histórica de ter carros com zero emissão de gases **poluentes**. ( 17 palavras, *Época*, 16 de março de 2015, p. 78).

**Second set (3 sentences)**

3 – Em um futuro bem próximo, entorpecentes podem sair da ilegalidade graças ao seu potencial de curar **doenças**. (17 palavras, *Galileu*, abril de 2015, p. 34).

4 – Apesar de complexa, misteriosa e assustadora, a esquizofrenia pode ser diagnosticada com **facilidade**. ( 14 palavras, *Veja*, 11 de fevereiro de 2015, p. 76).

5 – A Floresta Negra, no sudoeste da Alemanha, abriga um dos mais improváveis destinos gastronômicos do **planeta**. ( 16 palavras, *Veja*, 8 de abril de 2015, p. 88).

**Third set (4 sentences)**

6 – Depois do primeiro gole, o álcool é absorvido pelas membranas mucosas da boca e do **esôfago**. (16 palavras, *Galileu*, abril de 2015, p.15).

7 – A ideia de que há uma infinidade de universos é tão perturbadora quanto **empolgante**. ( 14 palavras, *Super Interessante*, março de 2015, p.18)

8 – A limpeza de um rio, lago ou baía de uma grande metrópole requer tempo e **dinheiro**. (16 palavras, *Época*, 23 de março de 2015, p.70).

9 – A irregularidade do ritmo cardíaco permite que o sangue represe em alguns apêndices do **coração**. ( 15 palavras, *Saúde*, março de 2015, p.46).

### **Official test (Tomitch, 2003):**

#### **First set ( 3 subsets of 2 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).

3 – 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).

4 - As bactérias degradam as emulsões coloridas do filme, criando imagens que

podem ser definidas como **futuristas**. (16 palavras, *Superinteressante*, fevereiro de 1992, p.14).

5 - A padronização agrícola, para atender aos consumidores, ameaça a diversidade

biológica do mundo **vegetal**. (14 palavras, *Superinteressante*, julho de 1992, p.10).

6 – 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).

#### **Second set ( 3 subsets of 3 sentences)**

7 - Para realizar as atividades cerebrais do pensamento, os neurônios tiram energia do oxigênio e da **glicose**. (14 palavras, *Superinteressante*, julho de 1992, p.10).

8 – 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).

9 - Cerca de 250 milhões de pessoas, ao redor do mundo, se encontram na mais profunda **depressão**. (16 palavras, *Superinteressante*, setembro de 1992, p.57).

10 – 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).

11 – 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).

12 - Mostra a capacidade do homem em transformar coisas simples em obras de arte, através da **dedicação**. (16 palavras, *Superinteressante*, setembro de 1992, p.3).

13 - 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).

14 – 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).

15 - 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).

### **Third set ( 3 subsets of 4 sentences)**

16 - 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).

17 - 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).

18 - 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).

19 - 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).

20 - A obra custou caro demais, a utilidade é incerta e o resultado final, **polêmico**.

(14 palavras, *Veja*, 23 de setembro de 1992, p.60).

21 - 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).

22 - 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).

23 - Pesquisadores descobrem que o antílope das pradarias norte-americanas é o

mais resistentes dos mamíferos **terrestres**. (15 palavras, *Superinteressante*, julho de 1992, p.37).

24 - 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).

25 – Depois de rejeitar acordo em plebiscito, a Dinamarca quer alterar a tendência de centralismo da unificação **européia**. (17 palavras – *Folha de S. Paulo*, 23 de setembro de 1992).

26 - 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).

27 - 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).

#### **Fourth set ( 3 subsets of 5 sentences)**

28 - 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).

29 - Quando o cineasta dá rédea solta ao puro amor pelas imagens, o filme arrebatava os **sentidos**. (16 palavras, *Folha de S. Paulo*, 23 de setembro de 1992).

30 - 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).

31 - 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).

32 - 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).

33 - Elas mostraram sinais de rotas das caravanas de mercadores, que levaram os

pesquisadores à **cidade**. (15 palavras, *Superinteressante*, junho de 1992, p.10).

34 - Cartão-postal sob suspeita: radiação eletromagnética das antenas da Avenida

Paulista pode afetar a saúde **humana**. (15 palavras, *Superinteressante*, junho de 1992, versão online).

35 - 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).

36 - As fêmeas dos escorpiões só deixavam os abrigos dez vezes por ano, no **máximo**. (14 palavras, *Superinteressante*, agosto de 1992, p.8).

37 - 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).

38 - Os satélites ajudam os oceanógrafos a descobrir a temperatura da água em

diversos locais do **planeta**. (16 palavras, *Superinteressante*, agosto de 1992, p.5).

39 - Nos casos de históricos de vida sedentária, evitar esportes anaeróbicos que

exigem melhor condicionamento **físico**. (15 palavras, *VIP EXAME*, junho de 1992, p.19).

40 - Catástrofes à parte, a maior atração da viagem são a própria galáxia e seus incríveis **habitantes**. (16 palavras, *Superinteressante*, agosto de 1992, p.24).

41 - 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).

42 - A saúde instável do presidente serviu como outro elemento psicológico do ataque de nervos do **mercado**. (16 palavras, *Veja*, 23 de setembro de 1992).

### **Fifth set ( 3 subsets of 6 sentences)**

43 - É a primeira vez que o Brasil vende tênis em quantidades expressivas no **exterior**. (14 palavras, *Veja*, 23 de setembro de 1992, p.84).

44 - O resto é luz do céu, claridade que desce da lua prateando a superfície **gelada**. (15 palavras, *VIP EXAME*, junho de 1992, p.44).

45 - 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).

46 - 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).

47 - Os bosques de mangues, regados pelas marés, garantem comida farta para a fauna dos **oceanos**. (15 palavras, *Superinteressante*, maio de 1992, p.25).

48 - Hoje, quando o planeta é visto de cima pelos satélites, seus contornos não têm mais **segredo**. (16 palavras, *Superinteressante*, maio de 1992, p.34).

49 - Mesmo sem saber o índice de queda nas vendas, desvalorizou as ações da **empresa**. (14 palavras, *Veja*, 23 de setembro de 1992, p.86).



50 - Para os oitenta milhões de telespectadores brasileiros, a televisão significa lazer acessível e **barato**. (14 palavras, *Veja*, 23 de setembro de 1992, p.92).

51 - 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).

52 - O paciente precisa de ressuscitação cardiorrespiratória o mais rápido possível, feita por pessoas **treinadas**. (14 palavras, *Folha de S. Paulo*, 28 de setembro de 1992).

53 - 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).

54 - 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).

55 - 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).

56 - Grandes quantidades de sal tornam a água mais pesada ou densa, diminuindo em consequência, seu **volume**. (16 palavras, *Superinteressante*, julho de 1992, p.17).

57 - Como seres civilizados, deixamos as cavernas nas últimas glaciações, no início da Idade da Pedra **Polida**. (16 palavras, *Superinteressante*, agosto de 1992, p.73).

58 - 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).

59 – 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).

60 - Os efeitos do sal na pressão das artérias dependem de outros minerais no **organismo**. (14 palavras, *Superinteressante*, fevereiro de 1992, p.15).

## Appendix E2 – The RST – List of words to be recalled

**Training session:**

First set (2 sentences)

- 1 – qualificação
- 2 – poluentes

Second set (3 sentences)

- 3 – doenças
- 4 – facilidade
- 5 – planeta

Third set (4 sentences)

- 6 – esôfago
- 7 – empolgante
- 8 – dinheiro
- 9 – coração

**Official test (Tomitch, 2003)**

First set ( 3 subsets of 2 sentences)

- 1 – errada
- 2 – saudável

- 3 – cultos
- 4 – futuristas

- 5 – vegetal
- 6 – economia

Second set ( 3 subsets of 3 sentences)

- 7 – glicose
- 8 – empresários
- 9 – depressão

- 10 – medicamentos
- 11 – militar
- 12 – dedicação

- 13 – natureza
- 14 – laboratório
- 15 – demissões

Third set ( 3 subsets of 4 sentences)

- 16 – foguetes
- 17 – paciente
- 18 – delicado
- 19 – perfeita
- 20 – polêmico
- 21 – animais
- 22 – atraentes
- 23 – terrestres

- 24 – pesados
- 25 – européia
- 26 – favores
- 27 – qualidade

Fourth set ( 3 subsets of 5 sentences)

- 28 – editais
- 29 – sentidos
- 30 – opacas
- 31 – comerciais
- 32 – ameaça

- 33 – cidade
- 34 – humana
- 35 – política
- 36 – máximo
- 37 – artificial

- 38 – planeta
- 39 – físico
- 40 – habitantes
- 41 – cabeça
- 42 – mercado

Fifth set ( 3 subsets of 6 sentences)

- 43 – exterior
- 44 – gelada
- 45 – extinção
- 46 – industriais
- 47 – oceanos

48 – segredo  
49 – empresa  
50 – barato  
51 – dinheiro  
52 – treinadas  
53 – corrida  
54 – eleitores

55 – célula  
56 – volume  
57 – polida  
58 – vítimas  
59 – burocracia  
60 – organismo

## Appendix E3 – RST – Student's table

**Teste de Alcance de Leitura**

Participante número: \_\_\_\_\_

Data: \_\_\_\_/\_\_\_\_/2015

Alcance: \_\_\_\_\_

1		2		3	
1.		1.		1.	
2.		2.		2.	

1		2		3	
1.		1.		1.	
2.		2.		2.	
3.		3.		3.	

1		2		3	
1.		1.		1.	
2.		2.		2.	
3.		3.		3.	
4.		4.		4.	

1		2		3	
1.		1.		1.	
2.		2.		2.	
3.		3.		3.	
4.		4.		4.	
5.		5.		5.	

1		2		3	
1.		1.		1.	
2.		2.		2.	
3.		3.		3.	
4.		4.		4.	
5.		5.		5.	
6.		6.		6.	

## Appendix F1 – Reading comprehension task – (Researcher’s version)

Este exercício é parte da pesquisa intitulada “Construindo Significados na Leitura de Cartuns”. As informações aqui reportadas serão confidenciais.

Participante número: \_\_\_\_\_

Data: \_\_\_\_/\_\_\_\_/2015

### PARTE I

1. Leia o texto abaixo com atenção.
2. Assim que for autorizado, escreva tudo o que você compreendeu nas linhas ao lado.

Note que há um glossário para lhe auxiliar.

3. Aguarde autorização para desdobrar a folha.

CELL PHONES MAY  
CAUSE CANCER?  
I'VE GOT TO TEXT  
MY FRIENDS ABOUT  
THIS DANGER...

.....  
.....

- |                                    |                          |
|------------------------------------|--------------------------|
| 1. <b>May:</b> pode/podem          | 4. <b>About:</b> sobre   |
| 2. <b>I've got:</b> eu tenho que   | 5. <b>Danger:</b> perigo |
| 3. <b>To text:</b> enviar mensagem |                          |

.....

### PARTE II

1. Agora, releia o mesmo texto.
2. Aguarde autorização para novamente desdobrar a folha.



**Cellphones may Cause Cancer.** Markstein, Gary (2011). The English Blog.

<http://jeffreyhill.typepad.com/english/2011/06/c>



**PARTE III**

1. Sem consultar as faces anteriores, responda:

“Em sua opinião, o que o cartum está informando ao leitor”?

.....

.....



Appendix F2 – Reading comprehension task – (Participants’ version)

Este exercício é parte da pesquisa intitulada “Construindo Significados na Leitura de Cartuns”. As informações aqui reportadas serão confidenciais.

Participante número: \_\_\_\_\_

Data: \_\_\_\_/\_\_\_\_/2015

**PARTE I**

1. Leia o texto abaixo com atenção.
2. Assim que for autorizado, escreva tudo o que você compreendeu nas linhas ao lado.

Note que há um glossário para lhe auxiliar.

3. Aguarde autorização para desdobrar a folha.

CELL PHONES MAY  
CAUSE CANCER?  
I'VE GOT TO TEXT  
MY FRIENDS ABOUT  
THIS DANGER...

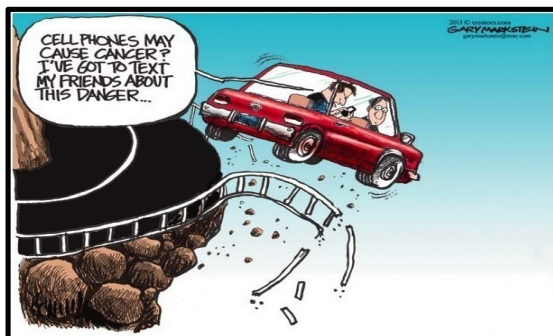
.....  
.....

- |                                    |                          |
|------------------------------------|--------------------------|
| 1. <b>May:</b> pode/podem          | 4. <b>About:</b> sobre   |
| 2. <b>I've got:</b> eu tenho que   | 5. <b>Danger:</b> perigo |
| 3. <b>To text:</b> enviar mensagem |                          |

.....

**PARTE II**

1. Agora, releia o mesmo texto.
2. Aguarde autorização para novamente desdobrar a folha.





**PARTE III**

1. Sem consultar as faces anteriores, responda:

“Em sua opinião, o que o cartum está informando ao leitor”?

.....

.....

## Appendix G – Retrospective questionnaire

Este questionário é parte da pesquisa intitulada “Construindo Significados na Leitura de Cartuns”. As informações aqui reportadas serão confidenciais.

Participante número: \_\_\_\_\_

Data: \_\_\_\_\_/\_\_\_\_\_/2015

**01. Responda as perguntas abaixo atentamente. Procure dar detalhes e se necessário faça uso de exemplos para expressar-se mais claramente.**

**1. Você conseguiu entender o texto do cartum escrito em inglês?**

Sim ( )            Não ( )

**a) Por que?**

.....  
 .....  
 .....  
 .....

**2. Em uma escala de 1 a 6, como você classificaria o grau de dificuldade do texto?**

Muito Fácil \_\_\_\_\_ Muito difícil

1 ( )    2 ( )    3 ( )    4 ( )    5 ( )    6 ( )

**3. Há alguma palavra do texto que você não tenha entendido?**

Sim ( )            Não ( )

**a) Caso sua resposta para a pergunta anterior tenha sido ‘sim’, faça uma lista dessas palavras:**

.....  
 .....

**4. Você acha que a ilustração lhe ajudou a entender a ideia central do cartum?**

Sim ( )      Não ( )

**a) Por que?**

.....  
.....

## Appendix H1 – Institution’s consent letter – (Pilot study)



Escola de Educação Básica Luiz Bertoli  
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 Código: 809000254020  
 89.190-000 - TAIÓ - SC  
 Fone: (47) 3562-8466  
[eeblb@sed.sc.gov.br](mailto:eeblb@sed.sc.gov.br)

**DECLARAÇÃO DE ANUÊNCIA**  
**Coleta de dados - Projeto Piloto**

Declaro para os devidos fins e efeitos legais que, objetivando atender as exigências para a obtenção de parecer do Comitê de Ética em Pesquisa com Seres Humanos da Universidade Federal de Santa Catarina, e como representante legal da Escola de Educação Básica Luiz Bertoli de Taió, tomei conhecimento do projeto de pesquisa: “CONSTRUINDO O SIGNIFICADO DE TEXTOS ILUSTRADOS: um estudo sobre o processamento de informações verbais e pictoriais na leitura de textos escritos em inglês como língua estrangeira”, e cumprirei os termos da Resolução CNS 466/12 e suas complementares, e como esta instituição tem condição para o desenvolvimento deste projeto piloto, autorizo a sua execução nos termos propostos.

Taió, 27/02/2015

ASSINATURA: .....  
 NOME: Osnildo Dalmarco  
 CARGO: Supervisor de Ensino Superior – GERED Gerência de Educação/Taió/SC  
 Secretaria de Educação do Estado de Santa Catarina  
 CARIMBO DO RESPONSÁVEL

ASSINATURA: .....  
 NOME: Nair Selene Alegri  
 CARGO: Diretora Geral da Escola de Educação Básica Luiz Bertoli de Taió/SC  
 CARIMBO DA RESPONSÁVEL

**2540-2 EEB LUIZ BERTOLI**  
 Rua Cel. Feddersen, 1356 - Centro - Taió/SC  
 CEP 89190-000 - Fone 47 3562-8466  
 E-mail: [eeblb@sed.sc.gov.br](mailto:eeblb@sed.sc.gov.br)  
 Ensino Fundamental (Parecer 3610/1965)  
 Ensino Médio (Parecer 520/04/1965)  
 Magistério (Parecer 155/1973)

## Appendix H2 – Institution’s consent letter – (Study)



Escola de Educação Básica Luiz Bertoli  
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[eeblb@sed.sc.gov.br](mailto:eeblb@sed.sc.gov.br)

## DECLARAÇÃO DE ANUÊNCIA

## Coleta de Dados Oficial

Declaro para os devidos fins e efeitos legais que, objetivando atender as exigências para a obtenção de parecer do **Comitê de Ética em Pesquisa com Seres Humanos da Universidade Federal de Santa Catarina**, e como representante legal da **Escola de Educação Básica Luiz Bertoli de Taió**, tomei conhecimento do projeto de pesquisa: **“CONSTRUINDO O SIGNIFICADO DE TEXTOS ILUSTRADOS: um estudo sobre o processamento de informações verbais e pictoriais na leitura de textos escritos em inglês como língua estrangeira”**, e cumprirei os termos da Resolução CNS 466/12 e suas complementares, e como esta instituição tem condição para o desenvolvimento deste projeto, autorizo a sua execução nos termos propostos.

Taió, 27/02/2015.

ASSINATURA: .....  


NOME: Osnildo Dalmarco

CARGO: Supervisor de Ensino Superior – GERED Gerência de Educação/Taió/SC  
 Secretaria de Educação do Estado de Santa Catarina

CARIMBO DO RESPONSÁVEL

ASSINATURA: .....  


NOME: Nair Selene Alegri

CARGO: Diretora Geral da Escola de Educação Básica Luiz Bertoli de Taió/SC  
 Matr. 1220

CARIMBO DA RESPONSÁVEL

**2540-2 EEB LUIZ BERTOLI**  
 Rua Cel Feddersen, 1356 - Centro - Taió/SC  
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 e-mail: [eeblb@sed.sc.gov.br](mailto:eeblb@sed.sc.gov.br)  
 Ensino Fundamental (Parecer 3619/1995)  
 Ensino Médio (Parecer 5209/4/1995)  
 Ensino Técnico (Parecer 155/1973)

## Appendix I1 – Teacher’s consent letter I



Escola de Educação Básica Luiz Bertoli  
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[ecblb@sed.sc.gov.br](mailto:ecblb@sed.sc.gov.br)

**DECLARAÇÃO DE ANUÊNCIA**  
**Coleta de Dados – Estudo Principal**

Declaro para os devidos fins e efeitos legais que, objetivando atender as exigências para a obtenção de parecer do **Comitê de Ética em Pesquisa com Seres Humanos da Universidade Federal de Santa Catarina**, e como professora de língua inglesa dos segundos anos 1,2,3,4 e 5 da **Escola de Educação Básica Luiz Bertoli de Taió**, tomei conhecimento do projeto de pesquisa: **“CONSTRUINDO SIGNIFICADOS NA LEITURA DE CARTUNS: os efeitos da proficiência em inglês como língua estrangeira, e da capacidade de memória de trabalho no processamento de informações verbais e pictoriais”**, e cumprirei os termos da Resolução CNS 466/12 e suas complementares.

Considerando que o conteúdo das tarefas a serem realizadas neste estudo corresponde aos conteúdos trabalhados com as turmas acima referidas, contribuindo assim para com a formação dos estudantes, autorizo a sua realização durante as aulas de língua inglesa, ciente de que os resultados obtidos nas mesmas não serão convertidos em notas para fins avaliativos.

Taió, 14 de maio de 2015.

ASSINATURA: *Vânia Fuchter Petris*.....

NOME: Vânia Fuchter Petris

CARGO: Professora de Língua Inglesa da E.E.B. Luiz Bertoli de Taió

## Appendix I2 – Teacher’s consent letter II



**Escola de Educação Básica Luiz Bertoli**  
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89.190-000 - TAIÓ - SC  
Fone: (47) 3562-8466  
[eeblb@sed.sc.gov.br](mailto:eeblb@sed.sc.gov.br)

**DECLARAÇÃO DE ANUÊNCIA**  
**Coleta de dados - Estudo Piloto**

Declaro para os devidos fins e efeitos legais que, objetivando atender as exigências para a obtenção de parecer do Comitê de Ética em Pesquisa com Seres Humanos da Universidade Federal de Santa Catarina, e como professora de língua inglesa do segundo ano 6 da Escola de Educação Básica Luiz Bertoli de Taió, tomei conhecimento do projeto de pesquisa: **“CONSTRUINDO SIGNIFICADOS NA LEITURA DE CARTUNS: os efeitos da proficiência em inglês como língua estrangeira, e da capacidade de memória de trabalho no processamento de informações verbais e pictoriais”**, e cumprirei os termos da Resolução CNS 466/12 e suas complementares.

Considerando que o conteúdo das tarefas a serem realizadas neste estudo corresponde aos conteúdos trabalhados com as turmas acima referidas, contribuindo assim para com a formação dos estudantes, autorizo a sua realização durante as aulas de língua inglesa, ciente de que os resultados obtidos nas mesmas não serão convertidos em notas para fins avaliativos.

Taió, 14 de maio de 2015.

ASSINATURA: .....*Cristiane Schmidt*.....  
NOME: Cristiane Schmidt  
CARGO: Professora de Língua Inglesa da E.E.B. Luiz Bertoli de Taió



## Appendix J – Transcription of all instructions given during data collection

All sections below present the instructions given to participants during data collection. These instructions were given in Portuguese, the participants' native language. They were recorded and transcribed to this section.

### **1. Instructions for the background questionnaire**

Este é um questionário sobre suas experiências de estudo e de contato com a língua inglesa. O objetivo de se aplicar este questionário é o de fazer um levantamento que mostre o envolvimento de cada um de vocês com esta língua estrangeira.

O questionário apresenta perguntas a respeito de diferentes tópicos, tais como: (a) cursos de inglês que vocês frequentam ou já frequentaram; (b) número de aulas de inglês que são oferecidas na escola semanalmente; e (c) atividades do dia a dia nas quais vocês se envolvem tendo certo contato com a língua inglesa, tais como, ouvir músicas ou assistir vídeos em inglês, etc”.

Peço, por favor, que cada um de vocês leia todas as perguntas antes de começar a responder, a fim de verificar se há alguma dúvida. Peço também que vocês respondam o questionário à caneta e que não coloquem seus nomes no mesmo, apenas o seu número de identificação no item “participante número”, no topo da folha. Lembrem-se de que as informações aqui relatadas são sigilosas, e de que serão usadas exclusivamente, como dados dessa pesquisa.

### **2. Instructions for the reading proficiency test**

Este é um teste de proficiência de leitura em língua estrangeira – inglês. O objetivo deste teste é o de verificar as habilidades de ler e de interpretar as ideias centrais de textos escritos neste idioma estrangeiro. Inicialmente vocês terão 10 minutos para ler um texto que conta com um glossário que lhes ajudará a compreender palavras que podem ser mais difíceis. Nesta folha, vocês podem fazer quantas anotações desejarem. O que peço, é que vocês leiam o texto e procurem compreender o maior número de ideias possível.

Após lerem o texto, vocês receberão um questionário contendo 6 perguntas a respeito do mesmo. As perguntas estão escritas em português e vocês poderão respondê-las em português também. O tempo para realizar essa tarefa será de 10 minutos. Caso seja necessário, vocês poderão consultar o texto para responder essas perguntas. No último minuto eu farei um sinal indicando que o tempo está por terminar. Nesse momento procurem finalizar por completo o que vocês estiverem escrevendo. Peço que vocês respondam as questões à caneta e que não

coloquem seus nomes no teste, apenas o seu número de identificação no item “participante número”, no topo da folha. Lembrem-se de que as informações aqui relatadas são sigilosas, e de que serão usadas exclusivamente, como dados dessa pesquisa.

### **3. Instructions for the reading span test**

Você irá ler várias sentenças sob os mais diversos assuntos. Essa leitura deve ser feita em voz alta. Além disso, você deverá prestar o máximo de atenção ao significado dessas sentenças. Ao terminar de ler cada sentença, deve memorizar a última palavra lida. Essas palavras deverão ser escritas na planilha que lhe foi entregue quando pontos de interrogação forem projetados na tela. Lembre de escrevê-las na exata ordem em que elas foram apresentadas. Só um detalhe! Assim que cada sentença for lida, lembre-se de que ela desaparecerá, ou seja, você não terá mais nenhum recurso externo para recordar das últimas palavras. Ou seja, você contará apenas com sua memória de trabalho. Além disso, a cada etapa, o número de sentenças a serem lidas aumentará e isso exigirá de você muita atenção. Vamos lá? Ah, lembre de que os dados coletados aqui serão mantidos em absoluto sigilo e serão utilizados apenas para atender aos objetivos dessa pesquisa.

### **4. Instructions for the reading comprehension task**

Essa será uma tarefa de compreensão. O objetivo dessa tarefa é o de verificar a capacidade que os leitores têm de compreender textos ilustrados escritos em inglês. Para tal, vocês deverão prestar muita atenção aos meus comandos, pois a tarefa será realizada em etapas e o tempo será cronometrado.

Observem que vocês receberam uma folha que está dobrada em várias partes. Cada uma dessas partes só pode ser desdobrada no momento que eu lhes der sinal, certo?

#### Primeira etapa:

Bem, quando eu sinalizar, vocês deverão desdobrá-la pela primeira vez e deverão ler o texto que lá está escrito, até que o alarme soe. Haverá um glossário para lhes auxiliar na compreensão. O tempo que vocês terão para ler esse texto será de 2 minutos. Pronto. Podem desdobrar.

#### Segunda etapa:

Agora, quando eu sinalizar, peço que por outros 2 minutos vocês escrevam tudo o que vocês compreenderam a partir da leitura que vocês acabaram de realizar, nas linhas ao lado do texto. Enquanto vocês escreverem, podem consultar o texto. Podem iniciar.

Terceira etapa:

Na sequência e assim que eu sinalizar, vocês novamente desdobrarão a folha e por mais 2 minutos irão ler o texto que lá aparecer. Vocês não poderão mais consultar as partes anteriores da tarefa. Podem desdobrar e começar a ler.

Quarta etapa:

Agora, na última etapa, vocês desdobrarão a última parte da tarefa e deverão, por mais 3 minutos, responder a pergunta que lá está escrita. A pergunta basicamente pede que vocês escrevam qual é a moral, ou seja, a ideia central do último texto lido. Mais uma vez, vocês não poderão consultar as partes anteriores da tarefa. Podem desdobrar a folha e começar.

**5. Instructions for the retrospective questionnaire**

Esta é a última atividade que será realizada nesse estudo. Trata-se de um questionário retrospectivo. Talvez esse tipo de questionário seja algo novo para vocês, mas ele simplesmente tem como objetivo permitir que vocês possam expor opiniões a respeito da atividade que acabaram de fazer. Sim, isso mesmo! Vocês irão falar a respeito da atividade: se foi complexa ou não, se vocês tiveram dificuldades e quais foram os motivos que os levaram a ter tais dificuldades, etc. Leiam as perguntas e verifiquem se há dúvidas de compreensão. Após, procurem respondê-las, dando detalhes ou mesmo exemplos que possam esclarecer suas opiniões.

## Appendix K – Data distribution – Descriptive statistics

		Statistic	Std. Error	
Proficiency	Mean	3,667	,2026	
	95% Confidence Interval for Mean	Lower Bound	3,261	
		Upper Bound	4,072	
	5% Trimmed Mean	3,685		
	Median	3,000		
	Variance	2,463		
	Std. Deviation	1,5695		
	Minimum	1,0		
	Maximum	6,0		
	Range	5,0		
	Interquartile Range	3,4		
	Skewness	,153	,309	
	Kurtosis	-1,327	,608	
	RST	Mean	2,592	,0564
95% Confidence Interval for Mean		Lower Bound	2,479	
		Upper Bound	2,704	
5% Trimmed Mean		2,583		
Median		2,500		
Variance		,191		
Std. Deviation		,4366		
Minimum		2,0		
Maximum		3,5		
Range		1,5		
Interquartile Range		1,0		
Skewness		-,056	,309	
Kurtosis		-1,112	,608	

## Tests of Normality

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Prof.	,214	60	,000	,901	60	,000
RST	,242	60	,000	,841	60	,000

a. Lilliefors Significance Correction

## Appendix L – Parents/Guardians’ Consent form

**UNIVERSIDADE FEDERAL DE SANTA CATARINA  
PROGRAMA DE PÓS-GRADUAÇÃO EM INGLÊS:****ESTUDOS LINGUÍSTICOS E LITERÁRIOS****TERMO DE CONSENTIMENTO LIVRE E  
ESCLARECIDO**

Prezados pais ou responsáveis,

Eu me chamo Sidnei Werner Woelfer e sou estudante de Mestrado 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 enviando este documento a fim de solicitar autorização para que seu filho(a), ou menor pelo qual és responsável, possa ser ‘participante’ da ‘coleta de dados’ desta pesquisa. Explicarei abaixo os detalhes.

**Por que esta pesquisa está sendo realizada?**

Muitos textos escritos em inglês trazem ilustrações, figuras e fotos que geralmente visam auxiliar os alunos a melhor compreender aquilo que eles lêem. Mas será que isso sempre acontece? Temos como objetivo investigar se ilustrações que são um pouco mais elaboradas realmente auxiliam os alunos a melhor entender os textos, ou se elas representam um desafio a mais para eles!

**O que será realizado nessa ‘coleta de dados’?**

Bem, os participantes realizarão cinco tarefas nas próprias dependências da escola e durante as aulas de inglês. As datas de realização das tarefas serão combinadas com antecedência. A primeira tarefa será um teste de memória. Os alunos irão ler uma série de frases escritas em língua portuguesa, irão memorizar a última palavra de cada uma delas, e por fim, irão escrever as palavras lembradas em uma planilha. Essa tarefa terá a duração aproximada de 20 minutos. A segunda tarefa será um questionário sobre as experiências prévias e atuais dos alunos com o estudo da língua inglesa. Este questionário será composto por perguntas

sobre o número de horas de estudo da língua inglesa por semana, sobre cursos de inglês que os alunos fazem no momento ou já fizeram no passado, etc. Essa tarefa terá a duração aproximada de 10 minutos. A terceira tarefa será um teste de compreensão de leitura. Os alunos lerão um texto e responderão 6 perguntas sobre ele. A duração desse teste será de aproximadamente 20 minutos. A quarta tarefa será um exercício de compreensão no qual os alunos lerão 1 texto ilustrado e responderão 3 perguntas sobre ele. Esta quarta tarefa também terá duração aproximada de 20 minutos. A quinta tarefa será uma entrevista escrita na qual os participantes expressarão sua opinião sobre aspectos do texto e sobre as questões da tarefa 4. Esta tarefa terá a duração de aproximadamente 5 minutos. Todas essas tarefas serão consideradas ‘atividades extra’ da disciplina de inglês, porém elas não afetarão as notas dos alunos. Os alunos que não desejarem participar serão acompanhados pelo professor de inglês da turma e realizarão outra atividade em uma sala separada, assim não perderão nenhum conteúdo.

### **Haverá algum risco envolvido nessa coleta de dados?**

Na verdade estas tarefas são muito parecidas com as atividades que os alunos já realizam nas aulas de inglês, por isso os riscos são mínimos. O que pode acontecer é os alunos ficarem um pouco ansiosos, pois essa geralmente é a reação que as pessoas têm quando fazem algo que sai um pouco de sua rotina normal.

Para evitar que eles se sintam assim, desde o primeiro encontro já será explicado que a coleta de dados não servirá para testar a sua ‘capacidade de aprender’. Os alunos serão informados de que a coleta de dados buscará por informações que no futuro poderão contribuir para que a o ensino do inglês nas escolas seja aprimorado.

Antes da realização das tarefas, os alunos receberão instruções bem detalhadas e realizarão uma sessão de treino. Desse modo, procuraremos fazer com que eles se sintam à vontade e percebam como são importantes para esta pesquisa científica.

### **E haverá algum benefício para os participantes?**

Sim. As tarefas que os alunos realizarão se tratam de exercícios de compreensão que ajudam a desenvolver a capacidade de olhar para detalhes que muitas vezes não são notados durante a leitura. Desenvolver a habilidade de perceber estes detalhes é algo que capacita os alunos a aprender mais através daquilo que eles lêem.

**Os participantes terão a sua identidade revelada?**

Não! Todos os dados serão confidenciais, ou seja, os participantes não terão seus nomes divulgados. As únicas pessoas que saberão de sua identidade serão minha orientadora e eu.

**Os participantes receberão acompanhamento adequado?**

Sim! Em todas as etapas os participantes receberão o meu acompanhamento. Quaisquer dúvidas ou dificuldades serão atendidas prontamente.

**Participantes e responsáveis terão acesso aos resultados da pesquisa?**

Sim! Após a coleta e a análise dos dados informaremos quais foram as conclusões obtidas através da distribuição de um relatório que será entregue a cada participante. Também haverá uma breve conversa com eles na qual o relatório será comentado em detalhes.

**É obrigatório aceitar esse convite?**

Não! A participação é totalmente voluntária. Este documento se trata de um convite. Caso o Sr/Sra desejarem não aceitá-lo, sua decisão será respeitada e isso não afetará a sua relação com a escola. O aluno (a) também não será prejudicado de forma alguma.

**Os participantes terão alguma despesa?**

Não! Como a coleta de dados ocorrerá na escola mesmo e em horário de aula, e como todos os materiais usados serão produzidos sem custo algum aos participantes, os mesmos não terão despesas e, portanto também nenhum tipo de ressarcimento será necessário.

**Em caso de algum dano, haverá alguma forma de indenização?**

Sim, isso é um direito de todo participante de acordo com a Resolução 466/12.

**É possível cancelar essa autorização após tê-la assinado?**

Sim! Mesmo que você tenha autorizado seu filho ou menor pelo qual é responsável a participar da pesquisa, e por qualquer razão queira cancelar essa autorização, você poderá fazê-lo a qualquer momento, sem prejuízo algum em termos de sua relação com a escola. Basta que me comunique através de um destes fones (48) 99990085 e (48) 32380034 , ou mesmo pessoalmente na escola.

**Em caso de outras dúvidas, com quem se deve entrar em contato?**

Em caso de dúvidas ou sugestões, o contato pode ser feito através de meu email ([sid.wv@hotmail.com](mailto:sid.wv@hotmail.com)) ou do e-mail de minha orientadora ([leda@cce.ufsc.br](mailto:leda@cce.ufsc.br)).

Se você precisar entrar em contato com o Comitê de Ética em Pesquisas com Seres Humanos - CEPSH-UFSC, que é o departamento que aprova a realização desse tipo de pesquisa, você pode escolher uma das seguintes formas de contato:

Comitê de Ética em Pesquisas com Seres Humanos - CEPSH-UFSC

Biblioteca Universitária Central - Setor de Periódicos (térreo) - atrás dos arquivos deslizantes.

Campus Reitor João David Ferreira Lima

Florianópolis - Santa Catarina - Brasil

CEP: 88040-900

Página na Web: <http://cep.ufsc.br/>

Telefone: (48) 3721-9206

E-mail: [cep.propesq@contato.ufsc.br](mailto:cep.propesq@contato.ufsc.br)

Esta pesquisa cumpre todas as exigências legais necessárias?

Sim. Declaro para os devidos fins e efeitos legais que cumprirei os termos da Resolução CNS 466/12 e suas complementares, que são os documentos que normatizam a realização de pesquisa com seres humanos no Brasil.

Assinando este documento de consentimento pós-informação, você estará autorizando seu filho (a) ou menor pelo qual é responsável a participar de nossa pesquisa. Muito obrigado!

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Sidnei Werner Woelfer  
Pesquisador

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Lêda Maria Braga Tomitch  
Orientadora

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Declaração de consentimento:

Declaro que li as informações acima. Quando necessário, fiz perguntas e recebi esclarecimentos. Eu concordo em autorizar (*nome do filho (a) ou menor sobre o qual é responsável*) a participar deste estudo.

Nome: \_\_\_\_\_



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Assinatura do pai, mãe ou responsável

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CPF

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Assinatura dos Pesquisadores Responsáveis

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Sidnei Werner Woelfer  
**Pesquisador**

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Lêda Maria Braga Tomitch  
**Orientadora**

Data: \_\_\_\_/\_\_\_\_/2015

## Appendix M – Participants’ assent form



**UNIVERSIDADE FEDERAL DE SANTA CATARINA  
PROGRAMA DE PÓS-GRADUAÇÃO EM INGLÊS:  
ESTUDOS LINGUÍSTICOS E LITERÁRIOS**

**TERMO DE ASSENTIMENTO LIVRE E ESCLARECIDO**

**Prezado aluno (a):**

Eu me chamo **Sidnei Werner Woelfer** e sou estudante de Mestrado 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 da ‘coleta de dados’ desta pesquisa. Explicarei abaixo os detalhes.

**Por que esta pesquisa está sendo realizada?**

Muitos textos escritos em inglês trazem ilustrações, figuras e fotos que geralmente visam lhe auxiliar a melhor compreender o que está escrito. Mas será que isso sempre acontece? Temos como objetivo investigar se ilustrações que são um pouco mais elaboradas realmente lhe auxiliam a melhor entender os textos, ou se elas representam um desafio a mais para você!

**O que será realizado nessa ‘coleta de dados’?**

Bem, você realizará cinco tarefas nas próprias dependências da escola e durante as aulas de inglês. As datas de realização das tarefas serão combinadas com antecedência. A primeira tarefa será um teste de memória. Você lerá uma série de frases escritas em língua portuguesa, irá memorizar a última palavra de cada uma delas, e por fim, irá escrever as palavras lembradas em uma planilha. Essa tarefa terá a duração aproximada de 20 minutos. A segunda tarefa será um questionário sobre suas experiências prévias e atuais com o estudo da língua inglesa. Este questionário será composto por perguntas sobre o número de horas de estudo da língua inglesa por semana, sobre cursos de inglês que você faz no momento ou já fez no passado, etc. Essa tarefa terá a duração

aproximada de 10 minutos. A terceira tarefa será um teste de compreensão de leitura. Você lerá um texto e responderá 6 perguntas sobre ele. A duração desse teste será de aproximadamente 20 minutos. A quarta tarefa será um exercício de compreensão no qual você lerá 1 texto ilustrado e responderá 3 perguntas sobre ele. Esta quarta tarefa também terá duração aproximada de 20 minutos. A quinta tarefa será uma entrevista escrita na qual você expressará sua opinião sobre aspectos do texto e sobre as questões da tarefa 4. Esta tarefa terá a duração de aproximadamente 5 minutos. Todas essas tarefas serão consideradas ‘atividades extra’ da disciplina de inglês, porém elas não afetarão as suas notas. Os alunos que não desejarem participar serão acompanhados pelo professor de inglês da turma e realizarão outra atividade em uma sala separada, assim não perderão nenhum conteúdo.

### **Haverá algum risco envolvido nessa coleta de dados?**

Na verdade estas tarefas são muito parecidas com as atividades que você já realiza nas aulas de inglês, por isso os riscos são mínimos. O que pode acontecer é você ficar um pouco ansioso, pois essa geralmente é a reação que as pessoas têm quando fazem algo que sai um pouco de sua rotina normal.

Para evitar que você se sinta assim, desde o primeiro encontro já lhe será explicado que a coleta de dados não servirá para testar a sua ‘capacidade de aprender’. Você verá que a coleta de dados buscará por informações que no futuro poderão contribuir para que o ensino do inglês nas escolas seja aprimorado.

Antes da realização das duas tarefas, você receberá instruções bem detalhadas e realizará uma sessão de treino. Desse modo, procuraremos fazer com que você se sinta à vontade. Você irá perceber como é importante para esta pesquisa científica.

### **E haverá algum benefício?**

Sim. As tarefas que você realizará se tratam de exercícios de compreensão que ajudam a desenvolver a capacidade de olhar para detalhes que muitas vezes não são notados durante a leitura. Desenvolver a habilidade de perceber estes detalhes é algo que lhe capacita a aprender mais através daquilo que você lê.

**A sua identidade será revelada?**

Não! Todos os seus dados serão confidenciais, ou seja, seu nome não será divulgado. As únicas pessoas que saberão de sua identidade serão minha orientadora e eu.

**Haverá acompanhamento de alguém em caso de necessidade?**

Sim! Em todas as etapas você terá o meu acompanhamento. Quaisquer dúvidas ou dificuldades serão atendidas prontamente.

**Você, seus pais, ou responsáveis terão acesso aos resultados da pesquisa?**

Sim! Após a coleta e a análise dos dados informaremos quais foram as conclusões obtidas através da distribuição de um relatório que será entregue a cada participante. Também haverá uma breve conversa na qual o relatório será comentado em detalhes.

**A participação nessa coleta de dados é obrigatória?**

Não! A sua participação é totalmente voluntária. Este documento se trata de um convite. Se você não desejar participar, sua decisão será respeitada e isso não afetará a sua relação com a escola e com o professor.

**Haverá alguma despesa para quem decide participar?**

Não! Como a coleta de dados ocorrerá na escola mesmo e em horário de aula, e como todos os materiais usados serão produzidos sem custo algum, você não terá despesas e, portanto também nenhum tipo de ressarcimento será necessário.

**Em caso de algum dano, haverá alguma forma de indenização?**

Sim, isso é um direito seu de acordo com a Resolução 466/12.

**É possível desistir de participar depois de ter aceitado?**

Sim! Mesmo que você tenha aceitado participar da pesquisa, e por qualquer razão queira desistir, você poderá fazê-lo a qualquer momento, sem prejuízo em suas notas e sem problemas de relação com a escola ou com o seu professor de inglês. Basta que me comunique através de um destes fones (48) 99990085 e (48) 32380034, ou mesmo pessoalmente na escola.

**Em caso de outras dúvidas, com quem se deve entrar em contato?**

Em caso de dúvidas ou sugestões, o contato pode ser feito através de meu email ([sid.ww@hotmail.com](mailto:sid.ww@hotmail.com)) ou do e-mail de minha orientadora ([leda@cce.ufsc.br](mailto:leda@cce.ufsc.br)).

Se você precisar entrar em contato com o Comitê de Ética em Pesquisas com Seres Humanos - CEPESH-UFSC, que é o departamento que aprova a realização desse tipo de pesquisa, você pode escolher uma das seguintes formas de contato:

Comitê de Ética em Pesquisas com Seres Humanos - CEPESH-UFSC  
Biblioteca Universitária Central - Setor de Periódicos (térreo) - atrás dos arquivos deslizantes.

Campus Reitor João David Ferreira Lima

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Telefone: (48) 3721-9206

E-mail: [cep.propesq@contato.ufsc.br](mailto:cep.propesq@contato.ufsc.br)

**Esta pesquisa cumpre todas as exigências legais necessárias?**

Sim. Declaro para os devidos fins e efeitos legais que cumprirei os termos da Resolução CNS 466/12 e suas complementares, que são os documentos que normatizam a realização de pesquisa com seres humanos no Brasil.

Assinando este documento de assentimento pós-informação, você estará aceitando a participar de nossa pesquisa. Muito obrigado!

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Sidnei Werner Woelfer  
**Pesquisador**

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Lêda Maria Braga Tomitch  
**Orientadora**

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**Declaração de assentimento:**

Declaro que li as informações acima. Quando necessário, fiz perguntas e recebi esclarecimentos. Eu concordo em participar deste estudo.

Nome: \_\_\_\_\_

Assinatura do participante

CPF

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Assinatura dos Pesquisadores Responsáveis

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Sidnei Werner Woelfer

**Pesquisador**

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Lêda Maria Braga Tomitch

**Orientadora**

Data: \_\_\_\_/\_\_\_\_/2015

## Appendix N1 – Fleiss' kappa - Inter-rater analysis

Participant	Literal Compr.	Inferential Compr.	Agreement
P1	3	0	1
P2	2	1	0,333
P3	0	3	1
P4	0	3	1
P5	0	3	1
P6	0	3	1
P7	0	3	1
P8	0	3	1
P9	0	3	1
P10	0	3	1
P11	0	3	1
P12	3	0	1
P13	2	1	0,333
P14	0	3	1
P15	0	3	1
P16	2	1	0,333
P17	0	3	1
P18	3	0	1
P19	0	3	1
P20	0	3	1
P21	3	0	1
P22	0	3	1
P23	0	3	1
P24	0	3	1
P25	3	0	1
P26	0	3	1

P27	0	3	1
P28	3	0	1
P29	3	0	1
P30	3	0	1
P31	3	0	1
P32	0	3	1
P33	3	0	1
P34	0	3	1
P35	0	3	1
P36	0	3	1
P37	0	3	1
P38	0	3	1
P39	3	0	1
P40	3	0	1
P41	3	0	1
P42	1	2	0,333
P43	0	3	1
P44	0	3	1
P45	0	3	1
P46	3	0	1
P47	0	3	1
P48	0	3	1
P49	1	2	0,333 3
P50	3	0	1
P51	3	0	1
P52	3	0	1
P53	3	0	1
P54	3	0	1
P55	3	0	1
P56	3	0	1

P57	1	2	0,333 3
P58	0	3	1
P59	0	3	1
P60	0	3	1
<b>Tota l</b>	72	108	

0,00

0,00 1851

5556 85

p_bar	0,933333333
Pe	3,42936E- 05
<b>K</b>	<b>0,933331047</b>



## Appendix N2 – Ratings – Reading comprehension task – Rater 1

Rater 1 - MA Candidate – Universidade Federal de Santa Catarina

Participant	
1	Literal
2	Literal
3	Inferential
4	Inferential
5	Inferential
6	Inferential
7	Inferential
8	Inferential
9	Inferential
10	Inferential
11	Inferential
12	Literal
13	Literal
14	Inferential
15	Inferential
16	Literal
17	Inferential
18	Literal
19	Inferential
20	Inferential
21	Literal
22	Inferential
23	Inferential
24	Inferential
25	Literal
26	Inferential
27	Inferential
28	Literal
29	Literal
30	Literal
31	Literal
32	Inferential
33	Literal

34	Inferential
35	Inferential
36	Inferential
37	Inferential
38	Inferential
39	Literal
40	Literal
41	Literal
42	Inferential
43	Inferential
44	Inferential
45	Inferential
46	Literal
47	Inferential
48	Inferential
49	Inferential
50	Literal
51	Literal
52	Literal
53	Literal
54	Literal
55	Literal
56	Literal
57	Literal
58	Inferential
59	Inferential
60	Inferential

Florianópolis, 20/08/2015.

## Appendix N3 – Ratings – Reading comprehension task – Rater 2

Rater 2 - MA Candidate – Universidade Federal de Santa Catarina

Participant	
1	Literal
2	Literal
3	Inferential
4	Inferential
5	Inferential
6	Inferential
7	Inferential
8	Inferential
9	Inferential
10	Inferential
11	Inferential
12	Literal
13	Literal
14	Inferential
15	Inferential
16	Literal
17	Inferential
18	Literal
19	Inferential
20	Inferential
21	Literal
22	Inferential
23	Inferential
24	Inferential
25	Literal
26	Inferential
27	Inferential
28	Literal
29	Literal
30	Literal
31	Literal
32	Inferential
33	Literal

34	Inferential
35	Inferential
36	Inferential
37	Inferential
38	Inferential
39	Literal
40	Literal
41	Literal
42	Literal
43	Inferential
44	Inferential
45	Inferential
46	Literal
47	Inferential
48	Inferential
49	Literal
50	Literal
51	Literal
52	Literal
53	Literal
54	Literal
55	Literal
56	Literal
57	Inferential
58	Inferential
59	Inferential
60	Inferential

Florianópolis, 20/08/2015.

## Appendix N4 – Ratings – Reading comprehension task – Rater 3

Rater 3 - MA Candidate – Universidade Federal de Santa Catarina

Participant	
1	Literal
2	Inferential
3	Inferential
4	Inferential
5	Inferential
6	Inferential
7	Inferential
8	Inferential
9	Inferential
10	Inferential
11	Inferential
12	Literal
13	Inferential
14	Inferential
15	Inferential
16	Inferential
17	Inferential
18	Literal
19	Inferential
20	Inferential
21	Literal
22	Inferential
23	Inferential
24	Inferential
25	Literal
26	Inferential
27	Inferential
28	Literal
29	Literal
30	Literal
31	Literal
32	Inferential
33	Literal

34	Inferential
35	Inferential
36	Inferential
37	Inferential
38	Inferential
39	Literal
40	Literal
41	Literal
42	Inferential
43	Inferential
44	Inferential
45	Inferential
46	Literal
47	Inferential
48	Inferential
49	Inferential
50	Literal
51	Literal
52	Literal
53	Literal
54	Literal
55	Literal
56	Literal
57	Inferential
58	Inferential
59	Inferential
60	Inferential

Florianópolis, 20/08/2015.

## Appendix N5 – Ratings – Reading comprehension task – (Complete table)

Rater 1: UFSC MA Candidate

Rater 2: UFSC MA Candidate

Rater 3: UFSC MA Candidate

Participant	R.1	R.2	R.3
1	Lit.	Lit.	Lit.
2	Lit.	Lit.	<b>Inf.</b>
3	Inf.	Inf.	Inf.
4	Inf.	Inf.	Inf.
5	Inf.	Inf.	Inf.
6	Inf.	Inf.	Inf.
7	Inf.	Inf.	Inf.
8	Inf.	Inf.	Inf.
9	Inf.	Inf.	Inf.
10	Inf.	Inf.	Inf.
11	Inf.	Inf.	Inf.
12	Lit.	Lit.	Lit.
13	Lit.	Lit.	<b>Inf.</b>
14	Inf.	Inf.	Inf.
15	Inf.	Inf.	Inf.
16	Lit.	Lit.	<b>Inf.</b>
17	Inf.	Inf.	Inf.
18	Lit.	Lit.	Lit.
19	Inf.	Inf.	Inf.
20	Inf.	Inf.	Inf.
21	Lit.	Lit.	Lit.
22	Inf.	Inf.	Inf.
23	Inf.	Inf.	Inf.
24	Inf.	Inf.	Inf.
25	Lit.	Lit.	Lit.

26	Inf.	Inf.	Inf.
27	Inf.	Inf.	Inf.
28	Lit.	Lit.	Lit.
29	Lit.	Lit.	Lit.
30	Lit.	Lit.	Lit.
31	Lit.	Lit.	Lit.
32	Inf.	Inf.	Inf.
33	Lit.	Lit.	Lit.
34	Inf.	Inf.	Inf.
35	Inf.	Inf.	Inf.
36	Inf.	Inf.	Inf.
37	Inf.	Inf.	Inf.
38	Inf.	Inf.	Inf.
39	Lit.	Lit.	Lit.
40	Lit.	Lit.	Lit.
41	Lit.	Lit.	Lit.
42	Inf.	<b>Lit.</b>	Inf.
43	Inf.	Inf.	Inf.
44	Inf.	Inf.	Inf.
45	Inf.	Inf.	Inf.
46	Lit.	Lit.	Lit.
47	Inf.	Inf.	Inf.
48	Inf.	Inf.	Inf.
49	Inf.	<b>Lit.</b>	Inf.
50	Lit.	Lit.	Lit.
51	Lit.	Lit.	Lit.

<b>52</b>	Lit.	Lit.	Lit.
<b>53</b>	Lit.	Lit.	Lit.
<b>54</b>	Lit.	Lit.	Lit.
<b>55</b>	Lit.	Lit.	Lit.
<b>56</b>	Lit.	Lit.	Lit.

<b>57</b>	<b>Lit.</b>	Inf.	Inf.
<b>58</b>	Inf.	Inf.	Inf.
<b>59</b>	Inf.	Inf.	Inf.
<b>60</b>	Inf.	Inf.	Inf.