The Effect of Emotion-Laden Words on Working Memory in Advanced and Intermediate Spanish-English Bilinguals

María José Loaiza Hernández and Jhoiner Santiago Rodríguez Neira

Pontificia Universidad Javeriana

Facultad de Comunicación y Lenguaje

Licenciatura en Lenguas Modernas con énfasis en inglés y francés

Bogotá, 2023

The Effect of Emotion-Laden Words on Working Memory in Advanced and Intermediate Spanish-English Bilinguals

María José Loaiza Hernández and Jhoiner Santiago Rodríguez Neira

Project director

Andrés Hernández Perdomo

Final Undergraduate Project Submitted as A Requirement to obtain The Degree of B.A in the Teaching of Modern Languages

Pontificia Universidad Javeriana

Facultad de Comunicación y Lenguaje

Bogotá, 2023

Table of contents

Table of tables

Table of figures

Acknowledgments

I would like to thank my family for always being supportive of my projects and their unwavering belief in me: my grandma, my mother, my sister, my uncles, my aunt and my cousin. I would like to make a special mention to the teachers of the *Licenciatura* because there is a lot of them in me as a teacher now; you are an inspiration. I also want to express my sincere gratitude to my thesis partner, my bestie, because I couldn't have done it without his support and assistance even in the most challenging stages of our journey. I am profoundly thankful for the guidance and patience of our thesis advisor, Andrés, and our FILA and ILA teacher, Micán.

Majo Loaiza

I would like to thank my family and friends, who have helped me achieve all my goals. Notably, I would like to say thank you to my thesis partner, Majo, who has been by my side from the very first semester and has been wonderful to work with. Additionally, we would like to express our gratitude towards the teachers and students that opened up their classrooms and allowed us to perform the experiments. Finally, a shoutout to Dr. T. Swift for her company during the time when we worked on the project.

Jhoiner Rodríguez

Abstract

Results of recent research on emotion-laden words and their effect on cognition processes have been inconclusive on multiple levels, with conflicting measurements regarding the advantage of L1 over L2 or of words of a certain valence over the others. Furthermore, little research has been done towards understanding the role that the level of language proficiency has in this process. This is why the present study intends to determine how emotion influences Spanish-English bilinguals' working memory depending on their proficiency level. The research is based on three pillar concepts: memory, emotion and proficiency.

The research follows a postpositivist worldview, a quantitative method and a non-experimental correlational design. The sample is composed by bilingual students of the LLM at the PUJ selected through judgmental sampling. Regarding the data collection instruments, a questionnaire where participants measure their perceived proficiency was implemented. Then, the participants' groups, who are naturally divided depending on their level of proficiency (advanced or intermediate) were asked to undergo three experimental tasks to test different cognitive processes.

To do so, this study considers the mixed factorial experimental plan, which allows the correlation of multiple variables: level of proficiency, level of retrieval, arousal, and valence. After the implementation of the experiments, data is analyzed using the Pearson coefficient to measure the strength of the correlation between the variables. The results of these analyses showed that the level of proficiency does not have a significant correlation with the level of retrieval, nor do the valence or arousal ratings. The significance of this data, however, was not as high as expected; hence further research on the topic is encouraged.

Resumen

Los resultados de investigaciones recientes sobre las palabras emocionalmente cargadas y su efecto en los procesos cognitivos no han sido concluyentes en múltiples niveles, con mediciones contradictorias sobre la ventaja de la L1 sobre la L2 o de las palabras de una determinada valencia sobre las demás. Asimismo, se ha investigado poco sobre el papel que desempeña el nivel de dominio lingüístico en este proceso. Por ello, el presente estudio pretende determinar cómo influye la emoción en la memoria de trabajo de los bilingües español-inglés en función de su nivel de dominio. La investigación se basa en tres pilares: memoria, emoción y dominio.

El estudio sigue un paradigma postpositivista, un método cuantitativo y un diseño correlacional no experimental. La muestra está compuesta por estudiantes bilingües de la LLM de la PUJ seleccionados mediante muestreo a juicio. En cuanto a los instrumentos de recolección de datos, se aplica un cuestionario en el que los participantes miden su nivel de lengua autopercibido. A continuación, los grupos de participantes, divididos de forma natural en función de su nivel de dominio (avanzado o intermedio), realizan tres tareas experimentales para poner a prueba diferentes procesos cognitivos.

Para ello, este estudio considera el plan experimental factorial mixto, que permite la correlación de múltiples variables: nivel de dominio, nivel de recuerdo, activación y valencia. Tras la realización de los experimentos, los datos se analizan mediante el coeficiente de Pearson para medir la fuerza de la correlación entre las variables. Los resultados de estos análisis mostraron que el nivel de recuerdo no tiene una correlación significativa con el nivel de dominio, ni tampoco las puntuaciones de valencia o activación. Sin embargo, la significancia de estos datos no fue tan alta como se esperaba; de ahí que se recomiende seguir investigando sobre el tema.

Résumé

Les résultats des recherches récentes sur les mots chargés d'émotion et leur effet sur les processus cognitifs n'ont pas été concluants à plusieurs niveaux, avec des mesures contradictoires concernant l'avantage de la L1 par rapport à la L2 ou des mots d'une certaine valence par rapport aux autres. En outre, peu de recherches ont été menées pour comprendre le rôle du niveau de compétence linguistique dans ce processus. C'est pourquoi la présente étude vise à déterminer comment l'émotion influence la mémoire de travail des bilingues espagnol-anglais en fonction de leur niveau de compétence. La recherche est basée sur trois concepts piliers : la mémoire, l'émotion et la compétence linguistique.

L'étude suit une vision post-positiviste, une méthode quantitative et une conception corrélationnelle non expérimentale. L'échantillon est composé d'étudiants bilingues du LLM aux PUJ sélectionnés par échantillonnage au jugé. En ce qui concerne les instruments de collecte des données, un questionnaire permettant aux participants de mesurer leur compétence perçue est mis en œuvre. Ensuite, les groupes de participants, qui sont naturellement divisés en fonction de leur niveau de compétence (avancé ou intermédiaire), sont invités à effectuer trois tâches expérimentales pour tester différents processus cognitifs.

Pour ce faire, cette étude envisage le plan expérimental factoriel mixte, qui permet la corrélation de variables multiples : niveau de compétence, niveau de rappel, excitation et valence. Après la mise en œuvre des expériences, les données sont analysées à l'aide du coefficient de Pearson pour mesurer la force de la corrélation entre les variables. Les résultats de ces analyses ont montré que le niveau de rappel n'a pas de corrélation significative avec le niveau de compétence, ni avec la notation de valence ou d'excitation. La signification de ces données n'était toutefois pas aussi élevée que prévu, raison pour laquelle il est recommandé de poursuivre les recherches sur le sujet.

Keywords: *Emotion-laden words, working memory, proficiency, valence, arousal*

1. Research problem

During the last decade, there has been an important amount of research related to the effect of emotion on cognition, both on monolinguals and bilinguals. Multiple studies have tried to determine whether emotion-laden terms are better remembered than neutral ones, and whether there are variations in the level of retrieval according to the language in which the stimuli are perceived (Baumeister *et al.*, 2017; Fan *et al.*, 2018; Ibañez, 2021; Ong *et al*., 2017; Sarli & Justel, 2020). The results, however, have been highly inconclusive on multiple levels: First of all, some research has shown that there is a retrieval advantage of emotional words in the first language over the second language (Baumeister *et al.*, 2017; Fan *et al.*, 2018; Sarli & Justel, 2020), while some others say the contrary (Ong *et al.*, 2017), and some others have suggested that there is no real difference (Diaz *et al.*, 2021; Heimberg, 2020; Langley, 2019). Secondly, several studies such as those carried out by Heimberg (2020), Sarli and Justel (2020) and Íbañez-Neira (2021) have put forward that words with positive valence have a higher probability of retrieval over negatively valenced ones, but others have concluded that there is no significant difference (Ferré *et al.*, 2010).

Furthermore, a commonly highlighted issue in studies of this nature is the fact that proficiency is not factored in, and it might have a crucial role in the results of the experiments. Previous research has come to this conclusion in its analysis and has suggested that it be contemplated in future studies (Ferré *et al.*, 2010; Ong *et al.*, 2017). Nevertheless, this recommendation has not been recognized yet, so this variable continues to be overlooked in most research related to emotion and cognition, and there has not been a definite conclusion regarding the possible effect of proficiency on the level of retrieval for emotional words. That is why the present study aims to explore and explain this phenomenon.

2. Rationale

A research proposal must meet multiple criteria to be considered valid. Among them are that it is relevant, pertinent and current. In this section, the grounds that justify the present study will be described.

Firstly, research must be relevant. In other words, its questions should lead to answers linked to the personal interest of the researchers or provide socially relevant results. The present study comes, in the first place, from a personal interest in the field of neurolinguistics. Exploration in this field led to finding the area that investigates the role of emotion on cognition processes, such as memory. This topic is closely linked to the first drafts of the research question, which were oriented towards finding out why individuals often feel a higher emotional effect of words, such as insults, in their mother tongue. Eventually this question evolved and took the current form, but it is still closely related to our personal interest.

This study also seeks to contribute to the construction of knowledge in a global sense. It aims to fill some research gaps in the field of neurolinguistics by providing an answer to whether some emotion-laden words have an advantage over others in their effect over memory, and by explaining the role of proficiency in this relation, as a large chunk of the literature suggests. As such, the present study may generate answers to issues that have been largely discussed on an academic level and that can eventually benefit society as it can have clinical applications, as stated in the research by Diaz et al. (2021).

Secondly, research must be pertinent. This study is linked to the nature of the B.A. teacher education program "*Licenciatura en Lenguas Modernas con Énfasis en Inglés y Francés*". The research itself will be limited to the analysis of the relation between different

notions of the field of neurolinguistics such as memory, emotion, and language processing; which is within the range of applied linguistics, a field that englobes the *licenciatura;* this is evidenced in the syllabus of some subjects as "Fundamentals of Applied Linguistics" which makes part of one of the main branches of the basic cycle of the curriculum along with languages and pedagogy: linguistics. Furthermore, despite the fact that the study will have no direct benefit to pedagogy, the progress in this area (neurolinguistics) is often linked to the development of new and more efficient teaching/learning methodologies, in this case, for a second language. In fact, as Hussein (2022) states, "knowing unconscious cognition—the intuitive mind—is crucial for language teachers. This viewpoint is part of a bigger trend: the advent of educational neuroscience, which tries to use brain and cognitive science to inform education" (p.05). This is why this kind of research is needed, especially in regions where inquiry on the area is so limited.

Thirdly, research must be current. The present project follows a line of study that has been gaining relevance throughout the last years, and it is advised by the findings of previous researchers. Its question has not yet been answered conclusively, and the construction of the state of the art that will be later presented has shown that the problem here proposed is still significant and applicable. What is more, it also responds to the growing interest in neurolinguistics by the teaching/learning of a second language field in the last decade.

Furthermore, research on this topic has been scarce in the South American context, even more so in Colombia. As the state of the art will show, the studies on neurolinguistics, specifically in the relationship between memory and emotion in the regional, national, and local level have been very limited, and most of the knowledge related to this area has come from countries such as the United Kingdom, the United States of America, and China. The present study is expected to create a precedent and an incentive for further research on this

field from local countries. This is notably relevant given that it allows a look into the interaction of variables linked to cognitive processing in a context where English is usually learnt as a foreign language.

These are the reasons why the present research project is viable and should be carried out. The problem on which it is based and the question that it seeks to answer follow the criteria that make them valid, and as such the whole research makes sense in the context where it is proposed.

3. Research question

3.1 General

How does emotion-laden words influence working memory of advanced and intermediate Spanish-English bilinguals, members of the LLM at PUJ (Bogotá)?

3.2 Auxiliary

- How does the variable of language proficiency relate to the level of retrieval?
- How does the variable of emotional valence relate to the level of retrieval?
- How does the variable of arousal relate to the level of retrieval?

4. Objectives

4. 1 General

Determine how emotion-laden words influence Spanish-English bilinguals' working memory depending on their proficiency level.

4.2 Specific

- Compare experimentally obtained arousal and valence ratings to those of the Affective Norms for English Words (ANEW).
- Relate the variable of language proficiency to the level of retrieval.
- Relate the variable of emotional valence to the level of retrieval.
- Relate the variable of arousal to the level of retrieval.

5. Hypotheses

Following the specific objectives stated above, and based on the findings of previous researchers, this study proposes the following hypotheses that are to be tested during the experimentation stage.

H1: Experimental arousal and valence ratings will match those of the ANEW, showing strong correlation.

H2: The higher the level of language proficiency, the higher the level of retrieval will be.

H3: The closer to the extremes of the emotional valence rating scale, the higher the level of retrieval will be.

H4: The higher the rating for arousal for a word, the higher the level of retrieval will be.

6. State of the art

6.1. International context

First, a research project conducted in Singapore (Ong *et al.*, 2017) focused on studying the variations in the emotional processing of information with negative or positive

valence, and the relationship with language in bilingual speakers. To study this, the study asked 58 Chinese-English bilinguals from Hong Kong to rate the valence and arousal of positive, neutral, and negative words presented in both languages. The results showed that, contrary to popular belief, perceived emotionality of the words was higher in the second language, which suggests that words presented in L2 do not have a lower emotional impact, and that the processing of words may be influenced by language proficiency and language complexity. In this regard, the paper brought to this study's attention the importance of getting abundant data about the research sample (for example, language use frequency, type of language used, age of acquisition), a step that had not been previously considered and that should be taken during the experimental application. It also showcased proficiency as a central factor that can influence the results obtained, justifying the pertinence of research focused on this variable, the present project included.

Second, an investigation article by Fan *et al.* (2018) found evidence that provides more support for the automatic access of emotional information in words in the bilinguals' two languages as well as attenuated emotionality on L2 processing. To achieve that, researchers performed a facial expression identification task with emotion words in the task-irrelevant dimension with late Chinese-English bilinguals. Their main focus was on implementing the face-word Stroop task[1] instead of the Stroop task[2], since the relationship color-word is not clear semantically, and comparing the results, which were similar. This study offers us important methodological references to obtain more reliable results: not

[1] The emotional face-word Stroop task involves presenting compound stimuli with congruent or incongruent combinations of emotion words and facial expressions, requiring participants to respond to one dimension while ignoring the other, akin to the classic Stroop task.
[2] In the Emotional Stroop task, participants are asked to identify the color of an emotion-laden word while their response time is measured. The emotional load of the word is said to affect this timed response.

assuming the proficiency of the participants based on their educational level but performing formal tests to have quantitative results, having a control group of words, and considering the inclusion of the emotional face-word Stroop task.

Third, an article by Baumeister *et al*. (2017) draws on an embodied knowledge perspective where the body is considered as a holistic unity. Here, 24 participants performed a memory task involving an encoding and a surprise retrieval phase, and data was obtained thanks to motor resonance[3] and skin conductance (SC) responses[4]. Results show that reading emotional words in a native language generated a deep and embodied emotional experience and that enhanced memory for emotional content is stronger in L1, supporting the idea that embodied cognition and emotional memory have a relationship**.** Likewise, it draws the attention to consider the health status of the participants to evaluate the imageability of the stimuli words, and the ethical protocol, and to have significant samples so that the results can be more conclusive.

Fourth, Heimberg´s (2020) PhD dissertation in Clinical Psychology explored the theory of the bilingual advantage[5] when individuals were exposed to an increased cognitive load due to emotionally valenced stimuli. This was tested by a working memory performance task in English monolinguals and English-Spanish bilinguals, and measured by reaction time (RT) and accuracy when placed under three emotionally valenced conditions (positive, negative, and neutral). Regarding the analysis of the findings, a comparison between monolingual (ML) and bilingual (BL) performance was done using a Multivariate analysis of

[3] Motor resonance involves the activation of motor areas of the brain in response to observing someone performing an action.
[4] Skin conductance responses reflect changes in the electrical conductance of the skin as a result of exposure to emotional or arousing stimuli.
[5] Bilingual advantage literature proposes that bilinguals perform significantly better on tasks of executive functioning when compared to monolingual individuals.

variance (MANOVA), while within-group bilingual performance was analyzed using two matched paired tests. There, no significant differences were identified. On the contrary, negatively valenced stimuli brought to the slowest RT and were the least accurate. This study notes that due to the repetitive nature of the task used, some participants may have had decreased motivation and/or attention as time progressed, inspiring the present research to alternate the stimuli instead of presenting it in blocks according to the valence. They used the data analysis program, MATLAB, to convert the RT and accuracy results in the performance figures; however, it did not prove to be a reliable tool since the conversion could have affected the precision. This is due to the fact that sustained attention to the tasks was not taken into account, and it was only possible to take into account mean response time and accuracy as a measurement for task performance. Because of this, the present project will not use it.

6.2. Regional context

Even though this section should count with a proportional number of entries to previous sections, finding previous work related to the relationship between emotion and memory on the regional, national, and local level was extremely difficult. Research in the field of neurolinguistics in general seems to be scarce in this area, and despite looking in several databases such as ProQuest, EbcoHost and Google Scholar, and using different search equations, the results were still very limited. What is more, out of the studies found, most did not match the present study's research sample (they worked with children, older adults or neurodivergent groups), had different focuses (such as pedagogical, clinical, or psychological), or did not include a central concept (for example, they talked about working memory but not emotion). The following sections thus present the studies that best match the purpose and area of interest of this research.

To begin with this section, a study carried out in the Universidad de Concepción (Íbañez-Neira, 2021) explored the effect of emotional valence on linguistic processing in contexts where the language learning does not occur in immersion. By means of a lexical decision task, the study discovered that valenced words are, as literature suggests, processed faster than neutral words, and that positive words are processed faster and with more accuracy than neutral words. It also proposed a novel classification of valenced words (centrality of the emotional valence), which led to conclude that response times are longer for positive words, and shorter for negative words when words are closely linked to emotions, sensations and feeling; and the opposite when they are not. This research joins that of Baumeister *et al.* (2017) in the embodiment theory, showing an enriching theoretical support and offers relevant methodological considerations such as the need to divide participants based on a trustworthy instrument that indicates their real proficiency level.

Secondly, Diaz *et al.* (2021) carried out a theoretical review about the effect of three factors (music, physical activity and the acquisition of a second language) on emotional memory. The study defines emotional memory as the information stored in our system in a durable way because, in its acquisition, consolidation or recovery, it was accompanied by an optimal and high level of physiological activation. These researchers carried out the review through a systematic search of 22 articles in indexed scientific journals. Regarding the studies on L2, the difference between retrieval of emotional information in L1 and L2 depends on the task and age of language acquisition. Likewise, most of them present comparisons in adults and emotional and/or neutral images or words as stimuli. They also have a high degree of applicability due to their low cost and flexibility to be adapted to different contexts and populations, as they are considered non-invasive interventions, thus confirming the viability

of the present study. What is more, it allows this study to have a clinical relevance, as it can be used to develop treatments addressing learning and memory problems.

6.3. National context

On a national level, a research paper published by Sarli and Justel (2020) refers to the emotional memory in users of a second language. The study that led to the article wanted to look into the relationship between memory and emotion in ML and Spanish-English BL speakers. In order to do this, an emotional valence task and two memory tasks (immediate and delayed) were conducted on a sample of 49 people. The collected data showed that those who coded the stimuli in Spanish (ML and BL) rated words with a higher emotional load in comparison to those who coded them in English (BL). Furthermore, the ML group had a higher number of intrusions than the bilingual groups. This led to the conclusion that there are particular factors, even though they do not specify which ones, in the processing of emotional information that modulate the emotional recollection in both BL and ML. This research is especially relevant for the current study for its proximity to its real context. As such, they share multiple challenges linked to the experimental field, like the fact that the ANEW database, used in most studies to provide valence data, can be irregular in the Latin American context. This is an important factor to consider for the present study; however, the ANEW database will most likely be used due to the lack of other standardized tools.

In addition, a bachelor thesis carried out at the Universidad Tecnológica de Pereira (Agudelo & Valencia, 2021) explored the executive function performance in bilingual and monolingual professors and teachers from institutions of the region to see if the former had an advantage over the latter. In order to do this, the researchers did multiple tests measuring inhibition (control of emotions, thoughts, and behaviors), shifting (brain flexibility to adapt to

new tasks), and updating (often considered to be equivalent to the working memory): a Stroop test, task shifting, and the Corsi block-tapping task. The results showed a considerable advantage of monolinguals over bilinguals regarding inhibitory control; a bigger working memory capacity for bilinguals (although it may be linked to age); and a better performance in shifting in monolinguals. In sum, this research, once again, manifests the importance of considering socio-economic background to have a reliable outcome, and the value of having a bigger sample size for the experiments.

6.4. Local context

Langley (2019) also conducted quantitative quasi-experimental research on executive functions (EF). The aim was to investigate whether there was an advantage in inhibition control for highly proficient Spanish-English late-bilingual adults, compared to Spanish-speaking monolingual adults in Bogotá. A total of 41 participants did the Victoria version of the Stroop Task (VST), which is suitable for people with busy lives thanks to its quick implementation. Additionally, participants had an international certification of English proficiency (TOEFL or IELTS), and did another questionnaire regarding their health and education levels of their parents to address demographic factors that can affect performance. Results showed that there was no significant difference between bilinguals and monolinguals. One possible explanation could be the lack of code-switching of bilinguals on a daily basis. This study provides the present project with methodological tools such as using a pilot to be sure that instructions are clear, and carry out more research concerning the bilingual advantage.

Finally, a study by Ibarra and Martinez (2018) sought to determine how working memory (WM) training could contribute to retaining vocabulary studied in English lessons

through the implementation of a set of strategies. Undergraduate students of EFL courses of a public Colombian University were divided into one experimental (28), and one control group (22). First, they used a test to assess learners' vocabulary knowledge before and post intervention. Second, WM training strategies were implemented which consisted of 10 tasks to tackle vocabulary learning. After being exposed for 10 weeks, most of the experimental group benefited, showing gradual progress in the retention and retrieval of words studied in lessons. Although this study does not relate to emotion, it is one of the few that studies WM in the local context. In addition, it is connected with the present study insofar as the research can have repercussions in the educational field. Thus, the study highlights the importance of being more aware of the factors that intervene and affect language learning, as the one analyzed in the present research: WM, making it possible to come up with alternatives that could counteract burdens or optimize the process.

7. Theoretical framework

This research is based upon three conceptual pillars: memory, emotion and proficiency, and their corresponding subcategories. The following section focuses on defining and describing these pillars, as well as the epistemological stance that the present study takes in regard to each of them. Where there is polysemic interpretations or ongoing discussion about a term, the position taken will be clarified. These concepts frame the research and guide its methodological decisions. Therefore, all of the main variables that will be considered throughout the experiments are briefly outlined.

7.1 Memory

The term memory often refers to the process of receiving information through experiences and storing them to be recalled later in time. Nonetheless, it also refers to the

information that is stored in the subconscious and cannot be consciously accessed (Ebbinghaus, 1885). Indeed, it is said that some part or form of the memory is functional since birth, although we cannot access those memories (Byrne, 2003).

Now, and for the purpose of this study, it is necessary to highlight what Corballis (2019) affirms: "Language could not exist without memory, in all its forms: working memory for sequential production and understanding, implicit memory for grammatical rules, semantic memory for knowledge, and episodic memory for communicating personal experience" (p. 01). Furthermore, the data that the study of Schroeder (2019) provides, as well as other studies, evidence that "...memory is influenced both by context (Smith and Vela, 2001) and by multi-sensory audiovisual interactions (Thelen *et al.*, 2015)" (p. 09). Thus, that influence underlines the link between language and memory, mental abilities involved in the present research.

7.1.1 Working memory

The WM theory is a complex multi-modal system which was first conceptualized by Alan Baddeley in 1974 and has been updated: Baddeley and Hitch (1974) coined the term "working memory" and created the working memory model consisting of a series of processes that work together. This model consists of four different components. First, the central executive, which guides attention; second, the phonological loop, that processes and stores information in a speech-based form; third, the visuospatial sketchpad, utilized and specialized for spatial and visual processing; and finally, the episodic buffer, that provides temporary storage for information (Baddeley, 2000; Baddeley & Hitch, 1974). Likewise, as Rudner (2018) argues, working memory is a platform for language processing and language learning. However, working memory storage has its limits which may affect language

processing during challenging situations or conditions; which is also why it will be important for the present study to expose participants to different types of tasks.

Now, there are three important phases of information processing in memory: encoding, storage, and retrieval, which are going to be defined. Nonetheless, for the purpose of this study the focus is on encode and retrieval, specifically on their function when working memory is involved, keeping in mind the nature of the experiments to be carried out.

7.1.1.1 Encode

Pursuant to Field (2011) the term "...refers to the mental processes of representing thought symbolically in language [...] or to the processes of the way information is represented from one format to another" (p.63). In the present research, the term will be understood more as the latter since the information will come from sensory input and be changed to be stored in the WM. This process is done because our brain needs to change the information into a form that it can cope with. An example is when "...a word is seen (in a book) may be stored if it is changed (encoded) into a sound or a meaning (i.e. semantic processing)" (McLeod, 2013, para. 6). In fact, there are some main ways of encoding: visual (picture), acoustic (sound) and semantic (meaning) (McLeod, 2013). For the study, the encoding expected is the semantic one.

7.1.1.2 Storage

Storage concerns the nature of memory stores: the place, the duration, the capacity and the type of information held (McLeod, 2013). It is said that most adults can store between 5 and 9 items in their working memory because it only has a certain number of "spaces" in which items could be saved (Miller, 1956). However, it is uncertain the specific amount of

information that can be stored in each space. In addition, the time of storage of information in working memory is usually brief (0-30 seconds) (McLeod, 2013). Therefore, the retrieval process in participants will be challenging and useful as an indicator of the emotion factor of the stimuli involved.

7.1.1.3 Retrieval

Memory retrieval refers to the recovery of information previously encoded and stored in the brain. However, this process is context-sensitive, so memory phenomena are common. For example, retrieval can be successful in one situation but fail in another. This is the reason why considering the error-prone nature of memory while doing the experiments would be relevant (Lockhart, 2001). Two forms of memory retrieval are recall and recognition.

7.1.1.3.1 Recall

Recall refers to the process of remembering something or someone without cues or the presence of the thing remembered. In other words, recall is the action of obtaining information from the brain. Some examples can be thinking of the name or face of a person, which requires the activation of neurons to rebuild that memory. (The Human Memory, 2022). This term is often used to describe a task that will be implemented.

7.1.1.3.2 Recognition

Recognition consists in identifying previously known information (encoded and stored) after seeing or experiencing the memory again. An example is when you remember the name of a person by seeing their picture (The Human Memory, 2022). In other words, you recognize information that is in your brain. This term is also used to describe a task carried out.

7.1.2 Emotional memory

It has been proven that a memory of a traumatic situation can cause the person to re-experience the same emotions the trauma caused in that moment, even at a physiological level. Thus, even though emotions are unconscious processes, it is inferred that there is a mechanism by which emotional experiences are stored. LeDoux (1999) called this process "emotional memory", an "implicit conditioned memory" that follows from an emotion (LeDoux, 1999). Moreover, the term emotional memory (EM) is also used to refer to "...the particular effect where emotions influence memory formation" (Sarli and Justel, 2020, p.26).

7.2 Emotion

According to Dewey (1895) emotions are experiences that interrupt the ongoing line of conduct when two tendencies start a conflict or tension with each other. Similarly, for Ekman and Davidson (1994), emotions are a process of automatic appraisal influenced by our past, where we feel our welfare to be threatened, and a set of psychological changes and emotional behaviors are displaced as a response.

Likewise, there are different theories that can be used to approach emotion. (Kostin, 2018). One of them is the Darwinian emotion perspective (Ekman *et al*., 1987), which argues that emotions are products of evolution. Therefore, its goal is to establish primitive universal emotion categories. Another is the Jamesian emotion perspective (Levenson, 1992), where emotions are caused by physiological and bodily changes. Thus, they try to identify the physiological aspects of emotions such as heart rate and neurological signals.

A third theory is the cognitive emotion perspective (Ortony *et al.*, 1990); here, changes in emotional states are induced by events and our perceptions of them. The focus is

on building models to describe the relations between events (appraisals) and emotions. Finally, the social constructivist emotion perspective (Spelman, 1989) studies social or individual differences of emotion perception and expression, as gender.

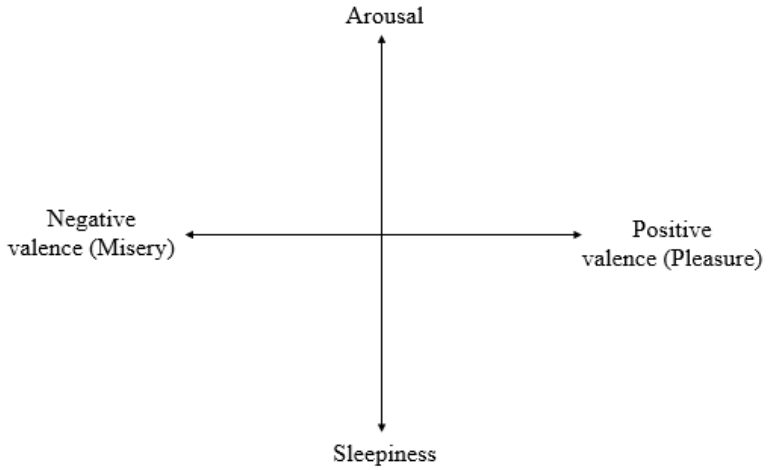
For the present study, the focus will be on the cognitive emotion theory (CET). This particular perspective studies how the processes of cognition influence emotional states and subsequent behavior. "CET suggests that our perception and comprehension of the environment significantly impact our emotions and decision-making" (Xu *et al.*, 2021, p. 03). Consequently, this theory makes it possible to think of evaluating and adjusting cognition to change how individuals think, feel and act, which is the principle of a study such as the present one. Furthermore, in CET emotions are associated with specific appraisals (stimuli, linguistic in this case) "...and described as vectors in a space defined by a set of primitive emotion dimensions" (Kostin, 2018, p. 20). This is the case of the Circumplex Model of Affect.

7.2.1 The Circumplex Model of Affect

The circumplex model of emotion was developed by James Russell in 1980. This model distributes emotions according to a two-dimensional circular space, with two axes that represent the dimensions of arousal and valence, as shown in *Figure 1*. In other words, this approach suggests that all affective states arise from those two fundamental neurophysiological systems, and can thus, be placed around the middle point, analogously to points on a compass (Russell, 1980).

Figure 1

The circumplex model of affect



Note. The figure shows the main axes of the circumplex model of affect, based on Russell's proposal. Source: Russell (1980).

This model, although questioned recently by researchers who claim it is insufficient in explaining all the sources of variation in the emotion domain (Fontaine *et al.,* 2007), continues to be one of the most frequently used models in the methodological construction of research in this area. In fact, the big majority of the studies reviewed in the state of the art section of the present research have taken it into account. This is why, in the name of preserving the comparability with the line of research followed, this study will also be based on this bidimensional model.

7.2.1.1 Valence

It refers to "the value associated with a stimulus as expressed on a continuum from pleasant to unpleasant or from attractive to aversive" (American Psychological Association, n.d). In other words, it is the value given to stimuli according to how they are perceived by an individual. It is one of the dimensions commonly measured in multidimensional scaling studies linked to emotion.

7.2.1.2 Arousal

It also refers to the value associated with a stimulus, but in this case, it is expressed on a continuum from arousal (or active) to sleep (Russell, 1980). Therefore, it is another way to give value to stimuli according to individuals' perception of them.

7.2.2 Emotion words

These are words that refer to specific affective states, as happy or angry; or processes like to worry. Additionally, they can refer to a function to either describe or express those states and processes; for example, “She feels sad”. Likewise, depending on the context, these words may also be just abstract words. Nevertheless, the term does not include words related to emotions (emotion-related words). To illustrate, sad is an emotion word while tears is an emotion-related word since the latter describes a behavior linked to the emotion, but does not name it (Pavlenko, 2008).

7.2.3 Emotion-laden words

Pavlenko (2008) defines emotion-laden words as “words that do not refer to emotions directly but instead express (“jerk”, “loser”) or elicit emotions from the interlocutors (“cancer”, “malignancy”)” (p. 148). This category includes multiple groups such as taboo, swear words or expletives, insults, reprimands associated with childhood, endearments, aversive words, and expressive interjections. The limit between these subgroups, however, are often hard to define because some words change categories according to the context and intention of the enunciator, and some words that are not normally considered as emotion-laden might take specific connotations in certain contexts.

7.3 Proficiency

Proficiency is a term that can be understood in multiple ways depending on the conception of language that is followed. One possibility, for example, is the formal approach, where language acquisition is considered as the innate ability to establish a mental system of rules, and as a consequence, proficiency is related "to the abstract competence people have to acquire the language and the neuronal and psycholinguistic configurations of language in the brain" (Bravo, 2014, p. 03). On the opposite side is the functional approach. By this conception, acquisition of the language is related to specific linguistic forms and factors linked to the sociocultural context where the learning takes place. In this case, proficiency is measured in "relation to people's performance when interacting and conveying meaning in different contexts" (Bravo, 2014, p. 03).

This dichotomy is similar to that highlighted by Cummins (2000), who makes a difference between conversational and academic language proficiency. The former can be understood as the ability to communicate in a second language with the support of interpersonal and contextual clues. The latter can be defined as the "ability to make complex meanings explicit in either oral or written modalities by means of language itself rather than by means of contextual or paralinguistic cues such as gestures and intonation" (Cummins, 2000, p. 59). The main difference is, then, the level of cognitive demand required, which is higher in the second category and is thus usually developed after the first.

Nevertheless, both conceptions should be considered, as none of them suffice to explain L2 learning on their own; especially with a population such as the one studied in this research: pre-service teachers that are required to achieve a high communicative ability in the English language, as well as a deep understanding of the rules and structure of it.

Furthermore, the population is to also become analysts and pedagogues in the target language.

In sum, proficiency can be used to indicate general ability in a language, which "...includes fluency (interacting rapidly over a broad range of topics) and accuracy (correctly, according to native - or near-native- speaker norms) (Field, 2011, p.145). Therefore, it is a qualitative and quantitative measure. For the purpose of the present study, the focus will be on the latter.

7.3.1 Bilingual

Bilingual is used to refer to people who possess or speak two languages. However, definitions are notoriously problematic since there are questions of how proficient the person has to be in both languages to be considered bilingual (Field, 2011, p.24). Some authors, such as Bloomfield (1935), define bilingualism as 'the native-like control of two languages' (p.56). A bilingual person, in his view, is someone who has learnt a foreign language to the extreme, and as a consequence, has become so proficient in its use, that they are virtually indistinguishable from the native speakers around them. This author does, however, point out that "one cannot define a degree of perfection at which a good foreign speaker becomes bilingual: the distinction is relative" (Bloomfield, 1935, p. 56). This both reaffirms the idea that in order to be bilingual, a person must have nearly perfect mastery of a second language, and highlights the difficulty in defining the difference between a bilingual and a speaker with a good level of language. In contrast, authors such as Macnamara (1967) affirm that bilinguals are anyone who has a minimal competence in one of the language skills (listening, speaking, reading and writing).

This discussion has been so problematic that some authors have started to differentiate the term “bilingualism” from “true bilingualism”. According to a recent study using content analysis and rhetorical perspectives to study these differences, the original term (bilingualism) “refers broadly to the ability of speaking two languages fluently and coherently”, while the concept derived from dissociation (true bilingualism) “overarches these features and adds extra ones, such as: native like proficiency, the same social and cultural level in both languages as well as their institutional recognition” (Scripnic, 2021, p. 215).

For the purpose of this research, the broad definition of bilingualism will be considered. In this way, any person that uses two languages and knows two language codes, even if this is only partially, can be considered a bilingual. The present study does, however, make a distinction between levels of proficiency (advanced and intermediate) and how they can be used to classify bilinguals. In the following section, the kinds of bilinguals that are to be studied during the research are described briefly.

7.3.1.1 Advanced bilingual

According to the ACTFL Proficiency Guidelines (2012) Advanced bilinguals as speakers can engage in conversations in a participatory manner to communicate information on autobiographical topics, or community, national, or international interest, using frames of past, present, and future. These speakers can also deal with social situations with unexpected complications, their language is abundant. As writers, they have the ability to write routine informal and some formal correspondence, narratives, descriptions, and summaries of a factual nature, using paraphrasing and elaboration to provide clarity. As listeners, they can understand the main ideas and most supporting details in connected discourse on a variety of

general interest topics. As readers, they can understand a wide variety of texts from many genres including professional, technical, academic, and literary. Texts with a high level of abstraction, uniqueness of vocabulary; cultural reference, or complexity of structure. They can understand and be understood by natives in all the abilities. This classification corresponds to levels B2 - C1 according to the Common European Framework of Reference for Languages (CEFR).

7.3.1.2 Intermediate bilingual

According to the ACTFL Proficiency Guidelines (2012) Intermediate bilinguals as speakers are distinguished primarily by their ability to create with the language when talking about familiar topics related to their daily life. They can ask simple questions and can handle a straightforward survival situation, typically using present time. As writers, they are characterized by the ability to meet practical writing needs, such as simple messages and letters, requests for information, and notes. In addition, they can ask and respond to simple questions in writing, implementing basic vocabulary. As listeners, they can understand information conveyed in simple, sentence-length speech on familiar or everyday topics in controlled listening environments where they hear what they may expect to hear. As readers, they can understand information conveyed in simple, predictable, loosely connected texts. These texts are not complex and have a predictable pattern of presentation, containing predominantly high frequency vocabulary. They can be understood by interlocutors who are accustomed to dealing with non-native learners of the language. This classification corresponds to levels A2 - B1 according to the Common European Framework of Reference for Languages (CEFR).

8. Methodological framework

8.1 Philosophical worldview, method and design

This research follows a postpositivist worldview. This worldview represents the "thinking after positivism, challenging the traditional notion of the absolute truth of knowledge" (Creswell & Creswell, 2018, p. 44). This means that it does not pretend to be absolutely positive about the knowledge that it presents about human behavior, but rather is a possible contribution to an ever-developing field. The present study fits into this worldview as it seeks to identify and assess the causes that influence effects, by the means of careful observation and the objective measurement of reality through experimentation.

Consequently, it pursues the quantitative method. This kind of approach focuses on "carefully measuring (or experimentally manipulating) a parsimonious set of variables to answer theory-guided research questions and hypotheses" (Creswell & Creswell, 2018, p. 206). This means that it tries to determine whether one variable affects the other, in order to test theoretically-grounded suppositions. Furthermore, it means that the data collected will be numeric and will be treated statistically.

Finally, this research follows a non-experimental correlational design. That is to say that it intends to "describe and measure the degree or association between two or more variables or sets of scores" (Creswell & Creswell, 2018, p. 46). As stated in Hernández *et al.* (2014), "[s]ometimes only the relationship between two variables is analyzed, but links between three, four or more variables are frequently located in the study" (p. 93). This research falls into this category being that three variables are involved: level of proficiency, valence, and level of retrieval. This type of study allows for the establishment of complex relationships among these variables through experiments based on factorial designs.

Non-experimental correlational research is used to examine the relationship between variables without the direct intervention of the researchers, which is useful for studies where the variables cannot be changed (Limberg *et al*., 2021). The present study fits into this group since the researchers cannot change the level of proficiency of the subjects given the restriction of time allocated for the interventions. Moreover, given that level of language proficiency is one of the variables that are being considered, and the fact that the population is already split into different classes, randomization of the groups is not possible. Hence, unlike previous research on the topic, this study does not adhere to an experimental or quasi-experimental design.

The characteristics of this kind of design, lack of random assignment and multiples measurements over time, can affect the internal and construct validity of the research, which makes it difficult to determine whether the observed relationships between variables is due to a causal relationship or other factors (Limberg *et al*., 2021; Dziak, 2023). In order to reduce these threats, researchers should bring forth clear operational definitions of the constructs, include both theoretical and empirical support for the research hypothesis, and take steps to choose valid and reliable measurements of said constructs (Tabachnick & Fidell, 2013; Graziano & Raulin, 2013). Consequently, the present research explains each methodological decision extensively, draws on procedures and instruments whose validity has been tested on multiple occasions, and includes pilots to improve the design of each experimental task.

8.2 Sampling

The population is composed of Advanced and Intermediate bilingual students of the LLM at the PUJ, so that the sample is homogeneous regarding the variables studied. The postulates of Giroux and Tremblay (2004) are contemplated in the sampling process. The

type of sampling is judgmental, which is a “non-probabilistic sampling technique in which the researcher himself selects the elements, because they seem typical of the group to which they belong.” (Giroux & Tremblay, 2004, p. 113). In this case, the participants are those whose teacher agreed to contribute to the research and allowed researchers to apply the techniques in their class of *Licenciatura*: English Intermediate II or English Advanced II.

Likewise, as Lina Westfall (2016) states in judgmental sampling “...the person doing the sample uses his/her knowledge or experience to select the items to be sampled” (p.02). They illustrate the theory with examples of cases when researchers can use this type of sampling; for example, when taking into account their experience, “the acceptance tester might select test cases that exercise the most complex features, mission-critical functions, or most used sections of the software” (Westfall, 2016, p.02). In sum, it is a strategy to select deliberately the sample so it can provide information to the study that could not be obtained from other choices (Maxwell, 1996).

Therefore, Intermediate and Advanced levels were included because from the researchers’ knowledge of the topic, the line of study averred in the state of the art, and the concepts addressed in the theoretical framework, they warrant inclusion. Regarding the strengths of this type of sampling, it does not carry a high cost; it does not consume a lot of time and it is considered ideal for explanatory research designs. However, it also has weaknesses since it might not allow generalization as it has a strong subjective filter. (Malhotra & Birks, 2006).

8.3 Techniques and instruments to collect the data

As the method of collecting the data is experimental (Giroux & Tremblay, 2004) the techniques used are circumscribed in it. The first one is the questionnaire, which “...consists

in asking the same series of questions in the same way to all the participants" (Giroux & Tremblay, 2004, p. 96). The present study uses one questionnaire: the adapted LEAP-Q by Marian *et al.* (2007) to obtain a self-reported measurement of the level of proficiency of the participants; a useful tool to compare it with the level that they are supposed to have according to the curriculum of the *Licenciatura* (Intermediate: B2.1 and Advanced: C1) to have a more accurate classification of their proficiency as it is the main variable of the research.

The LEAP-Q, adapted by Marilyn Hall at Northwestern University, is divided into four sections. The first one focuses on getting general information about the speaker, such as their last name, age, and gender. The second one asks for an overview of the languages they speak and their contact with each one in their daily lives. The third and fourth are similar, they go in depth to get information about their spoken languages. In this case, these sections were focused on Spanish, the participants' mother tongue, and English, their second language and the interest of this study. In each part, the questionnaire taker is asked about their age of acquisition for that language, the level of proficiency they have in each communicative skill, the factors that influenced their learning, and the exposure they have to the language. These variables, related to language history and experience, allow researchers to better predict L2 proficiency (Marian *et al.,* 2007).

The second technique is three experimental tasks: an encoding task, a free recall task and a recognition task following the same procedure as in Sarli and Justel (2020), with the exception that it will not evaluate deferred retrieval, as the focus of the study is the working memory. These tasks will involve a set of linguistic stimuli (Appendix B) that has been picked out from the Affective Norms for English Words (ANEW) database by Bradley and Lang (1999), and their adaptation to Spanish by Redondo *et al.* (2007). The ANEW provides

information about arousal and valence mean ratings, thus allowing researchers to select stimuli to use in studies that focus on language and emotion, such as the present one. The words were chosen considering several criteria: one was the ranges established by the results of Ong *et al.* (2017) after experiments with 58 participants, which represent mean ratings for valence and arousal for each category of emotion: positive, negative and neutral words (Table 1).

Table 1

Ranges for linguistic stimuli

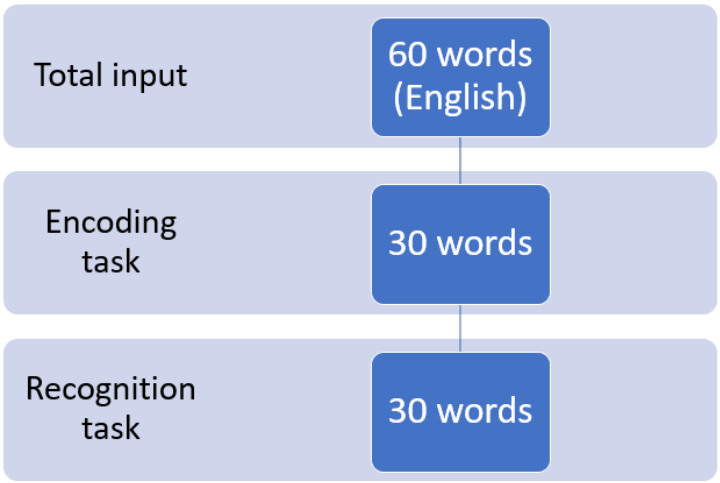
Type of word	Range of valence	Range of arousal
Positive	7.06-8.33	6.74- 7.83
Negative	1.29-2.93	6.33-7.86
Neutral	5.06-6.26	3.22-4.34

Note. Own elaboration based on the criteria described in Ong *et al.* (2017).

Later on, the stimuli were filtered to avoid words that were cognates (violin, *violín*), were very similar in spelling in both languages (radiator, *radiador*), had an inaccurate translation (despairing, *desesperado*), or had a translation that is not commonly used in the colombian context (spanking, *zurra*). Moreover, the list was scrutinized so as to make sure that all stimuli were in accord with the proficiency of the group, the highest-level word corresponding to a B2 according to the CEFR. This process resulted in a list of 60 words in total (Appendix C), which will be used in the tasks of encoding and recognition as shown in the following figure:

Figure 2

Distribution of linguistic stimuli in tasks

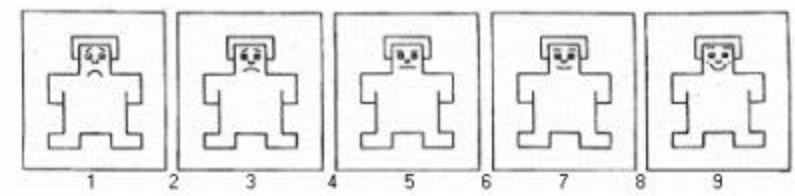


Note. Own elaboration. The words were divided into these groups randomly.

Given the specificity of the tasks, the instruments are as well specific. For instance, for the encoding task (Appendix C), whose purpose is to present the input, and to verify the degree of arousal and valence associated with the list of words, a SAM (Self-Assessment Manikin) will be implemented. The version of this instrument that is used is that adapted by Redondo *et al.* (2007) to measure the dimensions of arousal and valence, represented in a numerical scale going from one to nine, and being guided by a series of pictograms (Figure 3 and 4).

Figure 3

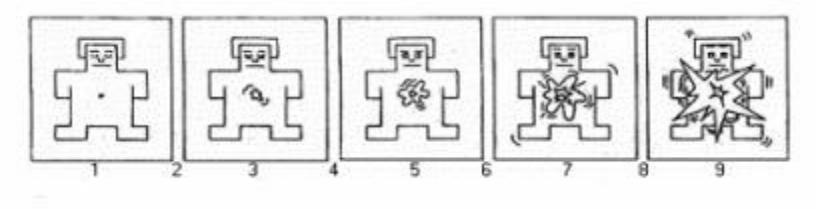
Valence dimension of the SAM



Note. Taken from Redondo *et al.* (2007).

Figure 4

Arousal dimension of the SAM



Note. Taken from Redondo *et al.* (2007).

Immediately after, the participants perform a surprise free recall task, to measure their level of retrieval of the stimuli, using a blank sheet of paper for them to write down the words they remember from the previous task (Appendix D). Finally, retrieval is assessed through a recognition task in which they select all the words they remember from the first task out of a list of 60 words (30 words from the original stimuli, plus 30 new ones) (Appendix E).

This study implemented the mixed factorial experimental plan, in other words, an "experimental plan that includes more than one independent variable and in which some participants are exposed to more than one modality of one of the variables, while others are exposed to only one modality of one of the variables" (Giroux & Tremblay, 2004, p. 272). As shown in the experimental plan outline below (Table 2), both experimental groups are exposed to all modalities of the variable of valence (negative, neutral and positive), but they only represent one modality of the variable of level of proficiency (Intermediate or Advanced).

Table 2

Experimental Plan

		Independent variable 1: Level of proficiency	
		Modality 1: Intermediate	Modality 2: Advanced
Independent variable 2: Valence	Modality 1: Negative	*X_1	*X_2
	Modality 2: Neutral	*X_1	*X_2
	Modality 2: Positive	*X_1	*X_2

Note. Own elaboration. X here represents the number of participants per experimental group.

8.4 Data analysis methods and instruments

The analysis of the data collected in the experimental tasks was done following the non-experimental correlational design, as mentioned above, to determine whether there is a cause-consequence relation between the independent and dependent measurements of the different variables (level of retrieval, level of proficiency, valence and arousal). As for the software, the analysis was conducted using *SPSS*, a program also employed by other studies such as the one of Sarli and Justel (2020). Consequently, this study made use of the Pearson correlation coefficient, "a statistical test to analyze the relationship between two variables measured at an interval or ratio level" (Hernández-Sampieri, Mendoza, 2018). This test does not define variables as independent or dependent, but only evaluates if there is a correlation

between them. As such, it does not regard causal notions; these must be determined theoretically.

This coefficient goes from -1 to 1, where these extremes mean a perfect correlation between the variables, as shown in the interpretations shown below in *Table 3*. If the sign of the coefficient is negative, it means a variable grows as the other decreases; if it is positive it means they grow together. Furthermore, the lower the value of significance(*s*) is, the more confidence there is that the correlation is true. For example, if *s* is equal or lower to 0.01, the coefficient is significant to the level of 0.01; in other words, there is a 99% of confidence that the relationship exists, and a 1% of error probability).

Table 3

Interpretations according to the Pearson correlation coefficient based on Sampieri and Mendoza (2018)

Pearson coefficient value (*r*)	**Interpretation**
-1.00	Perfect negative correlation
-0.90	Very strong negative correlation
-0.75	Considerable negative correlation
-0.50	Medium negative correlation
-0.25	Weak negative correlation
-0.10	Very weak negative correlation
0.00	Non-existent correlation
0.10	Very weak positive correlation
0.25	Weak positive correlation

0.50	Medium positive correlation
0.75	Considerable positive correlation
0.90	Very strong positive
1.00	Perfect negative correlation

9. Experimentation

9.1 Pilot

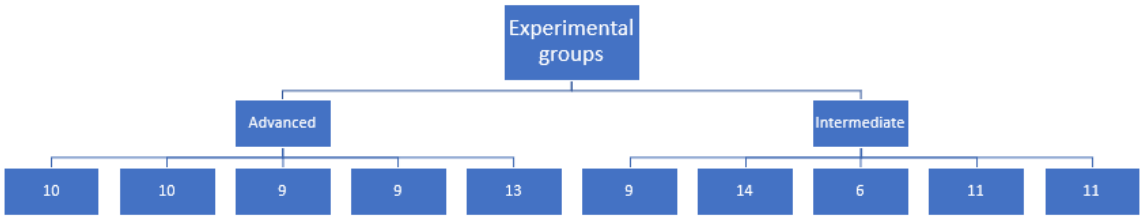
Two pilot experiments were carried out in the classes of Basic II and Intermediate I of the Pontificia Universidad Javeriana. These allowed the researchers to make several methodological decisions regarding variables and data collection methods: First, the original set of words, which included some in English and some in Spanish, was reduced to only those in the L2 (English). This decision was taken based on the interest of the present research, which is to compare how the emotion-working memory relationship varies according to level of proficiency in said language. In turn, the variable of language (L1 vs L2) was considered to be outside the scope of the present study.

Second, it was decided that only one questionnaire (LEAP-Q) would be used; which meant cutting a socio-demographic questionnaire and a language proficiency test. This decision is justified on three fronts: Literature suggests gender, social class and age of acquisition are not defining variables (Knickerbocker & Altarriba, 2013); the LEAP-Q has been proven to give an accurate portrayal of level of proficiency; and the application of these questionnaires would imply a significant time addition, which would reduce the chances of willing participation.

9.2 Experiment

Five experimental groups took part in the present research; five corresponding to the Advanced II classes and five to the Intermediate II of the PUJ. Two Advanced groups made out of 10 students, two of 9 students and one of 13, whereas the Intermediate groups were constituted by 9, 14, 6, and two of 11 students respectively. The selection of the groups was done through judgmental selection, based on the criterion of language proficiency level. The students were sent the LEAP-Q and informed consent (see Appendix A) previous to the application of the experimental tasks.

Figure 5
Participants' distribution among experimental groups



Note: *Own elaboration.*

The experiments were carried out in the classrooms corresponding to each of the classes. The researchers gave a brief introduction at the beginning and then pressed play on the instruction video, which was 20 minutes 30 seconds long and included an explanation of the terms “arousal” and “valence”, as well as instructions for each task. The instructions were given in the participants’ native language (Spanish) to ensure their understanding.

The first task (encoding) required students to rate the level of arousal and valence they associated with a word, using the chart that is shown in Appendix C. Before this, students were shown examples of its filling with words that were not included in the list to avoid bias. After a *beep*, each word appeared on a blank screen for 7 seconds; then participants had 15

seconds to mark down their ratings for both criteria. Participants were also asked to make a mark in the "Unknown" column during this time, if they did not recognize the word.

The second task (recall) requested students to write down as many words from the original list as they could remember (see Appendix D). They had 3 minutes to carry out this exercise; with a *beep* marking the beginning and ending of the timelapse. This task was administered without previous notice to avoid affecting the level of attention and concentration of the participants during the encoding task.

The third task (recognition) had the students look at a list of 60 words (30 corresponding to the original list, 30 new ones) and select those that were part of the original set. To do this, they could highlight, underline or circle the words. Participants were also given 3 minutes to carry out this task.

10. Results analysis

10.1 The LEAP-Q questionnaire

The LEAP-Q questionnaire allowed us to do a more profound characterization of the population that participated in the experiments. There were 64 women, 37 men and a non-binary person. Even when they mentioned that they were proficient in other languages, the main ones were Spanish and English for all of them. It is important to highlight that there was no significant difference between Intermediate and Advanced groups in terms of preferences of language for input or output, so they prefer on average to use Spanish 50% of the time and then English with around 40%. Regarding their cultural identification, they are mostly identified with Colombian culture. They have commonly had 16 years of formal education and they are currently enrolled in the teacher education program at PUJ.

There was also a question asking for their migration background, and it was evidenced that most of them have not emigrated, so they have spent all their life in Colombia, with some exceptions for short periods of time to countries like the United States, Spain, Canada, Mexico, Costa Rica, Bolivia; and one that migrated from Venezuela to India and then to Colombia. In terms of disability, a quarter of the population has visual problems, and less than 0,5% reported linguistic, auditive and/or learning difficulties. When asked about acquisition, students started acquiring Spanish from birth while English largely at 8 years of age, and expressed becoming proficient at 6 and 15 respectively. They perceive their proficiency in Spanish to be 8,9 for speaking, 9 for listening, and 8,6 for reading in a scale from 1 to 10, whereas for English they give account of 7,5 for speaking, 7,4 for listening and 8 for reading, which according to the questionnaire itself indicates a generally "very good" level for both languages.

Finally, their level of exposure to the languages varies due to their context. To illustrate, in a scale from 1 to 10, they rated their exposure to Spanish from their family is 9.5 while in English is 3,8, and reported their principal English input to be music and self-learning. Now, when asked for their principal learning contributors they selected interacting with friends, family and reading for Spanish, whereas multimedia content, reading and interacting with friends are the ones they commonly chose for English, which reflects the compensation of multimedia input when family does not speak the language. They answered that they have 3,6 of a foreign accent in Spanish and 5,8 in English, and they think that people can tell they are non-native speakers based on their accent 3,3 for Spanish and 6,7 for English in the scale from 1 to 10.

10.2 Experimental tasks

Hypothesis 1: Experimental arousal and valence ratings will match those of the ANEW, showing strong correlation.

When comparing the experimental ratings for valence with those of the ANEW, there seemed to be a very strong correlation between the two: 0.948 for intermediate and 0.940 for advanced following the Pearson coefficient, as shown in *Table 4*. This suggests that the scores established in the database and translated by Redondo *et al.* (2007) are valid for the population that interests the present research.

What is more, this correlation was significant to the level of 0.01. This means that there is almost full confidence that similar results would be obtained if the experiment were to be repeated with a sample that shares the characteristics of the present one.

Table 4

Correlation between experimentally-obtained valence ratings and those of the ANEW

		Valence inter.	Valence adv.	Valence ANEW
Valence inter.	Pearson correlation	1	,992*	,948*
	Sig (bilateral)		,000	,000
	N	30	30	30
Valence adv.	Pearson correlation	,992*	1	,940*
	Sig (bilateral)	,000		,000
	N	30	30	30
Valence ANEW	Pearson correlation	,948*	,940*	1
	Sig (bilateral)	,000	,000	
	N	30	30	30

Similarly, the arousal experimental scores in both intermediate and advanced exhibited a considerable correlation with those of the ANEW: 0.846 for the first and 0.840 for the latter, as seen below in *Table 5*. This, as stated before, cements the fact that the ANEW database is applicable in the current population. Furthermore, the Pearson coefficient for the relationship between the experimental data of the two levels also showed very strong correlation, with a score of 0.959. The significance of these results continues to be at the level of 0.01, which means that further experiments are bound to obtain the same results.

Table 5

Correlation between experimentally-obtained arousal ratings and those of the ANEW

		Arousal inter.	Arousal adv.	Arousal ANEW
Arousal inter.	Pearson correlation	1	,959*	,846*
	Sig (bilateral)		,000	,000
	N	30	30	30
Arousal adv.	Pearson correlation	,959*	1	,840*
	Sig (bilateral)	,000		,000
	N	30	30	30
Arousal ANEW	Pearson correlation	,846*	,840	1
	Sig (bilateral)	,000	,000	
	N	30	30	30

Hypothesis 2: The higher the level of language proficiency, the higher the level of retrieval will be.

The correlation between the level of language proficiency and the level of retrieval, the latter represented as the level of free recall and recognition, was weak. The correlation of Pearson between the level of proficiency and the free recall scores was of 0.166, and the one between proficiency and recognition scores was of 0.180 (Table 6). Thus, it can be inferred that there is not a positive nor a negative correlation between these variables, and consequently, it can be said that hypothesis two is false. The significance was considerable for both correlations, with a percentage of error of 9,5% for free recall and 7% for

recognition. This implies that results of similarly conditioned experiments may turn out to match the present ones.

Table 6

Correlation between the level of proficiency and the level of retrieval

		Proficiency	Free recall	Recognition
Proficiency	Pearson correlation	1	,166	,180
	Sig (bilateral)		,095	,070
	N	102	102	102

Hypothesis 3: The closer to the extremes of the emotional valence rating scale, the higher the level of retrieval will be.

According to the analysis of the data obtained in terms of emotional valence, and the mean values of free recall and recognition, there is a very weak correlation between the valence ratings and the level of retrieval, neither in the intermediate groups (Table 7) nor in the advanced ones (Table 8). The maximum value across these correlations was that of the crossing between valence and free recall in the intermediate bilinguals, which was of 0.205 according to Pearson.

Nonetheless, the significance for these correlations was considerably low: at the level of 0.278 for free recall in intermediate (27,8% of error), 0.376 for recognition in the same group (37,6% of error); and even worse for the advanced group with 0.744 (74,4% of error) and 0.938 (93,8% of error) for free recall and recognition respectively. This implies a high chance of variability if the tasks were to be applied similarly in future research.

Table 7

Correlation between the level of valence and the level of retrieval in intermediate groups

		Valence inter.	Free recall inter.	Recognition int.
Valence inter.	Pearson correlation	1	,205	,167
	Sig (bilateral)		,278	,376
	N	30	30	30
Free recall inter.	Pearson correlation	,205	1	,506*
	Sig (bilateral)	,278		,004
	N	30	30	30
Recognition int.	Pearson correlation	,167	,506*	1
	Sig (bilateral)	,376	,004	
	N	30	30	30

Table 8

Correlation between the level of valence and the level of retrieval in advanced groups

		Valence adv.	Free recall adv.	Recognition adv.
Valence adv.	Pearson correlation	1	,062	,015
	Sig (bilateral)		,744	,938
	N	30	30	30
Free recall adv.	Pearson correlation	,062	1	,458*
	Sig (bilateral)	,744		,011
	N	30	30	30
Recognition adv.	Pearson correlation	,015	,458*	1
	Sig (bilateral)	,938	,011	
	N	30	30	30

These results may be due to the fact that the coefficient of Pearson works linearly and this hypothesis calls for a bidirectional test. Thus, to contrast them and confirm whether the hypothesis is, in fact, null; the mean values discriminated by word type were checked (Table 9). This showed that the hypothesis is only accurate for the advanced group in the free recall task, where both the negative and positive words had higher ratings than the neutral ones. In the other cases, this pattern is not consistent, which points toward the same results as the correlations.

Table 9

Mean values for retrieval discriminated by word type

	Word type		
	Negative	**Neutral**	**Positive**
	Mean	**Mean**	**Mean**
Free recall inter.	2,60	2,90	3,22
Free recall adv.	3,10	2,88	3,34
Recognition int.	9,12	9,32	9,12
Recognition adv.	9,48	9,44	9,22

Hypothesis 4: The higher the rating for arousal for a word, the higher the level of retrieval will be.

According to the analyses, there is a weak correlation between the level of arousal and the level of retrieval. In terms of free recall, as illustrated in *Table 10* and *Table 11*, the relationship between the variables showed a coefficient of 0.129 in intermediate and 0.289 in

advanced. Similarly, the relationship between arousal and recognition also turned out to be low with scores of 0.169 and 0.150 for the respective groups. The significance values for these correlations, similarly to those of the valence, turned out to be quite low, with percentages of error ranging from 12,2% to 49,7%. This is to say, that there is a considerable possibility that these results will not hold if the experiments were to be repeated with another sample.

Table 10

Correlation between the level of arousal and the level of retrieval in intermediate groups

		Arousal inter.	**Free recall inter.**	**Recognition inter.**
Arousal inter.	Pearson correlation	1	,129	,169
	Sig (bilateral)		,497	,373
	N	30	30	30
Free recall inter.	Pearson correlation	,129	1	,506*
	Sig (bilateral)	,497		,004
	N	30	30	30
Recognition inter.	Pearson correlation	,169	,506*	1
	Sig (bilateral)	,373	,004	
	N	30	30	30

Table 11

Correlation between the level of arousal and the level of retrieval in advanced groups

		Arousal adv.	Free recall adv.	Recognition adv.
Arousal adv.	Pearson correlation	1	,289	,150
	Sig (bilateral)		,122	,429
	N	30	30	30
Free recall adv.	Pearson correlation	,289	1	,458*
	Sig (bilateral)	,122		,011
	N	30	30	30
Recognition adv.	Pearson correlation	,150	,458*	1
	Sig (bilateral)	,429	,011	
	N	30	30	30

11. Conclusion and discussion

11.1 Theoretical implications

11.1.1 The effect of proficiency on the level of retrieval

Following the line of study of Ferré *et al.* (2010) and Ong *et al*. (2017), this study took into consideration the proficiency level of participants, as the lack of presence of this variable was recognized in most research related to memory. Therefore, exploring this correlation was an unexplored path. That is the reason why other researchers hypothesized that the level of proficiency could have a crucial impact in retrieval figures reported by participants, but it showed no significant causal correlation.

This result leads to the conclusion that proficiency is, in fact, not a defining factor in the relationship between emotion-laden words and working memory. In this way, it joins other variables such as age of acquisition, gender, or social class in being determined as non-significant in experimental studies. This contributes to filling the research gap that was found in the field of interest, but as expected, is not a definite answer. The significance for this information was on average 91.75%, which is considerable but allows for a degree of variability in future iterations of the experiments.

A possible explanation for the low correlation between these two variables may be due to the type of sampling that was used. By implementing a judgmental process, largely based on the opportunity for application, done in groups that were divided in accordance with the already-established levels of language proficiency of the university, the groups might not have been properly discriminated in what corresponds to this variable. Sometimes, the level established by the language course that one is part of does not match the proficiency level that one has. Nonetheless, due to time and resources limitations, it was the sampling type that better suited our needs. This case would be similar to that of Íbañez (2021), whose language proficiency test did not allow him to precisely measure and classify the participants' level.

11.1.2 The effect of valence on the level retrieval

Regarding the variable of valence, previous studies reported positive words to cause higher chance of being retrieved by participants than negative ones (Heimberg, 2020; Sarli and Justel, 2020 and Íbañez-Neira, 2021). Nonetheless, the results obtained in the present study confirmed that correlation partially since it was presented only in the free-recall task, whereas for the recognition one the causal relation cannot be corroborated since the difference in the Intermediate group is inexistent and in the Advanced group it is opposed, similarly as observed by Ferré *et al.* (2010) where no significant difference was found.

These results join those of previous studies and contribute to the understanding of emotional valence among Spanish-English bilingual speakers. From the findings, it can be claimed that different valence types have a similar effect on the retrieval of linguistic stimuli from the working memory. This is to say that groups of words that are valenced positively, neutrally, or negatively do not exhibit a systematic advantage over others when it comes to language processing.

The reasons for these figures might have been due to the context or the participants' backgrounds. For instance, some of the positive words' meanings do not have a big cultural value, as is the case with the word success; or it may be because some of the negative stimuli used is relevant in the context, such as the words bullet or gun, which have a high significance in the Colombian and Latin-American history.

11.1.3 The effect of arousal on the level of retrieval

Though largely considered as a stimuli selection criterion, the analyses of previous research (Ferré *et al.*, 2010; Íbañez-Neira, 2021; Ong *et al.*, 2017; Sarli and Justel, 2020; Heimberg, 2020) tend to disregard the effect of arousal on the level of retrieval. Nevertheless, their literature reviews suggest that a higher emotional arousal, either negative or positive, influences working memory, lowering lexical processing speed and lowering accuracy when compared to neutral stimuli. For this reason, the present study decided to test the impact of arousal on the level of retrieval.

The results regarding the crossing of the two variables yielded a weak correlation. This suggests that despite variations in arousal, words are encoded, stored and retrieved in a similar way in the working memory. This goes to show that, although it is a useful criterion to select and classify emotion-laden terms, it may not have a considerable effect on the remembrance of them.

These findings are, however, open for discussion, since the degree of significance was substantially low for some of the crossings, which may be due to the sample size, as was the case for some studies that touch on the topic at hand (Baumeister *et al*., 2017; Íbañez-Neira, 2021). Significance tends to increase with bigger sample sizes because if a phenomenon is presented in the same way for a large group of people it is less likely that results vary when applying the experiments with other samples.

11.2 Methodological implications

11.2.1 Applicability of the ANEW in the chosen context

The results of the correlations between the experimentally obtained ratings for valence and arousal with those obtained from the ANEW and adapted to Spanish speakers by Redondo *et al*. (2007) showed that the database is applicable and valid in the chosen context. These findings are in opposition to those of Sarli and Justel (2020) who manifested the need to adapt the database to the Latin American context. This difference may be due to the screening of the words that was carried out prior to the selection of the words to be used in the tasks. Taking out cognates, possible mistranslations, and drastically different-length words might have been an adaptation in itself that allowed for a higher level of accuracy. Therefore, to some extent, it can be said that ANEW adapted to Spanish speakers can be used and can work effectively in the Bogota academic context if the study applies some filters.

11.2.2 Implementation of the LEAP-Q

It should also be underlined that the LEAP-Q adapted by Marian *et al.* (2007), whose use was identified in some studies of the state of the art, turned out to be a valuable tool to achieve a more detailed population characterization. Although the level of proficiency and the academic context of the individuals were known in advance thanks to the use of the

judgmental sampling technique, the questionnaire allowed the identification of other points of convergence such as their culture, their ages, their process of acquiring and learning English, and their self-perception of mastery. The latter being the most important for us, given that it is one of the analyzed variables. These findings matched those of previous studies which concluded that when the sample was taken from a similar context (Sarli and Justel, 2020), the characteristics of the subjects tend to coincide. All in all, the LEAP-Q allowed confirmation of the level of proficiency of participants, who perceived themselves as dominant bilinguals.

11.3 Pedagogical implications

As mentioned previously, the present study does not have a direct benefit to pedagogy; nonetheless, researchers recognize the importance of enriching teaching and/or learning methodologies with information from the field of study of neurolinguistics. This goes in line with Hussein (2022), who believes that knowledge about cognition is of paramount importance for language teachers. For instance, going back to said methodologies, the information obtained could be used as a starting point or the base from which they are built, as Ibarra and Martinez (2018) did by creating a set of strategies that tackled working memory in vocabulary learning.

Moreover, working within the Colombian context in this area of study is also valuable, as there is not abundant research in the field. Evidence-based teaching approaches grounded in neurolinguistic principles offer a more robust and reliable framework for teachers, promoting methods that have a solid foundation in the understanding of how the brain learns and processes language, and in this case, with contextualized results. This last element is highlighted because it is recognized that context can make a difference regarding research results and, consequently, learning necessities.

12. Limitations and future directions

A particularity that cannot be ignored about the present study is that the experiments were implemented using a group of stimuli in a single language (English), while most research in the area uses two languages and compares them (usually the native language versus English). The decision was taken in order to focus on the proficiency variable and to simplify the correlational design during the analysis process. Therefore, it is difficult in some aspects to juxtapose the results found with those of other studies. For example, when relationship results between level and arousal and retrieval are discriminated by language in Ong *et al.* (2017). Hence, it is advised to conduct further investigation including both Spanish and English stimuli.

Besides, thanks to the experiments carried out we identified other possible variables involved in the results. First, after conducting the pilots, some participants commented that they did not know certain words of the tasks; thus, the need to adapt the coding material was identified and a modification was made: to include a box where participants indicated whether the word was unknown to them. However, it was thought that this would not affect the actual experimental groups since the pilot was carried out at a lower level than the groups used in the study and the words were also filtered by level. Contrary to what was expected, some lacunas were reported, “wasp” being the main one noted among groups. Which could affect both your rating of it and your recall. Therefore, it would be interesting for future research to take it into consideration as a variable.

Another reason to urge researchers to continue exploring this topic is the limitation that we were presented with in terms of time, resources and available population. This might have had an effect on the results of this research due to outliers whose encoding ratings for valence and arousal differed greatly from the rest of the sample. To have more decisive

results, it is necessary to replicate the experiments in other settings in Bogotá and Colombia; even considering other university courses such as those of "*Inglés de servicios*" in order to have a bigger sample. This would help to have a more complete perspective of how the level of proficiency can influence the level of retrieval and whether the ANEW is accurately adapted to the Colombian population.

Furthermore, this study was made in the absence of economical support, contrary to the majority of the studies revised, which were given grants to their development that impacted the level and type of technology employed. Ergo the materials of the experiment were mainly the ones available in every classroom where the experiments were conducted, which means that even when there was an effort to have as homogenous conditions as possible among groups, there were discrepancies regarding illumination, background noise, chairs, and audio and image quality. It is important to recognize that the layout and quality of the materials for carrying out the experiments could affect the results of the participants between groups. Similarly, because of the lack of funding, the variable of processing speed was not able to be measured, unlike previous studies on the matter.

Finally, it is important to highlight the national and local research that was found in the area. Despite it not being copious, they are of great value towards understanding the variations of cognition in the Colombian context. From the researchers' epistemological perspective, it is considered relevant that studies based in our place of enunciation (Latin America) also contribute to the building of knowledge in positivist fields that have been historically dominated by the North. For this reason, we would like to call on those interested in continuing this line of inquiry to be motivated to carry out their own research.

References

ACTFL (2012). Proficiency guidelines. NY: American Council on Teaching of Foreign Languages. https://www.actfl.org/sites/default/files/guidelines/ACTFLProficiencyGuidelines2012.pdf

Agudelo, M. & Valencia, Y. (2021). *Bilingualism and cognition: analysis of executive function performance in bilingual and monolingual professors and teachers from institutions in Pereira.* [Bachelor Thesis, Universidad Tecnológica de Pereira]. Repositorio UTP. https://repositorio.utp.edu.co/items/1f45612c-7de6-4411-864b-e1139edcc8bf/full

American Psychological Association (n.d.). Emotional valence. In dictionary.apa.org. https://dictionary.apa.org/emotional-valence

Baumeister, J., Foroni, F., Conrad, M., Rumiati, R. & Winkielman, P. (2017). Embodiment and Emotional Memory in First vs. Second Language. *Frontiers in Psychology, 8:*394. https://doi.org/10.3389/fpsyg.2017.00394

Bloomfield, L. (1935). *Language.* Compton Printing LTD.

Bradley, M., & Lang, P. (1999). *Affective norms for English words (ANEW): Instruction manual and affective ratings.* Technical Report C-1, The Center for Research in Psychophysiology, University of Florida.

Bravo, C. (2014, July 14). The Importance of Defining L2 Proficiency for English as Foreign Language Learning and Teaching Assessment: A discussion in the current Chilean context.

https://www.academia.edu/16518571/The_Importance_of_Defining_L2_Proficiency_for_English_as_Foreign_Language_Learning_and_Teaching_Assessment

Byrne, J. (2003). *Learning and Memory.* (2nd ed.). The Gale Group, Inc.

Cambridge (n.d.). *English language assessment: General English.* https://www.cambridgeenglish.org/test-your-english/general-english/

Creswell, J.W., & Creswell, J.D. (2018). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (5th ed.). SAGE publications.

Corballis, M. (2019). *Language, Memory, and Mental Time Travel: An Evolutionary Perspective.* Front. Hum. Neurosci. 13:217. doi: 10.3389/fnhum.2019.00217

Cummins, J. (2000). Putting Language Proficiency. English in Europe: The acquisition of a third language, 19, 54. https://books.google.com.mx/books?hl=es&lr=&id=iaEGdFnQDJcC&oi=fnd&pg=PA54&dq=language+proficiency+&ots=aza_CrZpYJ&sig=e6To2vRBQLTzUp2Jw5d4Sxhn28Y

Dewey, J. (1985). The Theory of Emotion. (2) The Significance of Emotions. *Psychological Review 2*, 13-32.

Diaz Abrahan, V., Benitez, M., Bossio, M., Sarli, L. & Justel, N. (2021). Memoria emocional. Una revisión sistemática sobre la capacidad modulatoria de la música, la actividad física y el bilingüismo. *Revista de Psicología, 20*(1), 193-220. doi: 10.24215/2422572Xe068

Dziak, M. (2023). *Correlational research.* Salem Press Encyclopedia

Ebbinghaus, H. (1885/1913). *Memory: A Contribution to Experimental Psychology*. (Transl: Ruger, H. & Bussenius, C.). Teachers College.

Ekman, P. & Davidson, R.(1994). *The Nature of Emotion: Fundamental Questions (Series in Affective Science).* (1st ed.) Oxford University Press.

Ekman, P., Sorenson, E., & Friesen, W. (1969). Pan-cultural elements in facial displays of emotions. *Science*, 64(3875), 86-88. https://doi.org/10.1126/science.164.3875.86

Fan, L., Xu, Q., Wang, X., Xu, F., Yang, Y. & Lu, Z. (2018). The automatic activation of emotion words measured using the emotional face-word Stroop task in late Chinese–English bilinguals, *Cognition & Emotion, 32*(2), 315-324. https://doi.org/10.1080/02699931.2017.1303451

Ferré, P., García, T., Fraga, I., Sánchez-Casas, R., & Molero, M. (2010). Memory for emotional words in bilinguals: Do words have the same emotional intensity in the first and in the second language? Cognition & Emotion, 24(5), 760–785. https://doi-org.ezproxy.javeriana.edu.co/10.1080/02699930902985779

Field, F. (2011). *Key concepts in bilingualism.* (2011a ed.). Red Globe Press.

Fontaine, J. R. J., Scherer, K. R., Roesch, E. B., & Ellsworth, P. C. (2007). The World of Emotions is not Two-Dimensional. Psychological Science, 18(12), 1050–1057. https://doi.org/10.1111/j.1467-9280.2007.02024.x

Graziano, A & Raulin, M. (1993). *Research methods: A process of inquiry* (2nd ed.). HarperCollins College Publishers.

Giroux, S. & Tremblay, G. (2004). *Metodología de las Ciencias humanas. La investigación en acción.* (B. Álvarez, Trans.). Fondo de Cultura Económica. (Original work published 2002).

Heimberg, B. (2020). *The effect of emotionally valenced stimuli on working memory: A linguistic comparison*. Available from ProQuest Central; ProQuest Dissertations & Theses A&I. https://www.proquest.com/dissertations-theses/effect-emotionally-valenced-stimuli-on-working/docview/2498538207/se-2?accountid=13250

Hernández, R., Fernández, C. & Baptista, P. (2014). *Metodología de la investigación.* (6a. ed). McGraw-Hill. https://ia803103.us.archive.org/16/items/hernandezetal.metodologiadelainvestigacion/Hern%C3%A1ndez%20et%20al.%20-%20Metodolog%C3%ADa%20de%20la%20investigaci%C3%B3n.pdf

Hernández-Sampieri, R., & Mendoza Torres, C. P. (2018). Metodología de la investigación. Ciudad de México: McGraw-Hill Interamericana. https://ebookcentral.proquest.com/lib/[SITE_ID]/detail.action?docID=5485814

Hussein, A (2022). Deep Learning in Language Teaching and Learning. https://www.researchgate.net/publication/362225385_Deep_Learning_in_Language_Teaching_and_Learning

Ibanez Neira, D. (2021). *Pillow, pig, Poison : valencia emocional y su efecto sobre el procesamiento lingüístico en bilingües.* [Master Thesis, Universidad de Concepción]. Repositorio Bibliotecas UdeC. http://repositorio.udec.cl/jspui/handle/11594/6468

Ibarra-Santacruz, D., & Martínez, D. (2018). Can Working Memory Strategies Enhance English Vocabulary Learning?. *How*, *25*(2), 29-47. https://doi.org/10.19183/how.25.2.410

Knickerbocker, H., & Altarriba, J. (2013). Differential repetition blindness with emotion and emotion-laden word types. *Visual Cognition*, 21:5, 599-627. doi: 10.1080/13506285.2013.815297

Kostin, N. (2018). Working with Emotions in the Context of Psycholinguistics and Affective Computing. *Scrib.* https://es.scribd.com/read/423401616/Working-with-Emotions-in-the-Context-of-Psycholinguistics-and-Affective-Computing

Langley, A. (2019). *Inhibition control in proficient spanish-english late-bilingual and spanish monolingual adults in Colombia* [Master Thesis, Universidad de los Andes]. Repositorio institucional Séneca. .https://repositorio.uniandes.edu.co/handle/1992/35060

LeDoux, J. (1999). El Cerebro Emocional. Buenos Aires: Planeta

Levenson, R. (1992). Autonomic nervous system differences among emotions. *Psychological Science, 3*(1), 23–27. https://doi.org/10.1111/j.1467-9280.1992.tb00251.x

Limberg, D., Gnilka, P. B., & Broda, M. (2021). Advancing the Counseling Profession by Examining Relationships Between Variables. *Journal of Counseling & Development*, *99*(2), 145–155. https://doi.org/10.1002/jcad.12362

Lockhart, R. S. (2001). Memory retrieval. In N. J. Smelser, & P. B. Baltes (Eds.), *International encyclopedia of the social & behavioral sciences* (pp. 9613-9618). Oxford: Pergamon. doi:https://doi.org/10.1016/B0-08-043076-7/01523-0

Macnamara, J. (1967). The bilingual's linguistic performance—a psychological overview. *Journal of social issues*, *23*(2), 58-77. https://spssi.onlinelibrary.wiley.com/doi/abs/10.1111/j.1540-4560.1967.tb00576.x

Malhotra, N. & Birks, D. (2006). *Marketing Research: An Applied Approach*. Harlow, FT/Prentice Hall.

Marian, Blumenfeld, & Kaushanskaya (2007). The Language Experience and Proficiency Questionnaire (LEAP-Q): Assessing language profiles in bilinguals and multilinguals. *Journal of Speech Language and Hearing Research*, *50* (4), 940-967.

Maxwell, J. (1996). *Qualitative Research Design: An Interactive Approach.* London: Applied Social Research Methods Series.

McLeod, S. (2013). Stages of Memory: Encoding Storage and Retrieval. *SimplyPsychology*. https://www.simplypsychology.org/memory.html

Miller, G. A. (1956). The magical number seven, plus or minus two: Some limits on our capacity for processing information. *Psychological Review, 63*(2): 81–97.

Pavlenko, A. (2008). Emotion and emotion-laden words in the bilingual lexicon. *Bilingualism: Language and cognition*, *11*(2), 147-164. https://www.researchgate.net/publication/231890315_Emotion_and_emotion-laden_words_in_the_lexicon

Ong, E., Hussain, S., Chow, Y. & Thompson, C. (2017, March). *Variations in bilingual processing of positive and negative information* [Conference paper].6th Annual International Conference on Cognitive and Behavioral Psychology (CBP), Singapore. doi:10.5176/2251-1865_cbp17.14

Ortony, A., Clore, G. L., and Collins, A. (1990). *The Cog-nitive Structure of Emotions.* Cambridge UniversityPress

Redondo, J., Fraga, I., Padrón, I., & Comesaña, M. (2007). The Spanish adaptation of ANEW (affective norms for English words). *Behavior research methods, 39*(3), 600–605. https://doi.org/10.3758/bf03193031

Reinhart, A. (2017). Multivariate Analysis of Variance (MANOVA). In Allen, M. (Ed.), *The SAGE Encyclopedia of Communication Research Methods.* (p. 1059). SAGE Publications, Inc. https://dx.doi.org/10.4135/9781483381411

Rudner, M. (2018). *Working Memory for Linguistic and Non-linguistic Manual Gestures: Evidence, Theory, and Application*. Front. Psychol. 9:679. doi: 10.3389/fpsyg.2018.00679

Russell, J. A. (1980). A circumplex model of affect. Journal of Personality and Social Psychology, 39(6), 1161-1178. doi:10.1037/h0077714

Sarli, L., & Justel, N. (2020). Adquisición y Recuerdo de Palabras Emocionales en Población Monolingüe y Bilingüe. *Revista Colombiana de Psicología*, *29*(2), 25–40. https://doi-org.ezproxy.javeriana.edu.co/10.15446/rcp.v29n2.78445.

Scripnic, G. (2021). Refining the perspectives on language proficiency: Bilingualism and true bilingualism. Cultural Intertexts, 11, 205-218. Retrieved from https://login.ezproxy.javeriana.edu.co/login?qurl=https%3A%2F%2Fwww.proquest.com%2Fscholarly-journals%2Frefining-perspectives-on-language-proficiency%2Fdocview%2F2617716761%2Fse-2

Schroeder SR (2019). *Do Changes in Language Context Affect Visual Memory in Bilinguals*? Front. Hum. Neurosci. 13:364. doi: 10.3389/fnhum.2019.00364

Spelman, E. V. (1989), 'Anger and Insubordination' in A. Garry and M. Pearsall (eds), *Women, Knowledge, and Reality: Explorations in Feminist Philosophy*, Boston: Unwin Hyman.

Tabachnick, B. & Fidell, L. (2013). *Using Multivariate Statistics* (6th ed.). Boston, MA: Pearson.

The Human Memory (2022). *Memory Recall and Retrieval System*. https://human-memory.net/memory-recall-retrieval/#Recall

Westfall, L. (2016). Sampling Methods Excerpt from The Certified Software Quality Engineer Handbook. https://kajabi-storefronts-production.s3.amazonaws.com/sites/69255/themes/2149842111/downloads/IHrhnXpIShOUIuvRhouL_Sampling_Methods.pdf

White, H., & Sabarwal, S. (2014). Quasi-experimental design and methods. *Methodological briefs: impact evaluation*, *8*(2014), 1-16. https://www.researchgate.net/profile/Sharanbasappa-Durg/post/Can_a_quasi-experimental_design_be_retrospective/attachment/59d63c4179197b80779993a1/AS%3A414509891112960%401475838267060/download/Brief_8_quasi-experimental+design_eng.pdf

Xu, X.-Y., Niu, W.-B., Jia, Q.-D., Nthoiwa, L., & Li, L.-W. (2021). Why Do Viewers Engage in Video Game Streaming? The Perspective of Cognitive Emotion Theory and the

Moderation Effect of Personal Characteristics. *Sustainability*, *13*(21), 11990. MDPI AG. http://dx.doi.org/10.3390/su132111990

Appendix A

Informed consent

PONTIFICIA UNIVERSIDAD JAVERIANA
Facultad de Comunicación y Lenguaje
Licenciatura en Lenguas Modernas con énfasis en inglés y francés
The Effect of Emotion on Cognition in Advanced and Intermediate Spanish-English Bilinguals
Investigadores: María José Loaiza Hernandez y Jhoiner Santiago Rodriguez Neira
Profesor guía: Andrés Hernandez Perdomo

DOCUMENTO DE CONSENTIMIENTO INFORMADO PARA LA PARTICIPACIÓN EN EL ESTUDIO DE INVESTIGACIÓN

Antes de su participación en este estudio usted tiene el derecho a obtener toda la información relativa a los procedimientos que se utilizarán en el mismo. Por ello, en esta página se le proporciona, deberá leer detenidamente el documento antes de participar en el estudio. No dude preguntar a los investigadores responsables si tiene alguna inquietud o si necesita alguna aclaración bien sea antes, durante o después de hacer parte del estudio.

INVESTIGADORES RESPONSABLES
Nombre: María José Loaiza Hernandez
Correo: loaizahmj@javeriana.edu.co

Nombre: Jhoiner Santiago Rodriguez Neira
Correo: rodriguez.jhoiner@javeriana.edu.co

PROFESOR GUÍA
Nombre: Andrés Hernandez Perdomo
Correo: andres_hernandez@javeriana.edu.co

INTRODUCCIÓN
Se le invita a participar en el estudio en el marco de una investigación de pregrado para optar por el título de Licenciado en Lenguas Modernas con énfasis en inglés y francés de la Pontificia Universidad Javeriana.

OBJETIVO DEL ESTUDIO

Determinar cómo la emoción influencia procesos cognitivos en personas bilingües en inglés-español dependiendo de su nivel de dominio de lengua.

PROCEDIMIENTO

Se espera que tome parte en 3 tareas que permitirán medir el efecto de la emoción en la cognición. La realización de estas tareas se hará en 1 sesión de 30 a 45 minutos máximo.

BENEFICIOS

Se espera que su participación en este estudio contribuya a comprender cómo los hablantes de inglés como segunda lengua procesan palabras con distintas características semánticas y emocionales según su nivel de dominio del mismo.

RIESGOS

El estudio que se llevará no implica ningún riesgo para su salud.

CONFIDENCIALIDAD

Su identidad como participante en este estudio se mantendrá de forma confidencial, no se revelará bajo ninguna circunstancia y tampoco aparecerá su nombre en ningún informe o publicación derivada de este

estudio. Los investigadores responsables custodiarán los datos de este estudio, identificando con claves los nombres de cada participante y regulando la información en su computador.

COSTOS

Su participación no tendrá costo alguno para usted.

COMPENSACIÓN

Usted no recibirá compensación económica por su participación en este estudio porque el proyecto no contempla financiamiento para pagar a los participantes.

DERECHO A RETIRARSE DEL ESTUDIO

Su participación en el estudio es libre y voluntaria. Tiene derecho a retirarse del estudio en cualquier momento, y su decisión no afectará, bajo ningún concepto, su relación profesional con los investigadores o profesores.

CONTACTOS

En cualquier momento, podrá solicitar información adicional a los investigadores responsables sobre cualquier duda o aclaración que necesite. Si usted tiene alguna pregunta acerca de los derechos como participante en esta investigación o siente vulnerados sus derechos, usted puede escribir un correo a la facultad de Comunicación y Lenguaje (comunicacionylenguaje@javeriana.edu.co).

DECLARACIÓN DE CONSENTIMIENTO INFORMADO

Yo, _____ declaro que he leído (o se me han leído) las hojas de información que se me han entregado. He podido hacer preguntas sobre las características del estudio. He recibido suficiente información sobre el estudio. Comprendo que mi participación es libre. Comprendo que puedo retirarme del estudio en cualquier momento. Presto libremente mi conformidad a participar en la investigación. Mi consentimiento es libre y no ha sido forzado u obligado.

_____ _____

Fecha Firma del participante

_____

Firma de los investigadores responsables

_____

Firma del asesor de tesis

Appendix B

Sets of linguistic stimuli

Positive			Neutral			Negative			
E.W	M.V	M.A	E.W	M.V	M.A	E.W	M.V	M.A	
couple	7,91	7,08	cabinet	5,1	4,31	wasp	2,54	7,01	
adventure	7,76	7,62	seat	5,7	4	bullet	2,01	7,18	
party	8,26	7,66	white	6,1	3,99	beast	2,8	6,88	
birthday	7,54	6,74	basket	5,18	3,79	gun	2,08	6,41	
treat	7,86	6,79	custom	5,43	4,32	punishment	1,87	6,41	
wish	7,98	7,31	milk	5,83	4,07	mistake	2,62	6,4	
fun	8,32	7,68	butter	5,2	4,03	thief	1,93	6,98	
achievement	8,01	6,99	plain	5,18	3,84	crash	2,01	6,93	
chance	7,91	7,07	key	5,57	4,28	trouble	1,89	6,56	
success	7,69	6,83	salad	6,12	4,17	noisy	2,63	6,93	Encoding task
travel	7.84	7.39	lighthouse	5,48	4,2	shriek	2,78	6,78	
win	7,84	7,68	appliance	5,1	4,02	jealousy	2,27	6,87	
joy	7,61	6,92	lantern	5,11	4,22	severe	1,89	6,83	
intercourse	7,26	7,58	carefree	5,07	4	hurt	1,98	6,73	
vigorous	7,16	6,88	god	5,59	4,29	rage	2,11	7,58	
excitement	7,86	7,49	meek	5,9	3,51	fight	2,4	6,67	
applause	7,67	7,39	gentle	5,64	4,13	anger	2,5	7,33	
rescue	7,27	7	honey	5,46	4,06	hostage	1,74	6,39	
triumph	7,89	7,03	windmill	5,36	4,22	corpse	1,41	6,87	Recognition
champion	7,39	6,77	fabric	5,11	4,24	fear	1,96	6,9	task

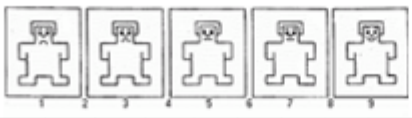
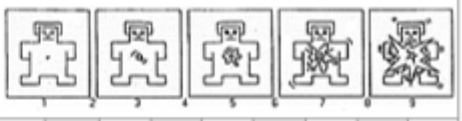
Appendix C

Encoding task

CODE:

Tarea de codificación

En la pantalla se van a presentar palabras por 7 segundos cada una. Califique cada palabra de uno a nueve según como le hace sentir, yendo de negativo a positivo en valencia y de relajación/no activo a activo en activación, para esto cuenta con 15 segundos. Puede usar las imágenes de la escala como guía. Si no conoce la palabra, marque con una X la casilla de palabra desconocida y califíquela igualmente.

Palabra	Desconocida	Valencia									Activación								
																			
		1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
1																			
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			
11																			
12																			
13																			
14																			
15																			
16																			
17																			
18																			
19																			
20																			
21																			
22																			
23																			
24																			
25																			
26																			
27																			
28																			
29																			
30																			

Appendix D

Free recall task

Escriba todas las palabras que recuerde de la tarea anterior en el espacio a continuación:

Appendix E

Recognition task

A continuación, se le presentará un grupo de 60 palabras. Seleccione las palabras que reconoce de la primera tarea.

mistake	carefree	champion	travel	thief	lighthouse
hurt	adventure	appliance	white	jealousy	corpse
fun	hostage	cabinet	fight	crash	triumph
treat	wish	shriek	achievement	plain	key
severe	win	punishment	god	rescue	birthday
noisy	basket	lantern	couple	success	milk
fear	vigorous	joy	custom	excitement	anger
applause	butter	party	seat	meek	wasp
rage	salad	trouble	fabric	windmill	bullet
beast	intercourse	gentle	honey	chance	gun