Daniel Reschke Pires

# L2 VOCABULARY INSTRUCTION: AN ANALYSIS OF SMARTPHONE APPLICATIONS FOR ENGLISH LEARNING

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

Florianópolis
2018

Ficha de identificação da obra elaborada pelo autor,
através do Programa de Geração Automática da Biblioteca Universitária da UFSC.

Pires, Daniel
L2 Vocabulary Instruction : An Analysis of Smartphone Applications for English Learning / Daniel Pires ; orientador, Celso Henrique Soufen Tumolo, 2018.
140 p.

Dissertação (mestrado) - Universidade Federal de Santa Catarina, Centro de Comunicação e Expressão, Programa de Pós-Graduação em Inglês: Estudos Linguísticos e Literários, Florianópolis, 2018.

Inclui referências.

1. Inglês: Estudos Linguísticos e Literários. 2. Instrução de vocabulário . 3. Aprendizagem de Línguas Assistida por Dispositivos Móveis (ALADIM). 4. Aplicativos de smartphone. 5. Lingua estrangeira. I. Soufen Tumolo, Celso Henrique. II. Universidade Federal de Santa Catarina. Programa de Pós-Graduação em Inglês: Estudos Linguísticos e Literários. III. Título.

Daniel Reschke Pires

**L2 VOCABULARY INSTRUCTION: AN ANALYSIS OF SMARTPHONE APPLICATIONS FOR ENGLISH LEARNING**

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

Florianópolis, 20 de fevereiro de 2018.

_____

Dr. Celso Henrique Soufen Tumolo
Coordenador do Curso

To my family,
especially to my mother.

## ACKNOWLEDGEMENTS

I would like to thank those who helped me along the arduous journey which is to write a thesis. First of all, I would like to thank my advisor, Celso Henrique Soufen Tumolo, who helped me a lot along this journey. His input and feedback guided me throughout the process of writing the thesis, and his support and openmindness motivated me to pursue my goals. I am also thankful for the knowledge and guidance given by all professors from PPGI UFSC, specially from professor Lêda Maria Braga Tomitch, whose expertise in academic writing (and many other fields) proved to be valuable. Furthermore, I have to express my gratitude to Gloria Gil and Juliana Bergmann, who kindly accepted to be members of the thesis committee. I also acknowledge the financial support provided by CAPES, which allowed me to carry out my research and share what I have learned in congresses and conferences in Brazil and abroad. I hope this type of support can still be given in the future to many other researchers in the country.

I would also like to thank my mother for being my safe harbor, for being the one to reassure me of what I can do even if she herself was going through some rough times. A big thanks to my colleagues for sharing moments of joy and also some moments of anxiety.

Finally, I would like to thank those who provide free access to books and journals on the internet. Without this, it would quite hard to have access to some of the readings necessary for this thesis.

Sou um técnico, mas tenho técnica só dentro da técnica.
Fora disso sou doido, com todo o direito a sê-lo.
Com todo o direito a sê-lo, ouviram?
(Álvaro de Campos).

## RESUMO

Os avanços na área de técnologia móvel tornaram os smartphones mais acessíveis e poderosos, o que levou ao crescimento da Aprendizagem de Línguas Assistida por Dispositivos Móveis (ALADIM). Levando em conta que a língua inglesa é a língua mais estudada por meio de aplicativos para smartphone (Sonnad, 2016) e que a maioria dos aplicativos para o aprendizado de inglês tem como foco principal a instrução de vocabulário (Kim & Kwon, 2012), este estudo buscou analisar seis aplicarivos para smartphone que podem ser usados para o aprendizado de vocabulário da língua inglesa. Mais especificamente, investigou-se: a) como novos itens lexicais são apresentados, revisados e consolidados pelos aplicativos; b) como os aplicativos incorporam elementos da literatura sobre aprendizado de vocabulário, tais como o trabalho com diferentes aspectos do conhecimento de uma palavra, múltiplos encontros com as palavras-alvo e o uso de línguagem não-verbal para ao ensino de vocabulário; e c) quais teorias de aprendizagem e métodos de esino de segunda língua parecem influenciar os aplicativos. Para a coleta de dados, seis aplicativos foram escolhidos seguindo critérios para assegurar que tivessem um número significativo de usuários. Os aplicativos foram analisados levando em consideração obras relevantes para o desenvolvimento de vocabulário, tais como Brown e Payne (1994, *apud* Hatch & Brown, 1995), Laufer (1997), Sökmen (1997) e Takač (2008). Os resultados mostram que os aplicativos: a) apresentam, revisam e consolidam vocabulário por meio da tradução da L1 para a L2, e vice-versa; b) ensinam a forma escrita e a forma oral das palavras, mas não trabalham com outros aspectos do conhecimento das palavras como o conhecimento das relações lexicais e aspectos ligados à sintaxe; c) permitem múltiplos encontros com as palavras-alvo, porém esses encontros são, na maioria das vezes, concentrados; d) fazem uso de imagens e vídeos para representar vocabulário de formal não-verbal; e e) aparentam ser influenciados pelo Behaviorismo e pelos métodos de Gramática-Tradução e Audiolingual.



**Palavras-chave**: Instrução de vocabulário; ALADIM; aplicativos de smartphone; L2.

**Número de páginas:** 140 **Número de Palavras:** 35.509

## ABSTRACT

The advancements in mobile technology have made smartphones more accessible and more powerful, which has led to the growth of the field of Mobile Assisted Language Learning (MALL). Considering that English is the most studied language through smartphone applications (Sonnad, 2016), and that most of the applications for English learning deal predominantly with vocabulary instruction (Kim & Kwon, 2012), this study aimed at analyzing six smartphone applications that can be used for English vocabulary learning. More specifically, it investigated a) how new lexical items are presented, reviewed and consolidated in these applications; b) how the applications incorporate elements from the literature in vocabulary learning, such as aspects of word knowledge, multiple encounters with words, and nonverbal representations of vocabulary; and c) what learning theories and language teaching methods seem to influence the applications. For the data collection, six smartphone applications were chosen following criteria to ensure that they were used by a significant number of users. The applications were analyzed taking into consideration literature that is relevant for the development of vocabulary, including Brown and Payne (1994, as cited in Hatch & Brown, 1995), Laufer (1997), Sökmen (1997) and Takač (2008). The results showed that the applications: a) present, review and consolidate vocabulary mostly through translation from the L1 into the L2, or vice-versa b) instruct the spoken and written form of words, but do often neglect other aspects of word knowledge such as knowledge of lexical relations and syntactic behavior; c) provide multiple encounters with the target vocabulary, but these are mostly massed; d) employ images and videos as nonverbal representations of target vocabulary; and e) seem to be influenced mostly by Behaviorism and by the Grammar-Translation and Audiolingual methods.



**Keywords**: Vocabulary instruction; MALL; smartphone applications; L2.

**Number of pages:** 139 **Number of words:** 35402

## LIST OF FIGURES

**TABLES LIST**

## ABBREVIATIONS LIST

ALM……...……..…….Audiolingual Method
CALL……...……Computer Assisted Language Learning
EAP……..……English for Academic Purposes
EFL……..……...…..English as a Foreign Language
ESL……..……..….English as a Second Language
ESP…….……..……...….English for Specific Purposes
L1……..……..……...…. First Language
L2…….....……...….Second Language
MALL……..……..…...Mobile Assisted Language Learning
PC…….....……..Personal Computer
UNESCO……..... United Nations Educational, Scientific and Cultural Organization
SLA……....Second Language Acquisition

## TABLE OF CONTENTS

## 1. INTRODUCTION

Once viewed as a neglected aspect of language learning (Meara, 1980, Carter, 2012), it is now widely accepted that vocabulary acquisition is an essential aspect of learning a language. Chapelle and Jamieson (2008) understand vocabulary as the building blocks of a language. They also point out that when learners encounter unfamiliar words, they need help from a teacher, a dictionary or a computer to properly acquire them. In this regard, computers and, more recently, mobile devices such as smartphones and tablets have been explored as a tool to assist language learning and, more specifically, vocabulary acquisition.

In the past decades, computers have become a valuable tool to second language teachers and students alike. The field which studies the use of computers to enhance language learning is called Computer Assisted Language Learning (thereafter CALL). In the words of Levy (1997), CALL is the search for and study of applications of computer in language teaching and learning. The field has grown consistently since its early days (1970s) and has since then been accepted as a recognized area of scholarship. During the past decade, digital devices have become more accessible which in turn have made possible for more people to explore these devices as an educational tool.

Only two decades ago, language learners who used CALL would be limited to tutorial programs in floppy disks or CD-ROMs; nowadays, there are thousands of language learning applications (or apps) available, with electronic support from not only computers, but also smaller and more portable devices, such as mobile phones (Thomas, Hayo & Warschauer, 2014). Because of this, a subset of CALL has recently emerged: MALL. The acronym stands for Mobile Assisted Language Learning and it encompasses the use of mobile technologies to enhance language acquisition (Chinnery, 2006).

MALL is a more recent field of study than CALL. Still, they are closely related fields as both involve computerized tools to assist language learning. As Stockwell (2012) acknowledges, MALL is not a fully independent field since it is directly connected to Second Language Acquisition (SLA), mobile learning in general and CALL. Thus, the study of MALL should take into consideration not only what is unique to the field, but also elements from its closely allied fields, namely SLA, mobile learning and CALL (Stockwell, 2012, p. 2).

Although the field of MALL is still an emerging one, a number of studies has recognized that mobile technology can be a valuable tool for language learning (Naismith et al, 2004; Stockwell, 2008; Ranalli, 2008;

Attewell & Savill-Smith, 2003). Recent studies have showed that most of the applications for English learning deal predominantly with vocabulary instruction (Kim & Kwon, 2012). With this in mind, the purpose of this study is to investigate smartphone applications for English learning that can be used for vocabulary development.

## 1.1 OBJECTIVES

### 1.1.1 General objective

This study aimed at investigating six smartphone applications for English learning that can be used for vocabulary development.

### 1.1.2 Specific objectives

The specific objectives of this study were:

- To examine the sources for the presentation, review and consolidation of new lexical items from the selected applications.
- To examine how the applications incorporate elements from the literature in vocabulary learning.
- To investigate the relation between the applications and learning theories, such as Behaviorism, and second language teaching methods[1], such as the Grammar-Translation method.

## 1.2 RESEARCH QUESTIONS

R1.) What are the sources for the presentation, review and consolidation of new lexical items in the selected applications?

R2.) What aspects of word-knowledge do the applications develop?

R3.) Do the applications provide a number of encounters with the target vocabulary? Are encounters massed or spaced?

R4.) What are the nonverbal representations employed and how can they assist the instruction of vocabulary?

---

[1] This study understands that a method "is a set of classroom specifications for accomplishing linguistic objectives" (Brown, 1994). The study does not attempt to distinguish approaches from methods, as they are often used interchangeably. These terms will be used according to the referential works mentioned. For more on the discussion between the terms, check Brown (1994) and Richards and Rodgers (1996).

R5.) What learning theories and language teaching methods seem to influence them?

## 1.2 SIGNIFICANCE OF THE RESEARCH

The continuous advancements in mobile technology have made smartphones more accessible and more powerful. This has led to an increase in the number of smartphones applications for language learning and in the number of people learning a language with them. Considering that English is the most studied language through smartphone applications (Sonnad, 2016), and most of the applications for English learning deal predominantly with vocabulary instruction (Kim & Kwon, 2012), investigation which takes into account the development of vocabulary in applications for English learning is necessary.

This study aims at contributing to the growing field of MALL by providing an analysis of six smartphone applications for English learning. With this analysis, the researcher expects to provide information on how these applications instruct vocabulary and what learning theories and language teaching methods influenced them. The results can be useful for other researchers of SLA and for teachers and learners of English who take interest in mobile learning.

## 1.3 ORGANIZATION OF THE REPORT

This study is organized as follows: chapter 2, a review of literature, presents the theoretical background for this study. This chapter begins with a review of learning theories such as Behaviorism and Constructivism and their place in mobile learning, followed by a review of language teaching methods, such as the Audiolingual method, and the role vocabulary played in them. Next, a review on vocabulary knowledge is presented, followed by literature on vocabulary instruction and learning. Finally, an overview of MALL is presented.

In chapter 3, the method applied in this study is explained, detailing the procedures adopted to select the applications, to collect data from them and to analyze them. Chapter 4 presents the results from the data analysis along with a general discussion for each of the applications selected for the study. Finally, chapter 5 provides answers for the research questions of this study, offering conclusions based on their analysis. In addition, chapter 5 discusses the limitations of the study and provides possible pedagogical implications derived from its findings.

# 2. REVIEW OF LITERATURE

This chapter provides the theoretical basis of this study. The first section, 2.1, presents an overview on learning theories and what recent studies have indicated in terms of their relationship to MALL. The second section, 2.2, reviews prevailing language learning methods and the role of vocabulary in them. The third section, 2.3, brings relevant literature on vocabulary knowledge, discussing what the different aspects of word knowledge and the differences between passive and active vocabulary knowledge. Then, section 2.4 reviews literature on vocabulary learning and instruction. Finally, section 2.5 provides an overview of MALL, explaining its origins in CALL, detailing what makes it specific and reviewing research considered relevant to this study.

## 2.1 LEARNING THEORIES AND THEIR PLACE IN MOBILE LEARNING

As mobile technology becomes more accessible, the number of smartphone users increases rapidly. Consequently, more and more mobile learning applications are being developed. It is necessary, in this context, to understand the learning theories which may influence the development of applications. The main theories and areas of learning relevant to learning with technology include behaviorism, constructivism and situated learning. (Naismith et al, 2004; Guo, 2014).

Behaviorist theory was proposed in the early 20th century. Among its first authors were Ivan Pavlov and John Watson. In behaviorism, the association between a stimulus and a response is facilitated through reinforcement. Skinner (1957) is perhaps the most influential work when it comes to language teaching and behaviorism. The author postulates that in every verbal behavior there are three important events: a stimulus, a response and a reinforcement. Skinner argued for the importance of reinforcement. In his view, when learners are given positive reinforcement, they feel better about themselves and become aware of what they know.

According to Skinner, there are six types of verbal behavior: a) tacts, which are used to make contact with the world, e.g. label the world; b) textual, involving reading, writing and dictation; c) echoic, in which stimulus is auditory and the response is vocal (e.g. repetition of words and sentences); d) intraverbals, in which there is no formal correspondence between stimulus and response-product, for example when the response ‘six’ is given to the stimulus ‘three plus three’e) mands, which are

typically demands, commands or requests; and f) autoclitics, which consist of verbal responses that change the effect on the listener of the primary operants, for example in *I think Brazil is a rich country*, the autoclitic *I think* moderates the strength of the statement *Brazil is a rich country*. In sum, the verbal behaviors show that learning in behaviorism is an observable behavior which is acquired mechanically and automatically through stimuli and responses.

In terms of language acquisition, behaviorist theory understands that children learn oral language from other human role models in a process which involves imitation, rewards and practice. For example, children acquire verbal behavior when their responses to stimuli are reinforced by adults, such as when a child sees an apple (a stimulus) and then says 'apple' (the response to the stimulus), parents can praise them by saying 'great' (a reinforcement).

When we think of behaviorism in MALL, mobile technologies are responsible for providing both the stimulus and the reinforcement. When a language learning application provides an activity to be done, a stimulus is actually being given. When the correct response is provided, the application itself is capable of providing positive reinforcement. According to Beatty (2010), CALL materials rely heavily on behaviorist methods of instruction as they generally offer reinforcement through text, audio, images, animations, and video. Lindaman and Nolan (2015) observe that recent research on MALL points to a behaviorist model of learner engagement in which reading or studying during time otherwise not used are common practices.

Constructivist theory was proposed in the late 1960s. In constructivism, learning is considered an active process in which learners build new ideas and concepts based on both their current and past knowledge. Instructors ought to encourage their students to discover principles by themselves. The idea is that learners should not take a passive role in the process of learning, but rather participate actively in the learning process. For that, instructors should give them appropriate contexts and tools to participate in such process. Naismith et al (2004) understand that mobile devices provide a unique opportunity to immerse learners in a realistic context and, at the same time, provide access to supporting tools.

Constructivism has influenced the field of language acquisition. The notion that learning is an active process means that language learners play a key role in their own language development. Under the light of constructivism, language teachers should provide appropriate opportunities for learning rather than transmitting knowledge. Moreover,

language learners' knowledge must be taken into account so that it can be developed and put into practice (Mvududu & Thiel-Burgess, 2012)

Mobile technology has been explored as a tool to promote constructivist theory. One example comes from Facer et al. (2004), which explored the use of this technology to encourage children to learn about animal behavior. Children aged between 11 and 12 years played a game which emulated a Savannah environment. Equipped with headphones and palmtops, children moved around a playing field hearing sounds of the Savannah, seeing images of the environment and interacting with it. The authors concluded that while children readily accepted the possibility of learning through mobile devices in a more informal fashion, the more formal and 'schooled' aspects of the game were considered the least successful. Their study can be considered as a constructivist one because the participants had an active role in understanding the rules of animal behavior and interaction with the environment and discovered these rules by themselves.

Proposed in the beginning of the 21th century, situated learning refers to learning in an authentic context, within authentic culture. Learning in this view is understood as more than simple acquisition of knowledge. Rather, it is a process which involves social participation. The situation in which learning happens plays a major role in this process (Naismith et al, 2004). According to Lave and Wenger (1991), situated learning focuses on the relationship between learning and the social conditions in which it occurs. They find it necessary to analyze the kinds of social engagements which provide proper contexts for learning to take place.

To Guo (2014), context-aware learning is a significant aspect of situated learning. Since mobile devices are portable and can be used in different places, learning activities can be improved by these devices. Taking advantage of this, Proctor and Burton (2003) developed an interactive audio-visual tour for visitors of the Tate Modern museum in London. More than eight hundred visitors took the pilot tour of the museum with mobile devices which allowed them to listen to expert commentaries and think about their experience by asking questions about what they had seen. They reported that the use of this technology made the interaction with the museum more interesting and that learners are likely to spend more time in these environments when assisted with this kind of support.

In this section, some learning theories and the possible roles of mobile technology in each of them have been discussed. The following

section deals with language teaching methods and the role of vocabulary in them.

## 2.2 LANGUAGE TEACHING METHODS AND THE ROLE OF VOCABULARY

As this study also seeks to investigate the relationship between smartphone applications for English learning and second language learning methods[1], it is necessary to review those which have had been relevant in the field.

Brown (1994) understands that a teaching method is a generalized set of specifications for accomplishing linguistic objects. To him, methods tend to be more concerned with roles and behaviors than with linguistic and subject-matter goals, sequencing and materials. Many methods for language teaching appeared during the 20th century. In spite of the differences between them, vocabulary instruction has had its place in all language teaching methods (Tumolo, 1999). In this section, I briefly describe some of the most relevant methods, and how vocabulary was worked with in each of them.

One of the first methods for teaching languages was the Grammar-Translation method. According to Celce-Murcia (1991, instruction was given in the native language of the students and the translation of classical texts and the study of grammar rules were predominant activities. Words were taught out of context, often by using vocabulary lists with the translation of the taught words in the students' native language. Schmitt (2000) observes that vocabulary work was restricted to the creation of dictionaries or ignored altogether. Drills were occasionally used and consisted in the translation of sentences from L1 to L2.

The Grammar-Translation Method has been criticized for the lack of activities to enhance communicative abilities and for forcing the memorization of "endless lists of unusable grammar rules and vocabulary and attempting to produce perfect translations of stilted or literary prose" (Richards & Rodgers, 2001, p. 4). Nevertheless, Brown (1994) observes that because Grammar-Translation tests are easy to construct and correct they can be graded more objectively than more communicative ones. To the author, this contributes for the popularity of the method.

---

[1] *Method* is used here as an umbrella term for methods and approaches, as the distinction between method and approach is out of the scope of this study. The word *approach* is employed in this chapter only if the authors referred to employed this word.

In the Direct Method, use of the mother tongue was not allowed and the target language was taught directly, that is, without any translation. Spontaneous use of oral communication was emphasized and, when approached, grammar was taught inductively. Vocabulary lists like the ones commonly used in the Grammar-Translation method were rejected. Instead, pictures and actions were used as resources to teach concrete vocabulary while abstract vocabulary should be linked to ideas in the target language (Brown, 1994). This meant that new words were to be taught within a context, not in isolation.

During the Second World War, the U.S army needed fluent speakers to assist in communication during the war. Not having found them, they developed their own method, the Audiolingual method (ALM) (Celce-Murcia, 1991). In this method, the use of drills was a core practice since it was believed that they led to habit formation. In this sense, the ALM was heavily influenced by behaviorist theories. Because of that, the method favored activities which reinforced good habits, like drills and form-focused activities (Schmitt, 2000). Brooks (1964) mentions some common kinds of drills involved repeating, replacing, restating and inflecting words and sentences.

As the Audiolingual Method prioritized the acquisition of structures, vocabulary was selected according to its simplicity. The number of words should be limited in early levels. ALM used tools such as tapes, language labs and visual aids to help students memorize vocabulary. Brown (1994) comments that the method was popular for many years and it is still inserted in current methodologies. One of the reasons for the success of ALM lies in the feeling of achievement experienced by learners once the memorized dialogues and vocabulary were understood as proficiency.

The ALM would later on be rejected by linguists such as Stephen Krashen and Tracy Terrel because it "viewed grammar as the central component of language" (Richards & Rodgers, 2001, p. 4). Krashen and Terrel understood that communication should be the main component of language, which led to the development of The Natural Approach. In this approach, language is acquired in a natural way by exposing learners to the language. Natural and meaningful communication is the source of the so called comprehensible input, which in turn leads to acquisition. Comprehensible input would provide vocabulary naturally just by exposing learners to the language. Stephen Krashen and Tracy Terrel believed that production should be deferred until speech emerged naturally, just like children do.

Influenced by the Natural Approach, the Communicative Language Teaching approach (CLT) prioritizes the ability to communicate. The primary use of language is communication and interaction. Because of this, instructors should develop activities which contain real communication and meaningful tasks. The teacher's main role in the classroom is to facilitate communication, leaving error correction in second place (Celce-Murcia, 1991).

Littlewood and Swan (1981) point out that CLT considers a language "not only in terms of its structures (grammar and vocabulary), but also in terms of the communicative functions that it performs" (p.10). In this sense, in CLT the learning of vocabulary should be connected to communicative functions such as giving advice, apologizing or asking for information. However, explicit instruction of vocabulary is seen as unnecessary because, in the CLT, vocabulary is expected to be acquired through exposure to the target language.

Along the 20th and the 21st century, many second language teaching methods have reached their pinnacles and also waded as new second language learning theories came along. They all have left a mark on the way second languages are understood and taught. However, have they also influenced more modern ways of learning a second language like through smartphones? This is a question which this study seeks answers for.

Regarding the role of vocabulary in the methods reviewed, one can realize that vocabulary played a different role in each of them. As more attention has been paid to vocabulary learning in a second language, it becomes important to understand what knowing a word means. Thus, literature on vocabulary knowledge is reviewed in the following section.

## 2.3 VOCABULARY KNOWLEDGE

### 2.3.1 What does it Mean to Know a Word?

There are many components involved in knowing a word. Although linguists do not always agree on the main aspects of word knowledge, they agree that it encompasses more than knowing the meaning of words. Carter (2012) points out that knowing a word involves the understanding of both its syntagmatic and paradigmatic relations. He notes that since words exist in a kind of semantic space, learners have to know what parts of this space they can or cannot occupy. Moreover, he explains that to know a word also means to know its context. He argues

that “syntactic and semantic knowledge must also include pragmatic knowledge” (p.185).

Tumolo (1999) describes a continuum which foreign language learners follow, which goes from a) never having seen the word; b) having encountered the word, but being unable to recall its meaning; c) recognizing the word when linked to some context; d) comprehending the word in the context; to e) knowing various meanings in different contexts. Therefore, at the end of this continuum, learners should have a deeper knowledge of the words, which would include knowing the different meanings a word can have depending on the context, i.e. having a pragmatic knowledge of the word (Carter, 2012).

Laufer (1997) outlines that knowing a word means knowing: a) its written and spoken form, which means being able to recognize it in written and spoken form and being able to spell and pronounce it; b) its structure, that is, recognizing and understanding its basic free and bound morphemes (e.g. knowing that the word *uncomfortable* is made up of un + comfort + able); c) its syntactic behavior, that is, knowing the possible combinations of the word (e.g. the verb enjoy is followed by a verbs in the gerund form); d) its meaning, which involves understanding polysemy as well as affective and pragmatic meanings and e) its lexical relations, its synonyms, antonyms, hyponyms and collocations. Clearly, knowing a word involves various aspects.

### 2.3.2 Passive And Active Knowledge.

It is generally accepted that one knows more words receptively than productively and that reception precedes production (Melka, 1997; Clark, 1993). To Laufer (1998), the learning of a word is typically a progress from receptive to productive knowledge. That means that the first component of word knowledge learned is usually its basic receptive knowledge, hence the term ‘passive knowledge’. Productive knowledge, according to the author, is the vocabulary that learners can not only understand but also use, hence the term ‘active knowledge’.

Laufer (1998) analyzed the development of passive and active vocabulary of Israeli high school students of EFL. Her study investigated vocabulary gains during a year in three conditions: passive, ‘controlled active’ and free active. She points out that one should distinguish between controlled and free active vocabulary because “not all learners who use infrequent vocabulary when forced to do so will also use it when left to their own selection of words” (Laufer, 1998, p. 257). The results of the study show that passive and controlled active vocabulary had significant

gains, whereas free active vocabulary did not. She argues that, in spite of a remarkable increase in passive vocabulary size, learners are unlikely to put such gains into use if they are left to their own choice of lexis. In other words, learners will only make use of words which they feel safe to use if they are not pushed to use less frequent words. In light of this, learners should be stimulated to produce output as it causes them to process language more deeply than input does.

## 2.4 VOCABULARY INSTRUCTION AND LEARNING

Vocabulary learning was a neglected part of language teaching for many years partially because linguistic research took particular interest in syntax and phonology, which "may have fostered climate in which vocabulary was felt to be a less important element in learning a second language" (Carter, 2012, p. 178). During the last decades, however, vocabulary learning has assumed a key role in SLA.

Lewis (1993), for example, proposed a lexical approach in which lexis played a central role. His approach highlights the importance of learning meaningful chunks of vocabulary, that is, words should not be learned individually without considering their possible combinations. Rather, vocabulary should be worked so as to develop learners' ability to understand the connectedness between words. This approach understands that language is made up of chunks that, when combined, "produce continuous coherent text" (p.7). To the author, lexical items[1] can be: a) words b) collocations, i.e. the frequent co-occurrence of certain words with significant frequency; c) fixed expressions, which include social greetings, politeness phases, phrase book language e.g. *can you tell me the way to* and *I'll have a coke/burger*; and d) idioms. Considering this, the Lexical Approach advocates for more emphasis on the development multi-word items. Moreover, Lewis understands that class time should also be used to help "learners develop strategies for dealing with unknown items they meet (…) particularly the ability to guess on the basis of context, situation or lexical clues" (p. 47).

Another study which sheds light on the importance of strategies was conducted by Payne (1988), which studied the strategies that ESL students use for vocabulary learning. The answers from an interview about the use of strategies were used to create a questionnaire which was

[1] Based on Lewis (1997), this study understands that words, collocations, fixed expressions and idioms are all lexical items.

administered to more than 100 ESL students, who were supposed to rate the strategies in terms of their effectiveness. The results were used by Brown and Payne (1994, as cited in Hatch & Brown, 1995), who concluded that the strategies fall into five essential steps: a) having sources for encountering new words; b) getting a clear image of the word form; c) learning the meaning of words; d) consolidating word form and meaning in memory and e) using the words. The steps will be taken into consideration for the analysis of the six selected applications so as to investigate whether MALL incorporates them.

Based on her review of literature on vocabulary learning, Takač (2008) concluded that the major strategies for vocabulary instruction all fall into two major categories, namely "presentation of meaning and form of new lexical items" and "review and consolidation (recycling and practicing of presented lexical items" (p.19).

The presentation of new lexical items consists in the instruction of new lexical items. According to Takač (2008), in this stage learners are generally "passive recipients of linguistic facts, although some procedures may involve learners' active participation" (p.20). The author mentions that some of the most common ways to instruct vocabulary include a) connecting L2 items with their L1 equivalents b) defining meaning of words c) presenting new words through contexts d) directly connecting the meaning to real objects or phenomena and e) encouraging learners to discover meanings by themselves. Table 1 shows summarizes these ways of presentation, with additional explanations and examples.

Table 1

Common ways for the presentation of new lexical items

| Way of presentation | Explanation and examples |
|---|---|
| Connecting an L2 item with its equivalent in L1 | Although this strategy is often used for checking comprehension, it is also used to point out similarities or differences between L2 and L1. |
| Defining the meaning of words | Meanings can be defined by using synonyms, antonyms, analytic definitions (*X is a Y which)*, taxonomic definitions (*Beer is a beverage)* giving examples (*Beverages – something like juice, tea, coffee)* or giving the superordinate term (*A guitar is a musical instrument),* among others. |

| | |
|---|---|
| Presentation through contexts | This involves creating a situation in which he lexical item is clearly contextualized. |
| Directly connecting the meaning to real objects or phenomena | This strategy includes procedures such as demonstrations, using realia and visual aids. |

*Note:* Adapted from "Vocabulary learning strategies and foreign language acquisition", by V. Takač (2008), p. 20. Copyright 2008 Višnja Pavii Takač.

These ways of presenting vocabulary presented in Takač (2008) communicate with the aforementioned steps suggested by Brown and Payne (1994, as cited in Hatch & Brown, 1995), especially the first three ones. For the first, which entails the sources for word encounter, Brown and Payne (1994, as cited in Hatch & Brown, 1995) suggested reading books, newspapers, magazines and listening to TV and radio. Other strategies included word lists (either from textbooks or generated by the students themselves), dictionaries and interaction with other speakers. Hatch and Brown (1995) point out that students' necessity and interest in learning a word contribute to its learning

The second essential step has to do with getting a clear image of the form of a vocabulary item. Strategies for this step include relating words from the L2 to similar ones (both visually and phonetically) in the L1 and associating words in the L2 itself. The authors highlight that learning the word form is necessary because it prevents mistakes related with confusing the form of one word with another. In this context, Takač (2008) points out that, in order to create a connection between meaning and form, learners should "attend to the orthographic and phonological form of the word". She mentions that, in the literature, some common ways to stimulate this connection: a) oral drills, in which learners listen to teachers pronouncing the target word several times and then repeating it chorally or individually; b) phonetic transcription and graphic representation and c) encouraging learners to try to spell words.

The third, getting the word meaning, involves strategies such as asking native speakers for definitions, making mental pictures of words and using dictionaries. Brown and Payne (1994, as cited in Hatch & Brown, 1995) suggest that it is also possible to learn meanings through context, which is a strategy mostly related to incidental learning. The authors note that different levels of definitions are necessary depending on the level of learners.

This second category proposed by Takač (2008) deals with the review and consolidation of lexical items, which is necessary to consolidate them in the long-term memory. According to the principle of

expanded rehearsal, learners should review new vocabulary shortly after its presentation, and then in subsequent gradually increasing intervals (Schmitt, 2000). At this stage, the instructor's role is to offer a number of ways to practice and connect words from memory. Table 2 shows the common ways to do review and consolidate lexical items mentioned by Takač (2008), along with their explanations and some details.

Table 2

Common ways of reviewing and consolidating lexical items

| Way | Explanation |
|---|---|
| Mechanical repetition of words | Takač (2008) mentions that even though deep level processing can be more effective in the long run, loud repetition may also contribute to word memorization. |
| Copying words | This can aid memory especially if accompanied by loud repetition or by the visualization of its meaning. |
| Word manipulation | Includes tasks such as grouping words and matching words to their definitions. |
| Integrating new words to old ones. | Activating linguistic pre-knowledge and knowledge of the world creates a link between new words and already known words |
| Semantic elaboration | Semantic elaboration stimulates the creation of links and semantic networks, as well as deep processing. |
| Tasks for word identification | These tasks have the goal of getting learners to pay attention to certain lexical items and to recognize their form. Examples are finding word in a text, solving anagrams, etc. |
| Tasks for recalling words from memory | This involves attempts to recall word meanings with the aid of the given form or vice versa. Since the objective is to enhance memory, |

| | |
|---|---|
| | teachers should encourage recall at spaced intervals. |
| Productive use of words | Learners create mental links when using words in meaningful contexts. The following activities promote productive use of vocabulary: completing sentences or texts, with words offered or not, using words in sentences, conversations, stories and many types of games. |

*Note:* Adapted from "Vocabulary learning strategies and foreign language acquisition", by V. Takač (2008), p. 20. Copyright 2008 Višnja Pavii Takač.

With regards to the five steps mentioned in Hatch & Brown (1995), the two last steps can be considered as steps to review and consolidate lexical items. The fourth step concerns the consolidation of word form and meaning in memory. Typical activities include vocabulary learning drills like crosswords, flashcards, matching exercises and crossword puzzles can help in reinforce the connection between form and meaning. The memory strategies[1] suggested by Oxford (1990) also assist in the consolidation of meanings in memory.

The final step has to do with using words. Although it has been claimed that this step is not required if learners only aim at acquiring receptive knowledge, it is a vital step if a deeper understanding of the word is desired (Brown & Payne, 1994, cited in Hatch & Brown, 1995). Using words also seems to provide a "mild guarantee that words and meanings will not fade from memory once they are learned" (Hatch & Brown, 1995, p.390).

It is safe to assume that instructional material that has clear sources to present, review and consolidate vocabulary, and that allows learners to engage in the five aforementioned steps is likely yield better results than material that does not. With this in mind, this study investigated how six smartphone applications present, review and consolidate vocabulary, also

[1] These strategies are further detailed in section 3.5, 'Factors involved in vocabulary retention'.

attempting to find if they allow learners to engage in the previously mentioned steps.

In spite of the value of the findings of Brown and Payne (1994, as cited in Hatch & Brown, 1995) and Takač (2008), linguists have found that there are a number of other factors that can enhance vocabulary learning. The following subsection tackles some of them.

### 2.4.1 Some Factors Enhancing in Vocabulary Learning.

Sökmen (1997) observes that, throughout the literature, some pedagogical themes seem to be predominant in terms of vocabulary instruction. They are: a) develop a large sight vocabulary, which means that learners should know a great number of high frequency words while making sure they also learn difficult words; b) integrate new words with the old, that is, learners should be stimulated to build semantic associations between new words and ones already known; c) provide a number of encounters with a word, especially encounters which are arranged in increasingly longer intervals; d) promote a deep level of processing, which acknowledges that there is better learning when there's more depth in processing due to the fact that words are encoded with elaboration; and e) facilitate imaging and concreteness, meaning that instruction with verbal [1] and nonverbal representations is likely to promote better results than instruction with only nonverbal representations, especially if these representations relate to learners' experiences and their real lives.

Learning a word involves being able to recall it. EFL students often claim that they have learned the target words of a lesson, but after some weeks their meanings seem to have faded from memory. Because of this, it is necessary that language instructors assist their learners in retaining the language they have been presented.

Studies point out that multiple encounters are necessary for true acquisition of a word. Nation (1990), for example, suggests a range of 5-16 encounters. Sökmen (1997) explains that if words are encountered in increasingly longer intervals, they are more likely to be stored than if encounters are presented at a single time. This is referred to as the spacing effect, which postulates that "for a given amount of study time, spaced presentations yield substantially better learning than do massed

[1] Mayer (2009) explains that verbal representations include spoken and printed words, whereas nonverbal ones include illustrations, video, animation or background sounds.

presentations" (Ellis, 1995, p. 16). If words are presented at a single time, without intervals between exposure to them, then they are presented in a massed manner.

The validity of the spacing effect has been found to assist in the learning of many contents, including vocabulary (Bloom & Shuell, 1981; Goossens et al., 2012; Kornell, 2009; Ullman & Lovele, 2016). Bloom and Shuell (1981), for instance, carried out a study in which high school students enrolled in a French course learned words under massed or distributed (spaced) practices. The results show that, even though the results were almost identical on a test given right after the completion of study, those who had learned words by distributed practice scored significantly better (35%) on a second test given 4 days later. The authors suggest that the spacing between repetitions can be more valuable than the number of repetitions.

Goossens et al. (2012) also investigated the spacing effect with regards to vocabulary learning. They conducted a study in which children were taught  found that there was better retention of words taught the meaning of words with the aid of pictures in both massed and spaced conditions. The authors found that the meanings of words taught in spaced conditions were better remembered than those taught in massed conditions in receptive and productive tasks.

Considering the effectiveness of spaced repetitions, Ullman and Lovelett (2016) made relevant pedagogical predictions. They suggest that language educators space out the coverage of topics and avoid working them in isolation. The idea is that a given topic should dealt with in different opportunities, not only in a single unit. The authors also advise language learners to 'space their study out over weeks, months and even years, continually coming back to the same material (p.19). Finally, they point out that because spacing is usually more effective at longer retention intervals, 'it should be employed by learners and educators with retention benefits in mind, especially longer-term retention' (p.19).

The importance of having multiple encounters with the target language becomes more salient in contexts of foreign language acquisition. In comparison to learners of English as a Second Language, learners of English as a foreign language are less likely to reencounter the words studied in class in other environments. Optimally, language that is worked with in class should be reencountered in adequate intervals. As Stevick (1982) observes, if these intervals are too long, most of the benefit from first will encounters will be lost and it will be like learning the words for the first time again.

In addition to frequency, meaning processing also plays a role in the memorization of vocabulary. Craik and Lockhart (1972) suggest that "trace persistence is a function of depth of analysis, with deeper levels of analysis associated with more elaborate, longer lasting, and stronger traces" (p. 675). The authors argued that deeper analysis should lead to better retention and that the storing of new information into long-term memory is not determined by how long it is held in short-term memory, but by how shallow or deep the initial processing is. The length of processing, the quantity of attention to the stimulus, the familiarity and meaningfulness of materials are some factors which can contribute to the depth of analysis. In this sense, highly familiar and meaningful stimuli that is processed long enough and with attention will be processed to a deep level faster than stimuli which is unfamiliar, less meaningful and rapidly processed without sufficient attention.

Throughout the literature, researchers have suggested different types of activities which are likely to promote deeper levels of processing. To Sökmen (1997), word associations are reinforced when learners are "asked to manipulate words, relate them to other words and to their own experiences, and then to justify their choices" (p.242). Boer (2007) proposed three levels of word-focused processing in her study: *repetition, manipulation and generation.* To the author, activities involving simple repetition represent the most basic level of processing, namely *repetition*, which includes unelaborated imitation of target words or their definitions. The following level, manipulation, occurs when learners notice patterns, review spellings, form links to similar L2 words, or when they infer, paraphrase or recall word meanings. The third and deepest level of processing, *generation*, involves the production of sentences using target words and the association of these words with learners' prior experiences and world knowledge. These three levels were used to analyze activities from the selected applications with regards to the levels of processing they may require.

To Laufer (2017), although it is difficult to operationalize the depth of processing required by a given task, attempts have been made to make this operationalization easier. Laufer and Hulstjin (2001) suggested the Involvement Load Hypothesis, in which 'involvement' is a "motivational-cognitive construct which can explain and predict learners' success in the retention of unfamiliar words" (p. 14). They proposed there are three components that make up the construct of involvement: a) need, the motivational, non-cognitive dimension of involvement; b) search, which involves finding the meaning of unknown L2 words; and c) evaluation, which entails the comparison of words and meanings to judge

it they are adequate for a given context. Real-life or learning tasks can induce one or more of these components. According to the authors, the more components they involve, the more involvement load they generate.

Attention has also been given to strategies which can help learners store and retrieve vocabulary in a second language. Oxford (1990) argues for the usefulness of working with memory strategies with language learners. The author affirms that although learners have the potential to store tons of information, only part of this potential can be useful unless memory strategies are employed to help learners. In this sense, she divides memory strategies into four categories: a) creating mental linkages by grouping, associating and placing new words into a context; b) applying images and sounds by using imagery, semantic mapping, using keywords and representing sounds in memory; c) reviewing; and d) employing actions through physical responses and mechanical techniques. These memory strategies are meant to assist different learning styles. She points out that even though some teachers think learning vocabulary is easy, "language learners have a serious problem remembering the large amounts of vocabulary necessary to achieve fluency". (Oxford, 1990, p. 39).

### 2.4.3 Explicit vs implicit vocabulary learning.

Research in vocabulary acquisition has gained recognition as an "important counterpart to syntax in not only language teaching but also theory-guiding in the field of applied linguistics" (Sok, 2014, p.1). Studies in vocabulary instruction have paid particular attention to implicit and explicit forms of learning.

Also known as incidental and indirect learning, implicit learning, in sum, refers to the learning of words through seemingly natural processes in which words are acquired without direct teaching. In this case, learners "remain unaware of the learning that has taken place, although it is evident in the behavioral responses they make" (Ellis, 2009).

Krashen (1989) supports implicit learning since, in the Natural Approach, natural exposure to language promotes acquisition without the need of direct instruction. To Krashen (1981), there is a distinction between 'acquisition' and 'learning'. The former takes place through the subconscious internalization of rules which is the result of exposure to comprehensible input, while the latter consists in the conscious formulation of explicit rules of grammar. Moreover, L2 acquisition calls for natural communication in which "speakers are concerned not with the

form of their utterances but with the messages they are conveying and understanding" (Krashen, 1981, p.1).

Explicit learning involves conscious process. Ellis (1995) describes it as learning in which "the individual makes and tests hypothesis in search for a structure" (p.6). In terms of second language learning, this means that learners should be aware of what they are learning about the language. One can argue then that explicit language learning comprises metalinguistic awareness. Nevertheless, explicit learning may have implicit aspects, and vice-versa. Ellis (2009) acknowledges that students can "reflect on knowledge that they have acquired implicitly (i.e. without metalinguistic awareness) and thus, subsequently, develop an explicit representation of it" (p.6). He adds that explicit learning of a certain linguistic feature can result in the incidental learning of others.

Ellis (1995) admits that it is difficult to estimate our L1 vocabulary size. Regardless of how many words we know in our L1, the author claims that they were not all learned through dictionary consultation. Rather, most of them must have been acquired through implicit learning. In this context, one of the main strategies for vocabulary acquisition consists in inferring meaning from context. Ellis (1994) concludes that the level of mental processing impacts vocabulary learning. This endorses Craik and Lockhart (1972) theory of levels of processing, which proposes that the deeper the analysis, the more vocabulary is retained in the long run.

Explicit vocabulary learning comprises the use of a number of metacognitive strategies, which include a) trying to infer the word from context; b) learning meaning by consulting dictionaries and vocabulary lists; c) attempting to consolidate new meanings by repetition; and d) associating learning strategies such as semantic or imagery mediation techniques (Ellis, 1995).

Both implicit and explicit approaches have benefits and downfalls. In the view of Nogueira (2013), the efficacy of one or the other depends on learners' individual differences, their learning environment, their level of proficiency and the type of vocabulary being worked with. Her study investigated learners' perceptions of their vocabulary learning process. One of the findings is that college and high school students have significant differences in how they prefer to acquire vocabulary in a second language. For instance, while college students value inferential processes for vocabulary acquisition, high school ones see them as a tool for reading comprehension, not for vocabulary acquisition, preferring to use dictionaries to learn new words. Considering these findings, it is crucial that attention is paid to their learners' individual differences before

choosing implicit or explicit approaches. Given the scope of this study, this means that the designers of applications whose goal is to instruct vocabulary in a second language should also pay attention to the users of these applications, providing instruction that is suitable for them. This is only possible if these designers take into consideration the findings of research carried out in the fields of SLA and MALL, among others.

In section 2.4, a review of literature on vocabulary instruction and learning was presented. First, it was argued that vocabulary has become an important part of SLA, with authors such as Lewis (1993) considering that it has a central role. Then, studies regarding vocabulary instruction and learning were presented, including Brown and Payne (1994, as cited in Hatch & Brown, 1995), who argued that vocabulary learning strategies can be summarized into five essential steps, and Takač (2008), who argued these strategies fall into two major categories: presentation of meaning and form of new lexical items and review and consolidation of presented lexical items. Also, some factors enhancing vocabulary learning were reviewed, suggesting that if language learners are to learn and retain vocabulary, they should a) have multiple encounters with it, especially if these encounters are spaced, not massed; b) be provided with activities that promote a deeper level of processing; and c) understand the value of and make use of memory strategies to help store new lexical items. Finally, literature on explicit and implicit vocabulary learning was reviewed.

Given the scope of this study, the following section presents an overview on the field of Mobile Assisted Language Learning (MALL), a more recent branch of Computer Assisted Language Learning (CALL).

## 2.5 MALL – an Overview

MALL is the learning of languages with the assistance or enhancement of mobile devices. Even though mobile devices can enhance the learning of many skills in a second language, smartphone applications for English learning seem to favor the instruction of vocabulary (Kim & Kwon, 2012).

Although MALL is still a young field, Burston (2013) found that more than 575 works related to MALL published over the past two decades. In spite of the significant number of publications in the field, in order to understand the MALL, it is necessary to comprehend CALL, the field which originated it. Because of this, this section begins with a summary of CALL, followed by the characteristics that define MALL and by a number of studies which investigated MALL.

### 2.5.1 MALL – ORIGINS IN CALL.

To Levy (1997), CALL is the search and study of "applications of the computer in language teaching and learning" (p. 1). It has the goal of improving "the learning capacity of those who are being taught a language through computerized means" (Cameron, 1999, p. 2).

Warschauer and Healey (1998) identified three stages of CALL: Structural, Communicative and Integrative CALL. In the first stage, structural CALL, learners used computers to do drills in order to develop their accuracy worked. The Grammar- Translation and Audiolingual methods were the basis for this type of work. The following stage, labeled Communicative CALL, had computers assist communicative exercises with the objective of improving fluency. Finally, the most recent stage, Integrative CALL, uses multimedia and the internet to assist the development of authentic discourse. Language is seen as a socio-cognitive construct that requires social interaction to be learned. The main characteristics of each stage are shown in Table 3.

Table 3
Stages of CALL

| Stage | 1970's – 1980's: Structural CALL | 1980's- 1990's: Communicative CALL | 21st Century – Integrative CALL |
|---|---|---|---|
| Technology | Mainframe | PCs | Multimedia and Internet |
| English-teaching paradigm | Grammar - Translation and Audiolingual methods | Communicate [sic] language teaching | Content-Based ESP/EAP |
| View of language | Structural (a formal structural system) | Cognitive (a mentally constructed system) | Socio-cognitive (developed in social interaction) |
| Principal use of computers | Drill and practice | Communicative exercises | Authentic discourse |
| Principal objective | Accuracy | And fluency | And agency |

*Note.* Adapted from "Computers and language learning: An overview" by M. Warschauer and D. Healey, 1998, *Language Teaching, 31*, p.1. Copyright 1998 by Mark Warschauer.

At first sight, the content in the table gives the impression that Structural CALL was replaced by Communicative CALL, which in turn was replaced by Integrative CALL. Nevertheless, the authors themselves point out that "as each new stage has emerged, previous stages continue" (p. 30) and that "current uses of computers in the language classroom correspond to all three of the paradigms mentioned above" (p. 30)

Similarly, Crook (1994) comments that Structural CALL (also called Behaviorist CALL) is still very much in practice. To him, drills and practices are still appealing for educators because they are easier to adopt than more innovative uses of technology and also because many instructors feel that multiple exposures to certain practices are beneficial to students.

21st century computers are powerful multimedia tools[1] that allow multimedia learning to take place. Mayer (2009) advocates for multimedia learning as "people learn better from words and pictures than from words alone". This does not mean that the mere presence of pictures will lead to the enhancement of learning. To the author, "effective instructional design depends on techniques for reducing extraneous processing, managing essential processing, and fostering generative processing" (p. 57). Extraneous cognitive processing is cognitive processing that does not serve the instructional objective. Mayer posits that this type of processing is caused by poor design of multimedia material, and should be avoided in order to optimize multimedia learning.

According to the redundancy principle proposed by Mayer (2009), this is not optimal as "people learn better from graphics and narration than from graphics, narration, and printed text" (p.118).

Technological advancements have made possible to use CALL for more genuine communication, allowing for Open and Integrated CALL practices to take place. In spite of this, Bax (2003) reminds us that the technological aspect has not been matched by "an open attitude in other key areas of implementation such as teachers' attitudes" (p.23). He adds that much of the software produced nowadays is still of the Restricted type. He concludes that, in general, we are in an Open phase

[1] Although Mayer (2009) focuses on computers as multimedia tools, his theory can be applied for smartphones too, which have become a major multimedia tool in the last years.

of CALL, but with institutions and classrooms that exhibit features of the Restricted and Integrated phases. Having conceptualized CALL and its phases, the characteristics that define MALL are now presented.

### 2.5.2 MALL: the characteristics that makes it specific.

In terms of technology, a mobile device should be portable and personal (Naismith et al, 2004). Because of these features, such devices can be easily accessed anywhere. Examples of mobile devices are smartphones, tablets, music players, handheld videogames and PDAs (Personal Digital Assistant, also known as palmtops).

According to Nezarat and Miangah (2012), the main characteristics of mobile devices are their portability and connectivity, characteristics which highlight the possibility of ubiquitous learning, which means learning anywhere and at any time. Taking into account these characteristics and the fact that people already use mobile technology on a daily basis, it seems natural to believe that it will play a valuable role in learning contexts too (Stockwell, 2012).

Due to their mobility, smartphones are not limited to the use inside language classrooms. Thus, language acquisition can occur in out-of-class situations, such as while commuting or waiting for someone. Stockwell (2008) claims that because of such mobility, mobile learning has the potential to increase the amount of time that individual learners spend engaged in language learning activities. Moreover, their educational use can reduce the psychological distance that may be associated with more formal language learning (Bax, 2003).

Even though smartphones are personal devices due to the fact that they normally support only one learner, their access to the internet makes them a communicational tool that can promote interaction. For instance, a picture taken with a smartphone is, at first, personal. However, if the learner decides to share it through social media, it becomes accessible to a number of other learners. Thus, modern mobile phones must be considered as tools which encompass both the individual and collective of our lives.

Klopfer et al (2002) defined five characteristics which would define mobile devices: a) portability - the device can be taken to different places and moved around within a site; b) social interactivity - there is the possibility of exchanging data with other people face-to-face, meaning that people can be side by side and interact socially while sharing data with their mobile devices; c) context sensitivity - mobile devices are able to gather and respond to real or simulated data which is related to the

current location, time and environment of the learner; d) connectivity - shared networks can be created by connecting mobile devices to other devices or to a common network; e) individuality - activities can be customized according to the learner's necessity (scaffolding for more complex activities, for example).

Because of all these properties, mobile devices can be used in a great number of pedagogical applications. Kenning (2007) understands these pedagogical applications can be divided into some dimensions, including: a) in class versus out-of-class; b) individual versus collaborative; c) entailing receptive or productive practice; d) interactive (entailing the exchange of information through videos, voice or SMS) versus content based (accessing or responding to content that is locally stored) and e) pull technology (content that is accessed by learners when they 'pull' what they want to learn) versus push technology (when materials are sent to learners at specified times).

### 2.5.3 Studies In Mall.

While the dichotomies aforementioned are sometimes overlapping (a MALL application can work with both pulling and pushing technologies, for example), they help understand the myriad of pedagogical uses mobile technologies can have, including the learning of second language. This possibility has been investigated by a various studies recently. Kim and Kwon (2012), for example, classified 87 applications for English as a Second Language (ESL) according to a number of criteria. In this study, they attempted to find the common features of smartphone applications and reported what they believed were their pros and cons. One of their findings was that most of the applications available in 2012 dealt predominantly with the development of vocabulary. Moreover, the authors pointed out that there was very little room for social interaction and collaboration in the applications analyzed, in spite of the fact that they are connected to the internet.

Another author who set out to classify language learning apps according to their pedagogical features was Guo (2014). He investigated the learners' perspectives of some apps, seeking to find out which characteristics they believed to be positive and negative. The author concluded that learners have positive attitudes towards the use of mobile apps for learning, partially because of the learners' willingness to explore the functions that their smartphones offer. Nonetheless, participants mentioned limitations, such as voice recognition problems. While other studies have indicated that the small screen size of mobiles is a physical

constraint (Huang &ex Lin, 2001), the participants in this study believed the screen size was not an issue (Guo, 2014). According to the author, a probable explanation for their tolerance is the fact that they are already adapted to the use of such small screens for daily activities such as social networking.

Another study which examined language learning apps was carried out by Heil (2016). 50 applications for language learning were selected based on their rankings on Google Play and on the Apple Application Store and then classified according to a number of criteria. The results show that 42 out of the 50 applications included a focus on vocabulary instruction. She reports that these applications tend to teach vocabulary in "isolated chunks rather than in relevant contexts" (Heil, 2016, p.7). She affirmed that a common way to assess vocabulary in isolation consisted in matching images to word meanings and that reading contexts were limited to sentences and not reading passages. Considering this, the author understands that "by providing more contextualized, authentic written input, learners will begin to process more than individual words and basic vocabulary" (p. 11). She concludes that there is still room for improvement in the field, and this should include, among others, the incorporation of adaptive learning features.

When using mobile devices, people often engage in multitasking[1], which means that their attention may not be optimal. Schmidt (2001) observes that even though there has been evidence suggesting the possibility of some unattended learning, attended learning is "far superior, and for all practical purposes, attention is necessary for all aspects of L2 learning" (2001, p. 3). Bailer and Tomitch (2016) comment that multitasking skills are becoming increasingly necessary in a world with such advanced, ubiquitous technology. However, the authors point out that such ubiquity has raised concerns regarding learning under conditions of distraction. In this context, they believe that educators should be aware of the risks involved in the use of new technologies and suggest talking to students about the limitations of multitasking as well as assisting them in achieving media literacy.

In sum, the studies on MALL carried out so far show that language learners are willing to use mobile technology to assist their studies and that, in spite of some limitations, mobile devices can help the acquisition of vocabulary. I will now present some studies which have investigated the role of CALL and MALL in assisting vocabulary acquisition.

---

[1] In spite of the relevance of multitasking to MALL, this study does not aim at investigating it further.

### 2.5.3 CALL, MALL and vocabulary acquisition.

Linguists have started to consider how computer and mobile assisted language learning can enhance vocabulary acquisition. Sökmen (1997) argues for the use of computer-assisted learning with software based on principles of vocabulary acquisition theories. She mentions that a significant number of software available at that time lacked depth and more varied exercises. Ellis (1995) has also criticized CALL by saying that "CALL programs have too often been driven by enthusiasm for what computers can be made to do and too rarely by an understanding of human cognition" (Ellis, 1995, p. 1). In this regard, the author suggests that CALL programs are not being developed with attention to the cognitive aspects, and that the interest for the technology itself is the driving force behind CALL. In spite of such critics, both Sökmen (1997) and Ellis (1995) acknowledge that, with proper development, computers can enhance vocabulary acquisition.

Grace (1998) analyzed the effects of "sentence-level L1 translations on the retention of L2 vocabulary presented in a pregnant[1] CALL context for beginning L2 learners" (p. 536). Although the author believes that inferring word meanings promotes better retention due to deeper processing, she acknowledges that incorrect meanings can be retained if wrong inferences are made. In this context, her study found that sentence-level translations reduce the chances of incorrect inferences from L2 context and the consequent commitment of wrong meanings to memory. Furthermore, she hypothesizes that "as a result of their verifications of meaning, sentence-level translations may also lead to elaborate, deep and durable encoding" (Grace, 1998, p. 534). The results of the study showed that the participants who had access to translations while inferring performed better in a post test. The author points out that such performance is not only due to the availability of the translations, but also because a great number of stimulus from the pregnant context was provided.

Stockwell (2008) carried out a study that aimed at comparing vocabulary acquisition in mobile phones and desktop computers. Participants could choose to do the selected activities in their preferred platform and could alternate between them freely. The results show that the participants obtained similar scores with the two platforms. The results also demonstrated that completing the activities through mobile

[1] Pregnant contexts are the multi-media texts used in the study, which included audiovisual aids and L1 translation.

took significant longer. The author argues that the mobility of these devices can be one of the reasons for this result. As participants could do the activities anywhere and at any time, Stockwell reasons that they did them in environments where it was harder to concentrate such as in trains or coffee shops, which required more time to finish the tasks.

In an attempt to explore the benefits of mobile phone applications for vocabulary learning, Fageeh (2013) conducted a study in which participants from an experimental group were given a list of words based on their textbooks and had to practice them using mobile phones, whereas participants from the control group had to use the textbook for this practice. The post-test scores indicate that the experimental group acquired the target vocabulary significantly better. The author also mentions that the use the mobile phones promoted higher motivation to complete the tasks.

Although MALL is still an emerging field of study, it has been given significant attention during the last years. The higher accessibility to mobile technologies results in a growing market for mobile learning, which in turn calls for more studies in the field. The review of literature presented in this chapter shows that, in spite of some limitations, mobile devices can assist vocabulary learning. Moreover, studies suggest that EFL learners willing to use their mobile devices as language learning tool. As Naismith et al (2004) acknowledge, mobile devices are "finding their way into classrooms in children's pockets, and we must ensure that educational practice can include these technologies in productive ways". In this context, this study sets out to add discussion to the field of MALL, especially in regards to vocabulary instruction. The following chapter tackles the method of this study, which will help achieve its objective.

# 3. METHOD

In this chapter, I will describe the method used to achieve the objectives of this study, namely, to analyze six applications for smartphones that can be used for English vocabulary learning. The applications were analyzed taking into consideration research on second language learning[1] and vocabulary development.

## 3.1 OBJECTIVES

With the advancement of mobile technology, studies which bring discussion on its educational uses become more important. With this in mind, the objectives of this study are:

1) To analyze six smartphone applications for English learning under the light of literature on vocabulary learning.
2) To examine their sources for the presentation, review and consolidation of new lexical items.
3) To examine how the applications incorporate elements from the literature in vocabulary learning.
4) To investigate how the relation between the applications and learning theories, such as Behaviorism, and second language teaching methods[2], such as the Grammar-Translation method.

## 3.2 RESEARCH QUESTIONS

In order to pursue the aforementioned objectives, this study, qualitative in nature, attempts to answer the following questions:

R1.) What are the sources for the presentation, review and consolidation of new lexical items in the selected applications?

R2.) What aspects of word-knowledge do the applications develop?

---

[1] Although the review of literature of this study includes research on both second and foreign language learning, the analysis will use the term second language learning as an umbrella term covering second and foreign language learning.

[2] This study understands that a method "is a set of classroom specifications for accomplishing linguistic objectives" (Brown, 1994). The study does not attempt to distinguish approaches from methods, as they are often used interchangeably. These terms will be used according to the referential works mentioned. For more on the discussion between the terms, check Brown (1994) and Richards and Rodgers (1996).

R3.) Do the applications provide a number of encounters with the target vocabulary? Are encounters massed or spaced?

R4.) What are the nonverbal representations employed and how can they assist the instruction of vocabulary?

R5.) What learning theories and language teaching methods seem to influence them?

## 3.3 PROCEDURES FOR DATA COLLECTION

Six smartphone applications were chosen according to the following criteria: a) having activities designed for vocabulary learning; b) being available on both Play Store and on the Apple Store; c[1]) having more than 50.000 estimated downloads on both Play Store[2] and on Apple Store[3] and d) not being designed for the development of a single language skill[4].

To choose the applications for this study, the following steps were taken. First, a search was conducted on the Google Play Store using the keywords '*English learning'*. The results from this search were then filtered according to the aforementioned criteria. In order to do that, the number of downloads each application had on Google Play was consulted. Those which had less than 50.000 downloads were excluded. To ensure that the remaining applications were also available for iOS devices, the website *SensorTower* was consulted. Those which were not available for both platforms were then excluded. The website was also used to check the estimate number of downloads the applications had on Application Store. Finally, six applications with most downloads were selected for the study. Table 5 shows the names of the ones which have fit the proposed criteria and the approximate number of users downloads they have on Google Play and on Apple Store. The table goes from the application with most users to the one with the least users.

Table 4

Estimate number of users of the applications selected for the study.

[1] The reasoning behind this criterion is that if an application is available in both of the most well-known platforms worldwide, such application has a significant number of users.

[2] The Google Play Store or Google Play (originally known as the Android Market) is a digital distribution service operated and developed by Google.

[3] The Apple Store is the online store of Apple Inc.

[4] This means that applications designed for one specific language skill, such as listening or reading, were not considered for this study

| Application | Number of downloads on Play Store[1] | Number of downloads on Apple Store[2] | Total |
|---|---|---|---|
| Duolingo | 4.650.000 | 1.000.000 | 5.650.000 |
| Memrise | 819.000 | 300.000 | 1.119.000 |
| Hello English | 605.000 | 10.000 | 615.00 |
| Babbel | 175.000 | 300.000 | 475.000 |
| ABA English | 75.000 | 200.000 | 375.000 |
| Lingualeo | 249.000 | 50.000 | 299.000 |

Due to the qualitatively scope of this study, the number of applications investigated will be smaller if compared to other studies, such as Kim and Kwon (2012) and Heil (2016). By working with six applications, it is possible to analyze them in more depth. This means that this study will not only describe the applications, but will also attempt to discuss their underlying principles in terms of vocabulary learning and language acquisition.

A framework was elaborated with the goal of guiding the collection and analysis of data from the applications. The framework is based on research presented in the chapter of review of literature, mainly Brown and Payne (1994, as cited in Hatch & Brown, 1995), Laufer (1997), Sökmen (1997), Takač (2008) and Mayer (2009).

[1] Approximate numbers acquired from www.googleplay.com. Access in September, 2017.

[2] Approximate numbers acquired from www.sensortower.com. Access in September, 2017.

Table 5

*Framework for the analysis of smartphone applications for English learning*

| | |
|---|---|
| 1. Vocabulary development | |
| | 1.1. What are the sources for the presentation of new lexical items? |
| | 1.2. Are there resources for learning their form and meaning? |
| | 1.3. What are the sources for the review and consolidation of lexical items? What is their design? Are there sources for consolidating word form and meaning in memory? Are learners provided with chances to use the words? |
| | 1.4. What aspects of word-knowledge are developed? |
| | 1.5. Does the application provide a number of encounters with the target vocabulary? Are encounters massed or spaced? |
| | 1.6. What are the nonverbal representations employed to instruct vocabulary? |
| 2. Learning theories | |
| | 2.1. What learning theories seem to influence the design of the applications? |
| 3. Language teaching methods | |
| | 3.1 Considering the analysis of the previous items of the framework, what language teaching methods seem to influence the design of the applications? |

The first section of the framework aims at analyzing the activities the applications provide for vocabulary learning. Sections 1.1 and 1.2 of the framework deal with the sources for the presentation, review and consolidation of lexical items and are based on Takač (2008) and Brown and Payne (1994, as cited in Hatch & Brown, 1995). Section 1.3 takes into consideration the different components of word knowledge, as outlined by Laufer (1997). Sections 1.4, 1.5 and 1.6 of the framework aim at analyzing vocabulary activities taking into consideration current trends in vocabulary learning, based mostly on the works of Sökmen (1997) and Mayer (2009). The second part of the framework focuses on understanding the influence of learning theories on the design of the applications. Finally, the third part has the goal of investigating the influences (if any) of language teaching methods in the design of the applications.

With the framework in mind, I used the applications and completed activities provided for vocabulary learning. To gather data for the analysis, I took print screens from sections and activities which fell under the categories from the framework.

## 3.4 PROCEDURES FOR DATA ANALYSIS

Once the applications were selected and their data was collected, a qualitative analysis was carried out. I will now explain how the data was analyzed according to different sections of the framework.

Table 6
Framework for the analysis of vocabulary development in the applications

| 1. Vocabulary development |
|---|
| 1.1. What are the sources for the presentation of new lexical items? Are there sources for learning their form and meaning? |
| 1.2. What are the sources for the review and consolidation of lexical items? Are there sources for consolidating word form and meaning in memory? Are learners provided with chances to use the words? |
| 1.3. What aspects of word-knowledge are developed? |
| 1.4. Does the application provide chances for learners to encounter the target vocabulary in different contexts? Are encounters massed or spaced? |
| 1.5. What are the nonverbal representations employed to instruct vocabulary? |

For sections 1.1 and 1.2 of the framework, I classified the activities provided by the applications into two large categories: sources for the presentation of new lexical items and sources for the review and consolidation of lexical items. This was done with basis on based on Takač (2008), which lists a variety of ways of presenting, reviewing and consolidating lexical items. Although many activities from the applications fell perfectly into one of the ways presented in these tables, some fell into more than one. In these cases, I attempted to understand the overall objective of the activity, that is, whether it was to present new vocabulary or to review and consolidate words that had been presented previously. Moreover, I also investigated whether the applications provided chances for learners to use the words, as this is regarded in the literature as a vital step for vocabulary learning (Hatch & Brown, 1995; Sökmen, 1997; Swain, 1995; Takač (2008).

Section 1.3 of the framework had the goal of providing the grounds for the investigation of which components of word knowledge are dealt with by the applications. For this section, the five components outlined by Laufer (1997) were used, namely knowledge of words' written and spoken forms, structure, syntactic behavior, meanings and lexical relations.

Sections 1.4 and 1.5 aimed at providing the information for the analysis of whether the applications incorporated current trends in vocabulary learning. Section 1.4 grounded the investigation of whether the applications provided multiple encounters with target vocabulary, and whether this was done in a massed or spaced manner. For example, if the word 'football' is presented, reencountering it multiple times should increase its retention (Nation, 1990). Moreover, linguists believe retention is further increased if these encounters are spaced, not massed (Bahrick & Phelps, 1987; Bloom and Shuell, 1981; Ullman & Lovellet, 2016).

Section 1.5 of the framework aims at investigating the nonverbal representations from the applications. When nonverbal representations facilitate imagery of vocabulary, memory links are believed to be strengthened (Clark & Paivio, 1991; Laufer, 1997; Mayer, 2009; Sadoski, 2005). With this in mind, I analyzed pictures and images used in the applications and their relationship to verbal representations, attempting to understand their role in the instruction of vocabulary. One of the guiding principles for this analysis is Mayer's (2009) triarchic model of cognitive load which posits that effective instructional design depends on techniques for reducing extraneous processing, managing essential processing, and fostering generative processing (p. 57).

Furthermore, the analysis aimed at unveiling whether the applications are influenced by language learning methods, such as the Audiolingual and the Grammar-Translation method, and by language learning theories, such as Behaviorism and Constructivism.

# 4. RESULTS AND DISCUSSION

In this chapter, the analysis each of the selected applications is presented according to the criteria given previously. First, a brief description of each application is given. Second, the sources for the presentation of new lexical items are examined, considering sources for learning the meaning and form of words. Third, the sources for review and consolidation are discussed, analyzing if there are opportunities for receptive and/or productive use of vocabulary. Finally, a more general discussion is presented in order to provide answers for the research questions of this study.

## 4.1 BABBEL

Babbel is a freemium[1] application for language learning which offers courses in various languages, including English. According to Chang (2017), there are more than one million users who subscribe to the application, which also offers some free content. Each language course is made of elementary, intermediate and extra lessons. Only the first lesson of each course is available for free, and they are the ones for which the analysis is provided.

### 4.1.1 Sources for the presentation of new lexical items.

In Babbel, new words are usually presented with the aid of an image which represents the word and its translation into the learners' L1. Figure 1 exemplifies how the target vocabulary is presented.

[1] Freemium applications are free to download, but they charge money to allow access to some of its features.


*Figure 1*. Word presentation in Babbel

The first encounters present only the target word, its translation and an image to represent it, as in figure 1. In these first encounters, learners hear the target word and should translate it before proceeding to the next activity. Even if they pronounce the word perfectly, the application may not recognize it as such. If this happens, they may understand that their pronunciation is incorrect and worry unnecessarily.

Word meanings in Babbel are taught predominantly by providing the target word with its translation into the learner's L1. Regardless of the level of the activity, word meanings are presented in such fashion. Images are also employed to assist in the meaning-making process. However, the visual representations are always followed by words in the L1 and are never the only source for acquiring meaning.


Figure 2. Sources for learning the meaning of words in Babbel.

Both words and expressions are taught in the same fashion, as figures 2 shows. Having images can assist learners in creating their representations of the vocabulary being taught. Nevertheless, there is little room for other strategies. Brown and Payne (1994, as cited in Hatch & Brown, 1995) mention strategies such as for word definitions and explaining the word meaning and asking for the word in English. As Babbel relies on translation to teach the meaning of words, these strategies did not find their place into the app.

### 4.1.2 Sources for reviewing and consolidating new lexical items.

Once lexical items have been presented, Babbel provides some activities for learners to review and consolidate them. One of the most frequent activities for consolidating meaning is done by providing a target vocabulary item in the L2 and four options in the L1 for the learner to choose, as figure 3 shows.


Figure 3. Learners have to choose one of out of the four translations offered by Babbel for an L2 item.

In the examples in figure 3, the lexical items to be practiced were *leather jacket* and *to be hammered*. There are four options, out of which only one is correct. The options are all in the learners' L1 and they have all been presented prior to this activity.

As to sources for reviewing vocabulary, the application creates review units based on the vocabulary that has been worked with, as in the figure below.


Figure 4. The review system from Babbel.

Figure 4 shows that learners have the chance of reencountering the vocabulary presented in previous units by doing reviews. These reviews are generated automatically and include words from different units. The word review (*revisão*) indicates that the vocabulary has been met before. Figure 5 is an example of how vocabulary is reviewed.

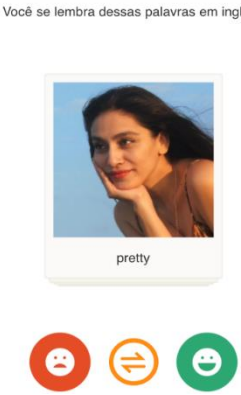


Figure 5. Reviewing words in Babbel

As exhibited in figure 5, learners are able to say whether they remember the target word or not. If they do not remember a certain word, the application will reintroduce it in further reviews, which does not happen if they say they remember the word. The idea behind this is to give learners more encounters with the word in order to assist with its

retention and also to provide a chance for them to check whether they still remember the words presented previously.

Another activity which may aid in consolidating form and meaning in memory consists of filling the gaps of a conversation using the vocabulary presented in previous activities, as depicted in figure 6.


*Figure 6.* An activity for consolidating meaning in memory in Babbel.

In figure 6, for example, learners should fill in the conversation with the words "grab" and "grub", which were presented previously. However, the words appear now in a meaningful context, characterized as two friends talking after a party in the case of figure 6. Placing new words into a context is one of the memory strategies mentioned by Oxford (1990), which points out that this strategy assists in remembering new vocabulary as well as encountering related words.

As in other activities from the app, the sentences from the conversation are still followed by their translations into the learners' L1. Even though this can be an aid to those who, for any reasons, cannot hear the word, I believe this kind of activity could be done without the assistance of the L1 because the target words had already been presented. Furthermore, learners could fill in the gaps by analyzing the context of the conversation. This way, chances are more attention would be paid to the other words of the conversation since they are the contextual clues that suggest the correct answer.

While the availability of the L1 is a straightforward, easy-to-access way to consult meaning, it is unlikely to promote deeper levels of processing. Because meanings in the L1 are always given, learners do not have to attend to many details related to a given word, such as its relation with other words and other possible meanings. Schmidt (2000) maintains

that a determining factor for word retention is the amount of attention learners pay to language features. Considering this, the ease of the activities ends up requiring little attention to language features, which may result in poor language retention.

There are not many sources for the productive use of target words in the application. The type of activity depicted in figure 7 is one of the few chances for the use of target vocabulary.

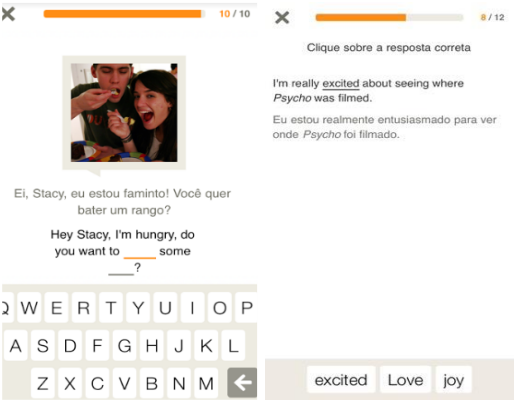


*Figure 7*. Sources for using words in Babbel.

In the activities of figure 7, for example, learners are asked to fill the gaps with the missing words, which in this case are *grab*, *grub* and *excited*. Although they may fill in the gaps without reading the translation below the image, they may also read the translation of *do you want to grab a grub (você quer bater um rango*) and simply translate the missing words. The production allowed by this design of the activity is very controlled because the only two words that can be produced are the ones provided by the app. Therefore, learners are unable to create sentences that they thought of themselves. Swain (1995) hypothesizes that production in the target language is necessary because it causes learners to process language more deeply, that is, with more cognitive effort. Moreover, the author points out that when learners produce in the target language, they can notice the gap between what they need to express themselves and what they know. With the type of production illustrated in figure 7, it is unlikely that learners of the application will notice the gap between what they want to produce and what they can.

### 4.1.3 BABBEL - GENERAL DISCUSSION.

All things considered, Babbel provides sources for the presentation, review and consolidation of words. Regarding the essential steps for vocabulary learning suggested by Brown and Payne (1994, as cited in Hatch & Brown, 1995), the application has sources for all of them. Notwithstanding, it provides few opportunities for the production of language. The use of the vocabulary presented is restricted to activities in which the learners' sole role is to choose one of two words to fill in the gaps. As discussed, this type of activity is less cognitively demanding and may be less assistive in the learning of words. Furthermore, learners are unlikely to notice the gaps in their knowledge due to the dearth of production.

The lack of activities which allow for more free use of language is probably linked to the difficulty of assessing this kind of production in the MALL context. When the number of answers for an activity is limited, it is much easier for feedback to be given by the application itself, while unrestricted production would probably require human contribution or a more developed feedback technology.

With respect to the research question 2 "what aspects of word-knowledge do the applications develop?", the analysis suggests that it can assist the learning of words': a) written and spoken forms; b) syntactic behavior and c) meanings. These aspects are developed to different degrees, with an emphasis on the instruction of the written and spoken form of words, which is mostly done by listening to their pronunciation and then typing them. For example, the word *excited* has to be typed multiple times in lesson it is presented. The application also pronounces it several times. However, there is no instruction on the structure of words. In the case of the word *excited*, learners could benefit from knowing that the root of the word is the verb *to excite* and that by adding the suffix *–ed* the verb becomes an adjective. Moreover, the lexical relations of words are also disregarded, which means that there is no instruction on the possible synonyms, antonyms, hyponyms and collocations of a word.

The syntactic behavior of words can be learned by doing activities such as the one in figure 7, as this type of activity requires attention to the possible combinations of words. In the case of figure 7, the word *excited* is preceded by the word *really* and proceeded by *about*, which are examples of the possible combinations of the word. From this example, one may learn that the adjective *excited* is followed by the preposition *about*, and can be intensified by the adverb *really*.

Nevertheless, this learning would depend entirely on learners as the application does not provide such information, meaning that the syntactic aspects of words are not explicitly instructed in Babbel.

Schmitt (2000) argues that "there is sometimes much more to a word than its denotative meaning, implying that teachers need to consider how to incorporate register information into their vocabulary teaching" (p.35). From this perspective, the instruction of word meaning should also include the work with the register. Accordingly, Babbel offers some activities which can develop learners' knowledge about the register of certain lexical items, as in figure 8.

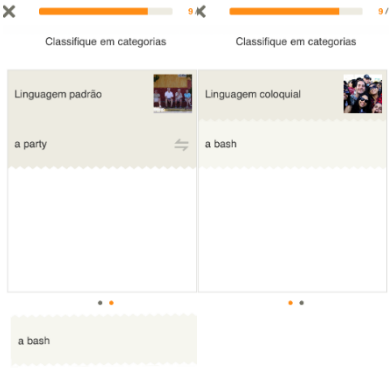


*Figure 8*. An activity designed to assist with the register of lexical items.

With regards to the research question 3 "does the application provide a number of encounters with the target vocabulary?", the analysis of the application has revealed that target words can be reencountered multiple times within the unit which presented them, and also in the so called *review system*. As explained, Babbel generates reviews containing the lexical items that have been studied, which can help learners consolidate what they have learned.

The developers of the application claim that it "reintroduces words through six memory stages, using the technique of spaced repetition" (TheBabbelmethod, 2017). Because of this claim, one can understand that vocabulary in Babbel is presented through distributed practices rather than massed ones. Studies have shown that the retention of L2 vocabulary is higher when instruction is spaced rather than massed, and that the spacing of repetitions can be more valuable than the number of repetitions

(Bahrick & Phelps, 1987; Bloom and Shuell, 1981; Ullman & Lovellet, 2016). For the positive effects of spaced repetition to take place, however, the application would have to ensure that content is reviewed in the appropriate timing. This is not guaranteed to happen since Babbel only creates the reviews, but does not send notifications to remind learners they should be done. In other words, the spacing effect will only happen if learners themselves commit to an optimal schedule of studying.

Concerning research question 4 "what are the nonverbal representations employed to instruct vocabulary", Babbel makes use of images to assist in the presentation and review of lexical items. Under the Dual Coding Theory, pictures can provide cues to identify words and help meaningful elaboration in the form of nonverbal context (Sadoski, 2005). By looking at figures 1 and 2, one can see that information about the target items is given through different media, that is, through graphics, written texts and narration at the same time. According to the redundancy principle proposed by Mayer (2009), this is not optimal as "people learn better from graphics and narration than from graphics, narration, and printed text" (p.118). The author explains that when graphics, narration and printed text are given concurrently, "the visual channel can be overloaded by having to visually scan between pictures and on-screen text" (p.118). Nevertheless, as Mayer himself admits, if the written texts is shortened to a few words (as is usually the case in Babbel), then the written text becomes less redundant and therefore causes less extraneous processing.

In regards to the research question 5 "what learning theories seem to influence the development of the applications?", Babbel has characteristics which suggest it is influenced by Behaviorism. There are plenty of activities which ask for the repetition of words and sentences. Under the light of Behaviorism, such activities explore an echoic verbal behavior. The application provides several visual and audio stimuli along with positive reinforcement for correct answers as a way to promote learning.

Concerning research question 5 "what second language learning methods seem to influence them?" the application relies on translation and on the repetition of audio to assist in language acquisition. These are traces of the Grammar-Translation and Audiolingual methods, suggesting that the application may have been influenced by them. As previously noted, translation into the learners' L1 is available in the majority of the activities from the app. Grace (1998) suggests that offering meanings in the L1 in texts can prevent wrong inferences from being stored in memory and assist in vocabulary acquisition. Nevertheless, the application does

not ask learners to infer meanings nor does it work with reading comprehension. Therefore, L1 meanings are not offered for the sake of preventing wrong inferences, especially considering that the application already provides pictures for that.

One of the reasons for the heavy use of L1 may be related to the accessibility of the application. By having translations alongside the vocabulary, the application becomes more accessible to a number of learners who have little to no knowledge of the target language because word meanings are all provided straightforwardly through translations. This means that learners are less likely to feel in doubt about the receptive aspects of word knowledge. On the other hand, productive word knowledge is unlikely to be developed due to the lack of opportunities for the use of vocabulary, as discussed previously.

Babbel also has traces the Communicative Approach. The target vocabulary of some of the units acts as a support for certain functions, such as "getting something to eat" or "going shopping", which is a common way to work with vocabulary in the approach. However, the application cannot be considered as one to focus on communicative skills since there are no opportunities for real communication.

In sum, Babbel is an application which: a) has sources for the presentation, review and consolidation of vocabulary that aim at instructing it through translation and repetition, suggesting that the Audiolingual and the Grammar-Translation methods underpin its design; b) can help develop the written and spoken form of words, as well as their syntactic behavior and meanings; c) provides multiple encounters with target vocabulary within the unit that presented it and in review units; and d) uses images to assist in the instruction of vocabulary.

## 4.2 DUOLINGO

Duolingo is one of the most popular applications for language learning designed for mobile devices. With more 150 million users worldwide (Hickey, 2015), it offers courses in more than 60 languages. Although all its content is 100% free, the application generates revenue through what is called *human computation*. Garcia (2013) explains that human computation has the objective of "combining human and computing power to solve problems neither people nor computers could solve alone" (p.20). In the case of Duolingo, the problem that cannot be solved neither by people nor by humans is the translation of websites. Garcia argues that, for translating the web, the translation done by computers is not good enough while professional translators are too

expensive. Duolingo may help with this by offering translation as a by-product of the applications' usage.

One of the websites which uses Duolingo learners' translations is Buzzfeed, a well-known humor page. According to the website, native speakers of Portuguese, Spanish and French learning English on the application work together to translate Buzzfeed articles while an algorithm[1] selects the best translations to create a better translated post (Buzzfeedpress, 2017). The sheer amount of Duolingo users "guarantees high-speed, high-volume translations, ensuring that BuzzFeed content can be translated in a matter of hours" (Buzzfeedpress, p.1 2017).

The content of Duolingo is divided into what it calls "sections", which go from basic to advanced ones. Each section contains up to 11 topics, which are either vocabulary or grammar related. Due to the scope of this study, only the sections related to vocabulary will be considered. Figure 8 shows an example of how Duolingo organizes its content in sections.


*Figure 9.* An example of a section from Duolingo.

The section from figure 8 shows some vocabulary topics, such as *viagem* (traveling) *números* (numbers) and *educação* (education). Each of these topics is further divided into smaller lessons containing a limited number of target words. The lessons are divided into even smaller parts which work with a small number of target words. For example, in a lesson

[1] According to the Wikipedia, an algorithm is "a self-contained sequence of actions to be performed. Algorithms can perform calculation, data processing and automated reasoning tasks" (Algorithm, 2017).

whose name was *animals*, the target words were *horse*, *bird* and *duck*. I will now analyze how the instruction of these words according to the framework adopted for this study.

### 4.2.1 Sources for encountering new lexical items.

Learners encounter new words in Duolingo by choosing an L2 word which corresponds to the L1 word demanded. As figure 10 shows, the application asks learners to identify the image which represents the word in the heading, which in this case was *avião* (airplane).

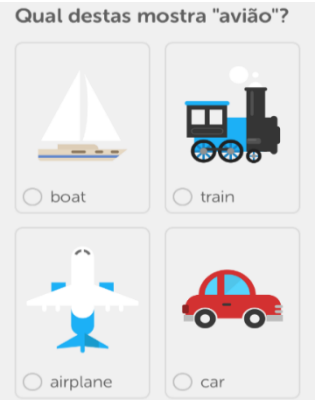


*Figure 10*. A source for word encounter in Duolingo

Selecting the correct alternative is a relatively easy task since images corresponding to the target vocabulary are also provided for each option, as figure 10 evidences. For example, within the section entitled 'travelling', one lesson introduces the words 'boat', 'train', 'airplane' and 'car'. Once the learner selects an alternative for the L1 word, the application pronounces it and says whether it is the correct one. The reason why this type of activity can be considered a presentation one and not a sort of assessment lies on the fact that corresponding images are exhibited along with the target vocabulary. This means that when learners read the target word in their L1 (*avião*, in the case of figure 10), all they have to do is choose the image which represents it. Since the signifiers[1]

[1] In structural linguistics, the signifier is the means through which the signified is expressed. In this case, the signifiers *avião*, *airplane* and the image of a plane all lead to the same signified, the idea of the airplane.

in the L1 and L2 lead to the same signified, learners do not have to know the word in the L2 to tap on the correct picture. In this context, the use of images can assist the presentation of new lexical items.

When the target words are more abstract, they are presented in sentences and not with words. Picture 11 exhibits an example of presentation of more abstract vocabulary.

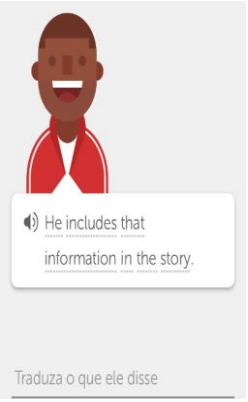


*Figure 11*. Another source for encountering words in Duolingo

Figure 11 shows the first lesson of the section entitled *Comunicações*, whose target words are 'search' and 'information'. Due to the fact that these words are less concrete, it becomes more difficult to present them with images. Sadoski (2005) explains that "concrete things, actions, and observable qualities or relations are relatively easy to develop, whereas concepts that represent abstract things, actions, qualities, or relations are acquired with more maturity" (p.5), which means that abstract concepts require more effort to be learned. This is likely the reason why abstract lexical items are presented in sentences, and not with pictures.

Learner are supposed to translate these sentences such as the one in figure 11, which can be done without any aid from the app. It is also possible to tap the words of the L2 sentence to see their possible meanings in the L1, as figure 11 shows. The figure also shows the image of a man. Unlike figure 10, this image is unlikely assist in the comprehension of the target vocabulary, although it may serve as a reminder that the "he" is the masculine third-person, singular personal pronoun.

The sources for learning the meaning of words in Duolingo are the same ones used to provide the first encounters. That is, while being presented to the target words, learners have the chance of learning their

meanings, either with the help of images or by reading their meanings in the L1, as figure 12 shows.

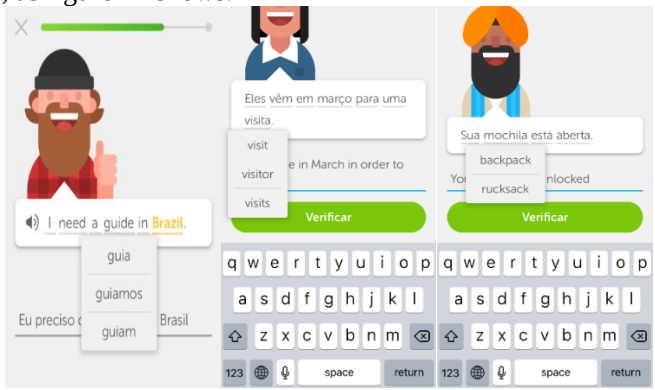


*Figure 12*. Sources for learning the meaning of words in Duolingo

For example, when doing the activity from figure 12, learners can access the meanings from all the words in the sentence. In the case of figure 12, upon tapping the word ‘guide’, learners are offered three possible translations: *guia*, *guiamos* and *guiam*. The learner is then expected to choose the one which best fits the sentence. As was the case in figure 11, the image in figure 12 does not assist the comprehension of the sentence nor the target word “guide”. The insertion of the image of a man in figure 12 is probably connected to one of the layouts of Duolingo, which usually presents the image of someone smiling and supposedly producing the sentence the learner has to translate.

### 4.2.2 Sources for reviewing and consolidating new lexical items in Duolingo.

As mentioned previously, Duolingo focuses on a limited number of target words in each lesson. These lessons contain activities which can help consolidate word form and meaning in memory. For the consolidation of word form, one frequent activity is to type in the words pronounced by the application, as shown in picture 13.

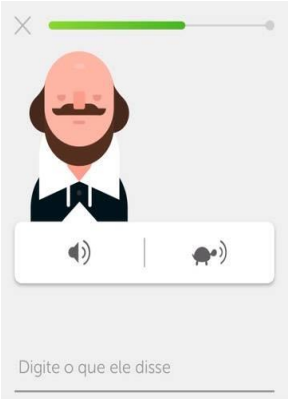


*Figure 13*. A source for the consolidation of word form in Duolingo.

Figure 13 shows that in this kind of activity learners have to click on an audio file and write what they hear. There are two speech rates which they can choose to hear: a normal and a slower one, which is represented by the image of turtle. At this stage, the application expects that learners will be able write the word simply by hearing it because they have already been presented to the spelling of the target words. This type of activity can be considered a drill, and is a typical exercise in Audiolingual methods.

Another type of activity that may help consolidate word form entails the spelling of target words. Learners are asked to type the target language word for a word in their L1, as depicted in figure 14.


*Figure 14*. Spelling target words in Duolingo.

In figure 14, for instance, learners should spell the word ‘horse’ in English. At this stage, there are no aids other than the image for learners

to access. Considering the five aspects of knowing a word outlined by Laufer (1997), namely, knowledge of its written and spoken form, structure, syntactic behavior, meanings and lexical relations, this kind of activity assists in the acquisition of the word form. Other aspects such as knowledge about the word structure and syntactic pattern are not approached.

One of the most common review activities consists of matching the target words in the L1 and their correspondents in the L2 by touching them, as figure 15 shows.

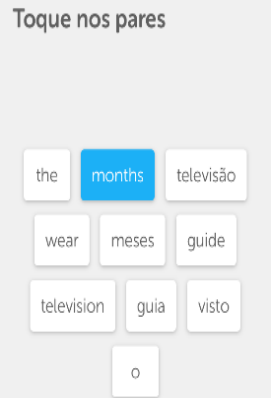


*Figure 15*. Matching L1 and L2 words in Duolingo.

The activity from figure 15 contains the target word ‘guide’ and some words which were introduced in different lessons, such as *meses* (months) and *televisão* (television), meaning that this activity also works as a source for the consolidation of lexical items. Although reencountering vocabulary which was previously dealt with can benefit lexical consolidation, it is unclear whether Duolingo algorithm for spaced repetition works with planned or unplanned intervals in this case.

In the case of figure 15, the word *visto* can become a challenge for learners. Because the unit in question deals with the topic of traveling, it would be possible to expect the word *visto* to be paired with the word *visa* in English. Nonetheless, the correct pair in this activity is *wear*. Because verbs in Portuguese are conjugated, the verb ‘wear’ in English could be assimilated to a number of conjugations of the verb in Portuguese: *visto*, *vestimos* and *vestem*, to name a few, are all possible translations of *wear*. This problem could easily be avoided by having a small context to disambiguate the verb. For example, the sentence *I wear*

*a shirt* could be easily paired with *Eu visto uma camisa* without confusing learners.

For the learners to use the target word, *Duolinguo* provides the L1 word and an image to represent it and then asks learners to write the L2 word. As an example, it asks the learner to write the word in English for *cavalo*, as in figure 16, below.


Figure 16. Feedback from Duolingo

As can be seen in figure 16, the application asks the learner to write the word in English for the Portuguese word *cavalo*. If the learner misspells the word, the application then points out the correct answer. Considering this context, it is possible to say there is a chance for learners to test their knowledge of the word. It is, however, a very simple one because it gives learners the correct answer but no explanation which could assist in consolidation of vocabulary.

The application provides some activities in which feedback is given. Figure 17 below, for example, shows how feedback is given in the app.


*Figure 17*. Problematic feedback from Duolingo

The original sentence *continuou chovendo por uma semana* was translated as 'it kept raining for a week', which was considered as incorrect since the particle 'on' (underlined in figure 17) was missing. Although 'it kept raining for a week' makes perfect sense and correctly translates the original sentence, the feedback comes in red color, signaling a mistake. The answer suggested by the application should be presented as yet another possibility, not as a mistake. This happened because Duolingo feedback [1] for this activity was created by comparing the learners' sentence to a pre-established one. By having just one possible answer, the application ignores other valid responses, which may cause learners to believe they have made a mistake when they have not. As Swain (1995) postulates, production in the target language is an opportunity to test hypotheses about comprehension and about linguistic form, especially when this production generates feedback from the interlocutors. It is not fruitful, in this context, to have confusing feedback from the interlocutor, which in this case would be the application.

Since all activities from Duolingo involve some sort of translation, which means that the words have already been produced and are there to be translated, learners are not provided with chances to produce language which they think for themselves. Therefore, it is possible to say that Duolingo is an application which focuses mostly on receptive knowledge. Hatch and Brown (1995) point out that if language learners only want to have a receptive knowledge of language, it is not obligatory to use

[1] Duolingo has more intelligent ways of providing feedback, like lexeme based feedback. For more information, check Settles and Meeder (2016).

language productively However, if they want to move as far along the continuum of word knowledge as they can, then word use is vital.

### 4.2.3 Duolingo – general discussion.

Duolingo is one of the most used mobile application for language learning in existence. One of the reasons for its popularity is the simplicity of its design. The application is easy to navigate and instructs vocabulary straightforwardly with translation activities. As Nation (2001) points out, translation "has the advantages of being quick, simple and easily understood" (p.110). In the case of Duolingo, the presentation of new words with the learners' L1 can facilitate learning for those who are not familiar with the target language, *e.g.* beginner learners. However, this sort of presentation is unlikely to require deeper levels of processing because meanings are quickly given away with the translations and learners have no reasons to process the words with more depth. As mentioned previously, deeper levels of processing can result in better retention (Craik & Lockhart, 1972; Baddeley, 1990).

It is relevant to point out that the use of translation *per se* is not the issue here. Rather, the problem lies in the fact that the translational activities are often too simplistic and do not evolve along with the level of the lessons, i.e. they remain the same throughout the app. As stated before, simple translational activities make the application accessible for those who beginning to use the app. However, as learners move along the lessons, they are likely to become dull and repetitive. To Sökmen (1997), activities with translation do not have to be dry and non-interactive exercises. For example, Heltai's (1989) oral translation activities involved communicative activities such as information gaps, pair work as ways to summarize and paraphrasing. The author says that while translation was over-used in the past, it can still be a valuable tool, especially for foreign language teaching. He maintains that translation activities can be a worthwhile exercise under the following conditions: a) they should not be used in excess or to the exclusion of other types of work; b) they should always be thoroughly prepared; c) they should be integrated it with other activities and d) they should be interesting and inspiring, both in oral and written modes.

With reference to the research question 2 "what aspects of word-knowledge do the applications develop", the analysis suggests that Duolongo can assist, to different degrees, the learning of a words written and spoken forms and meaning.

The development of the written form takes place in activities that require the spelling of words or sentences, such as the one in figure 14. The spoken form can be developed in most of the activities since the application pronounces the words in most of them. Listening to the words is much more usual than pronouncing them. Nevertheless, there are no activities designed to help learners connect the written to the spoken form, which is an important aspect to be developed, being the second step of the 5 steps put forth by Brown and Payne (1994, as cited in Hatch & Brown, 1995). Schmitt (2000) argues that explicit instruction in the L2 phonological system is often necessary because second language learners think and perceive orthography in ways dictated by their Ll, which many times is different in kind from the L2 being taught.

As shown previously, Duolingo provides word meanings mostly by associating the target words in the L2 to a meaning from the L1 (one exception is exemplified in figure 10, which shows an activity that uses images to explain the meanings of the L2 words). Overall, a meaning in the L2 is directly equated with a meaning the L1. In figure 15, for instance, the L2 word *wear* was equated with *visto*, and the word *guide* was equated with the word *guia*. The problem is that both *wear* and *guide* can have other meanings, depending on the sentence. Moreover, *visto* can also be a noun, in which case the appropriate translation would be *visa*. When doing the activity shown in figure 15, the first meaning I thought for the word *visto* was *visa*. Because the activity presents the words in isolation, it was difficult to know whether *visto* was a verb or a noun.

In some translation activities learners can access different meanings for one word, as exhibited in figure 12. For example, upon tapping the word *aberta*, learners will encounter the translations *open* and *unlocked*. Yet, the application does not explain whether these options are synonyms or if they have different meanings depending on the context. The words *open* and *unlocked* can different pragmatic meanings and should not be treated as synonyms, as the application does.

Regarding research question 3 “do the applications provide a number of encounters with the target vocabulary?”, in Duolingo vocabulary is reencountered multiple times within the lesson they were presented. For instance, the word *boat*, one of the target words from the second lesson in the unit entitled *travelling*, was met from 3 to 5 times in the lesson which presented it. Subsequent encounters take place at the last lesson from each unit, entitled *palavras mais fracas* (weaker words). Through its algorithm, Duolingo is able to identify the words that have been mistaken more frequently, subsequently adding these words to the lessons entitled *palavras fracas*. This means that vocabulary that caused

difficulty to learners is going to be reencountered more often than vocabulary that did not.

Once a unit has been finished, Duolingo assesses the need for practice and review of its content. Settles and Meeder (2016), explain how this assessment is done:

> Once a lesson is completed, all the target words being taught in the lesson are added to the student model. This model captures what the student has learned, and estimates how well she can recall this knowledge at any given time. Spaced repetition is a key component of the student model: over time, the strength of a skill will decay in the student's long-term memory, and this model helps the student manage her practice schedule (p. 1850).

As the authors point out, the application evaluates how much learners have learned from each lesson and how long it has been since they finished it. With this evaluation, strength meters are created to show students how likely they are to remember the content from a given unit, as can be seen in figure 8. Three or four golden bars indicate that the lesson has been done/reviewed recently, while one or two mean the lesson should be reviewed. The more learners practice the content from the units, the slower the strength bars it will decay, which goes in accordance to the forgetting curves presented in Settles and Meeder (2016). Considering this, it is safe to assume that Duolingo offers multiple encounters with target vocabulary and that these encounters are spaced in an organized fashion.

With reference to the research question "what are the nonverbal representations employed and how can they assist the instruction vocabulary?" the analysis of the application shows that images are employed to instruct vocabulary. Some of the activities from the application are likely to enhance learning of new words, while many are unlikely to do so. As discussed before, the application often introduces concrete words with the aid of images that represent them. When this happens, the images are the nonverbal representations of the target words. Because of the images, learners can comprehend the meaning of the written form of words, i.e. their signifiers, without resorting to their L1. For example, upon seeing the image of a boat, learners access their mental representation of the word and associate it with its signifier in English. Therefore, Duolingo makes good use of images when it comes to instructing concrete vocabulary. This goes in accordance to Sadoski (2005), who argues that the usefulness of pictures is connected to a number of factors, such as the concreteness value of the word, as "it is

easier to picture concrete words such as tree than abstract words such as true" (p.225).

While the meanings of concrete vocabulary are facilitated by the use of images, more abstract vocabulary and sentences are not. As depicted in figure 11, abstract words such as *information* were illustrated by the image of a person pronouncing a sentence containing them. The images do not illustrate a possible context in which the sentence might be said. Rather, it seems as if the image is only there so that it feels like the sentence is being pronounced by someone. Sadoski (2005) explains that, under the light of the Dual Coding Theory, rich verbal and nonverbal contexts contribute to the comprehension and memorization of words. Moreover, in light of the principles of the multimedia learning (Mayer, 2009), these images would be considered extraneous material as they "compete for cognitive resources in working memory and can divert attention from important material" (p.89). In this sense, it would be more useful to have images that helped contextualize the sentences, stimulating thus the mental representation of the words.

Finally, with regards to research question 5 "what learning theories and language teaching methods seem to influence the applications? the use of positive reinforcement throughout lessons suggests that Duolingo is influenced by behaviorism. The positive reinforcement is given though: a) sounds played when a correct answer is supplied; b) after the end of every lesson and c) through daily and monthly reports. Figure 18 shows examples of positive reinforcement.


*Figure 18.* Examples of positive reinforcement and positive punishment in Duolingo.

As figure 18 depicts, positive reinforcement is given each time a correct answer is supplied and when learners meet their *xp goals*[1]. The figure also shows that when learners provide an incorrect answer, they are given a sort of positive punishment. This type of punishment consists of presenting a negative consequence after an undesired behavior is exhibited, with the objective of making the behavior less likely to happen in the future (Sadowski, 2012). In the case of figure 18, the undesired behavior is selecting the wrong word for *imposto* (tax), and the punishment is given with a sound typically associated with error. With this, the application would be making this undesired behavior less likely to happen in the future.

According to Sadowski (2012), negative punishment happens "when a certain desired stimulus/item is removed after a particular undesired behavior is exhibited, resulting in the behavior happening less often in the future" (p.1). Duolingo also utilizes this type of punishment. When learners make mistakes, the green bar (which can be seen at the top of figure 18) recedes. The green bar represents a desired stimulus which is taken away when the undesired behavior (making a mistake) takes place. The more mistakes learners make, the more the bar recedes. Questions answered incorrectly are posed again until a correct answer is provided. As a consequence, lessons can only be finished if the mistakes previously made are not repeated.

Concerning the influence of language teaching methods, the predominance of translation-based activities suggests that aspects of the Grammar-Translation method underlie the development of the application. Brown (1994) points out that in such method, the most common type of drilling activity consisted in "translating disconnected sentences from the target language into the mother tongue" (p.19). This type of drilling is a key source for vocabulary presentation and consolidation in Duolingo. While drills with translation are used as a source for the presentation of lexical items, they are a better tool for consolidation because their purpose is to practice language. A lot of drills were also used in the Audiolingual method to reinforce 'good' habit formation (Schmitt, 2000). The fact that Duolingo also has a number of repetition (echoic) activities which ask learners to repeat/type what they

[1] Duolingo works with *xp goals*. When learners start using the application, they choose how much time they want to spend daily with it. With this information, the application establishes xp (experience) goals, which can be met by doing a certain number of activities each day.

hear suggests that the Audiolingual method also underpins its development.

All things considered, Duolingo is an application which a) presents, reviews and consolidates lexical items with activities that involve translation and repetition, suggesting that the Audiolingual and the Grammar-Translation method underpin it; b) can assist the learning of the written and spoken form of words, as well as their meanings; c) offers multiple encounters with target vocabulary, with spaced encounters provided with the aid of an algorithm; and d) uses images as an aid in the instruction of vocabulary, although some of these images are unlikely to have do so.

## 4.3 LINGUALEO

Lingualeo is a freemium application for learning English with versions for English learners from Brazil, Russia and Turkey. As of December 2015, over 13 million users had used the application.

Lingualeo's content is divided into grammar lessons and vocabulary lessons. Due to the scope of this study, only the latter will be taken into account. One key feature of the design of this application is that it generates vocabulary lessons based on the topics chosen by learners, as shown in figure 19.


Figure 19. Lingualeo's glossaries.

There are glossaries in many topics, such as jobs, education, sports, tourism, family members, among others. These glossaries can be

accessed at any time, and in any particular order. For this analysis, the glossary for *profissões* (jobs) will be used, as shown in figure 20.


*Figure 20*. Types of vocabulary activities in Lingualeo

There are six types of activities offered for each topic: 1) *Brainstorm*; 2) *Palavra-tradução* (translation words in English into the L1); 3) *Tradução-palavra* (translation of words in the L1 into English); 4) *Leo Sprint* (a game in which learners have to tell whether the translations shown are appropriate); 5) *Compreensão oral* (an activity in which learners type the words they hear); and 6) *Construção de Palavras* (an activity in which learners build words letter by letter). All of the activities are based on the gloss chosen, which in this case was *profissões.*

### 4.3.1 Sources for the presentation of new lexical items.

The application introduces new words in a section named 'brainstorm'. First, each target word is presented along with an image that represents its meaning, a translation into the users' L1 and its phonemic transcription, as picture 21 shows.

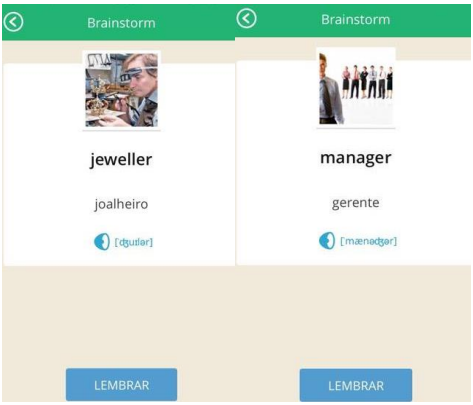


*Figure 21*. Sources for the presentation of new lexical items in Lingualeo

As Figure 21 shows, in the presentation stage, learners are not required to do any tasks. They may click on the icon next to the phonemic transcription to hear the target word, but they may also click on *lembrar* (remember) to proceed to the next word. According to Takač (2008), it is common for learners to have a more passive role in this stage, only receiving linguistic facts.

The application also presents new lexical items in the glossary section. The design of this presentation is very similar to the one used in the brainstorm section, that is, a number of words related to the topic is presented with the help of pictures, phonemic transcriptions and translations into the learners' L1. The only difference is that learners now can tell whether they have understood the meanings of the words or if they want to study them further, as figure 21 shows.

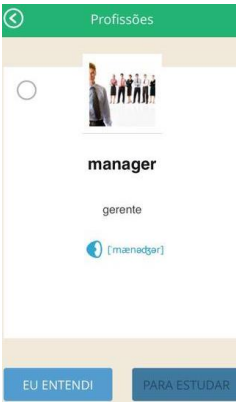


*Figure 22*. Vocabulary presentation in the glossary section of Lingualeo

If the target word 'manager' in picture 22 has been understood, learners can tap on *eu entendi* (I have understood). If not, they can tap on *para estudar* (to study) so that the application continues to work with it in other sections. This means that learners have a more active role than in the brainstorm section since they are asked to judge whether they understand the meanings or not.

### 4.3.2 Sources for reviewing and consolidating new lexical items in Lingualeo.

As shown in the previous section, Lingualeo has a brief presentation of the meaning and form of target words in the section *brainstorm*. Once these words have been presented, learners engage in a number of activities which may assist in consolidating meanings and forms into memory. The first type consists in offering four words in the L1 for a target word.


*Figure 23*. An activity for the consolidation of meanings in the Brainstorm section of Lingualeo.

As shown in figure 23, the application provides four alternatives in the L1 to translate the target word *priest*. These alternatives are all from the same content, which in the case of figure 23 was *jobs*. Because alternatives are not just distractors such as pronouns and prepositions, learners are more likely to consider all the options.

One issue with this section has to do with the fact that most nouns in Portuguese have a gender, whereas most nouns in English do not. As figure 24 evidences, the application asks learners to choose a suitable Portuguese word for the English words 'administrator', 'entrepreneur' and 'programmer'.


*Figure 24*. Translation of nouns from English into Portuguese does not account for the different genders in Portuguese.

The correct alternatives for the target words in figure 24 would be *admistrador*, *empresário* and *programador*. However, *administrator* can be both *administrador* (male) and *administradora* (female) in Portuguese. *Entrepreneur* and *programmer* also have both a male and a female word in Portuguese. Because of this, learners may understand that the target words are only meant for men, which is not the case. This becomes more likely considering that the application also works with words that are gender-specific, such as *sportsman*. Since the application does not provide any explanation on which words are gender-neutral in English, learners are expected to figure this out by themselves. In this sense, if taken into consideration the different aspects of knowing a word suggested by Laufer (1997), the application only assists in the learning of word meaning but disregards other important aspects such words' basic morphemes and syntactic structure.

In the section *Leosprint*, the application creates a game with words from a given content and also with some random words. In the game, learners have to tell whether a translation is appropriate or not, as depicted in figure 25.

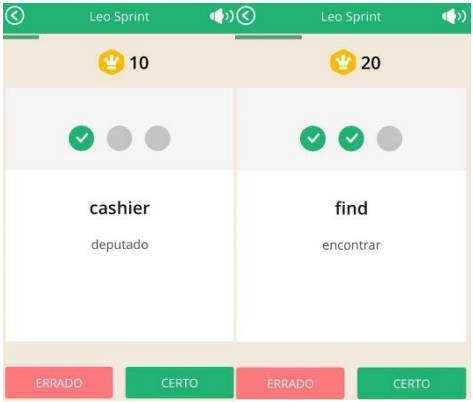


*Figure 25*. Leosprint, a game provided by Lingualeo.

For example, in picture 25, the word 'cashier' was translated as *deputado* (*congressman*), which is not a possible translation. Learners should then tap on *errado* to score points. For each time they correctly tell whether a translation is right or wrong, they score 10 points. If they do so three times in a row, double the points are awarded. If they do so six times in a row, then triple the points are awarded, and so on. The game lasts 30 seconds and at its end the final score is given, along with the best

score ever achieved by the learner and how much experience the learner has earned, as shown in figure 26.


Figure 26. Scores from the game Leosprint.

*Leosprint*, therefore, is a source for reviewing the lexical items presented in the *Brainstorm* section. The game rewards quick thinking and stimulates learners to achieve higher scores every time they play. The score and the experience bonus given at the end of it are rewards for the performance of learners. In terms of Behaviorism, these rewards are positive reinforcements which should increase the frequency with which learners play the game. Indeed, learners may play the game over and over until they beat their own scores. In doing so, they can be consolidating new lexical items in memory.

Another source for consolidating vocabulary is *Construção de Palavras*. In this section, the application provides all the letters which make up the target word and its translation into learners' L1. Learners should use these aids to spell the words, as evidenced in figure 27.

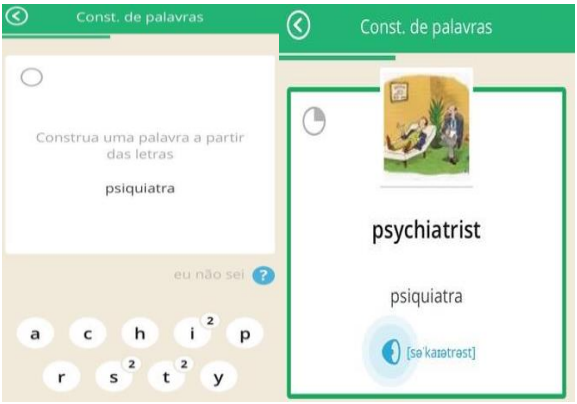


*Figure 27*. An example from an activity in the section Construção de Palavras.

Figure 27 shows the target word 'psychiatrist', which was previously presented in the brainstorm section. All the letters which form the word are scrambled, and learners have to tap them in the correct order. If the wrong letter is tapped, the application shows it in red to signalize the mistake. Once the word has been correctly spelled, the application provides its pronunciation and its phonemic transcription. *Construção de Palavras* is a section which assists in the consolidation of word form because learners have to pay attention to the spelling of words in order to form them appropriately.

All the sources for the review and consolidation of lexical items analyzed so far are built up according to the topic chosen by learners. However, more content is available in the *conteúdos* (content) section, as shown in figure 28.


*Figure 28*. TED Talks offered by the application

Figure 28 shows that the application offers access to a number of TED Talks[1] topics, such as arts and business. Upon selecting one of them, a TED Talk is played with English subtitles. Learners can tap on words they do not know to check their possible meanings, as shown in figure 29.

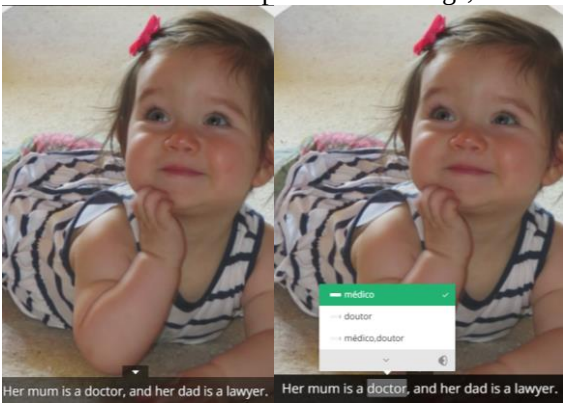


*Figure 29*. A TED Talk with English subtitles available in Lingualeo.

Figure 29 shows a section of a TED Talk, whose subtitle read 'Her mum is a doctor, and her dad is a lawyer'. The figure also shows that the word 'doctor' was selected and two meanings were offered in

[1] A TED talk is a video created from a presentation at the main TED (technology, entertainment, design) conference or one of its many satellite events around the world.

Portuguese: *doutor* and *médico*. Learners can then add this word to a glossary containing only the words they selected.

Although the activities in this section do not aim at reviewing or consolidating vocabulary from the glossaries, learners may end up reencountering words which were previously studied but still need to be consolidated in memory. For example, the word ´doctor' was presented in the *brainstorm* section of the application, and if learners access this specific TED Talk, they would reencounter this word incidentally.

Schmidt (1994) understands that incidental learning involves the learning of one thing (e.g. grammar) when the learners' main goal is to do something else (e.g. communicate). Taking this notion into account, by offering TED Talks, Lingualeo is also providing a source for a more incidental type of vocabulary learning because when learners watch these talks, their primary goal is to comprehend the talk itself. Since the application does not provide target words to be focused on while watching the talks, learners should not feel like their main goal is to learn vocabulary.

Another section Lingualeo provides is called *organize as palavras* (organize the words). The activities in this section do not work with vocabulary introduced in other sections such as *brainstorm*. As figure 30 evidences, the application claims that the section 'develops semantic prediction', which means that it aims at developing learners' ability to predict upcoming words in texts.

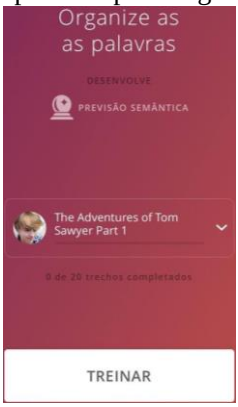


*Figure 30*. The opening screen from Organize as palavras and extracts from books available.

For this section, the application offers extracts from literary works in English, such as *The Adventures of Tom Sawyer*, *Pocahontas*

and *Robin Hood*. There are three sets of extracts, classified according to their difficulty[1]: beginner, intermediate and advanced. Figure 31 shows an example of each of the sets.

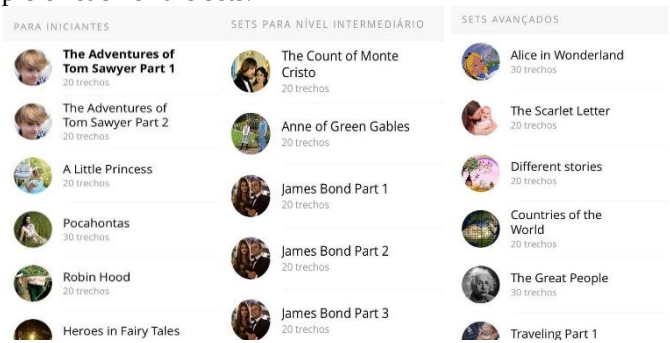


Figure 31. Three sets of extracts in the section Organize as palavras.

As evidenced in figure 31, most of the extracts are from literary works. However, there are also some newspaper and magazine articles. Once an extract is chosen, the application hides some of the words from the text and shows these words in random order at the bottom of the smartphone screen, as shown in figure 32.

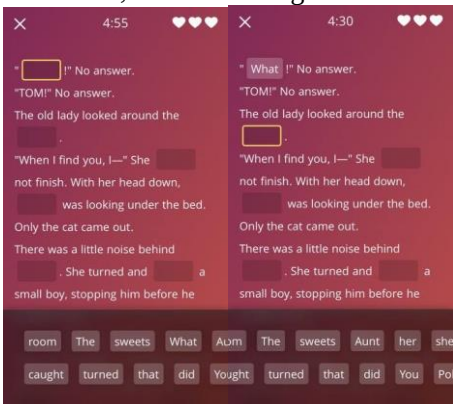


*Figure 32*. An example from Organize as palavras, a Cloze exercise.

The selected extract in the case of figure 32 is from 'The Adventures of Tom Sawyer Part 1'. All the words missing from the text are available at the bottom of the screen, and only the correct one can be

[1] The application does not provide information on how they classify the readings into difficulty levels.

chosen. The application does not allow incorrect ones to fill the gaps in the text. This allows learners to try different options, as long as they finish the activity within the time frame of 5 minutes and make no more than three mistakes during the whole activity.

Considering the memory strategies proposed by Oxford (1990), this type of activity, referred to as a Cloze exercise[1], can potentially assist in the consolidation of lexical items because learners have to associate words and put them into contexts. According to the author, by doing this learners are more likely to retain words into memory. For example, the word 'years' is associated with both 'ago' and 'old' in the example of figure 33.

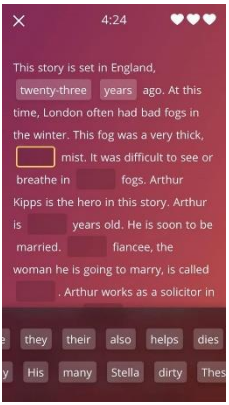


*Figure 33*. An example of word association in Lingualeo.

Successful completion of this activity requires attention to syntactic aspects of words. This does not mean that learners must explicitly know the part of speech of every word in the text, but that, as in the case of figure 33, the word *year* can be combined with *old* and *ago* whereas other options such as *Stella*, *help* and *his* do not. In other words, learners must pay attention to word collocations[2]. Therefore, this type of activity helps to develop important aspects of word knowledge outlined by Laufer (1997), namely syntactic behavior and lexical relations.

[1] A cloze exercise is a passage of suitable length that has had some words deleted (Honeyfield, 1977).

[2] In corpus linguistics, a collocation is a sequence of words or terms that co-occur more often than would be expected by chance (Collocation, 2017).

### 4.3.3 Lingualeo - general discussion.

The analysis carried out in sections 4.3.1 and 4.3.2 reveals that there are sources for both presentation and consolidation of lexical items. However, there are more sources for their review and consolidation than there are for their presentation. In this sense, Lingualeo is an application that works best as a tool to assist in the consolidation of vocabulary, which may or may not have been presented with the help of the application.

*Linguoleo* presents new lexical items by providing translations of target words into learners' L1 and by providing visual aids to illustrate these items. This way of presenting vocabulary falls under two of the ways proposed by Takač (2008), namely *connecting an L2 item with its equivalent in the L1* and *directly connecting the meaning to real objects or phenomena*. According to the Nation (2001), connecting visual aids to verbal definitions may result in dual encoding, which means that meanings would be stored both visually and verbally, thus facilitating word recall.

As 4.3.2 shows, Lingualeo provides different sources for the review and consolidation of lexical items. While activities such as *Leo Spring* and *Construção de palavras* have the goal of reviewing and consolidating vocabulary presented by the application, the activities with TED Talks and *Organize as palavras* provide encounters with words that were not planned by the application. When watching TED Talks, learners are likely to encounter new words and retrieve old ones from memory. New ones can be selected for further study while old ones are further consolidated into memory because of this retrieval. As Baddeley (1990) suggests, each retrieval reinforces the linking between form and meaning in memory, making subsequent retrievals easier.

With regards to the research question 2 "what aspects of word-knowledge do the applications develop", the analysis of Lingualeo has revealed that it has resources which can assist in the development of words': a) written and spoken forms; b) syntactic behavior, e.g. the possible combinations with other words; c) meaning, with some attention given to polysemy and; d) lexical relations.

Knowledge of the written form was especially developed in the section named *Construção de Palavras*, which required learners to build words from their letters (as evidenced in figure 27). Knowledge of spoken form was developed through the audio and through phonemic transcriptions, particularly in the section named *Compreensão Oral*. Learners could develop their knowledge of words' syntactic behavior and lexical relations in *Organize as Palavras*, as the activities in this section

led learners to think of the possible combinations between words (as evidenced in figures 31 and 32).

Considering the research question 3 “does the application provide a number of encounters with the target vocabulary”, Lingualeo does provide these encounters. The words found in the *brainstorm* section are reencountered in the following sections of the application, e.g. *Leo Sprint* and *Compreensão Oral*. However, these encounters are rather massed as the words are only reencountered within the topic being worked with. For example, when learners chose to study the topic *profissões*, words such as ‘jeweler’ an ‘manager’ are presented and then reencountered in different activities but when another topic is chosen, learners will not meet these words again. Therefore, multiple encounters take place only within the unit. This goes opposite to Ullman and Lovelett (2016), which suggests that, considering the effectiveness of spacing, coverage of topics should be spaced out, not introduced and completed just to move on to another topic, as if the previous one was learned.

With respect to the research question 4 “what are the nonverbal representations employed and how can they assist the instruction of vocabulary?”, Lingualeo uses image to assist in the instruction of vocabulary.

As shown in figures 21, 22 the images are always presented along four verbal representations of the target vocabulary: the spelling of the target word, its translation, its phonemic transcription and an audio recording of its pronunciation. In light of Mayer (2009), these concurrent verbal representations may lead to an overload of the visual channel as learners have to “visually scan between pictures and on-screen text” (p.118). In the case of figures 21 and 22, learners may create a mental image of a jeweler and a manager without seeing an image representing these jobs, and because of this the printed text can be perceived as redundant. Considering this, some of the nonverbal representations employed in Lingualeo do not seem to assist the instruction of vocabulary substantially.

In sum, Lingualeo is an application that: a) has valuable sources for the review and consolidation of vocabulary; b) can assist the development of different aspects of word-knowledge; c) provides a number of encounters with target vocabulary, but mostly within the topic/unit it was learned; and d) uses images with the goal of assisting the instruction of lexical items, with some of these images being unlikely to help achieve this goal.

## 4.4 ABA ENGLISH

ABA English is a freemium application developed by the American and British Academy, an international school from the Persian Gulf region. As of July 2017, the application had an estimate 272.000 downloads on Google Play and the Appstore. Its content is divided into six levels: beginners, lower intermediate, intermediate, upper intermediate, advanced and business. Learners can start from the beginner level and advance through the course or begin at a specific level. All the levels have a total of 23 units, each containing 8 sections, as evidenced in figure 34.

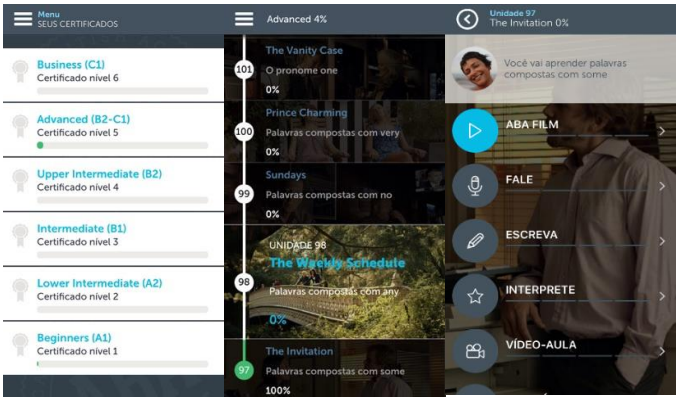


*Figure 34*. Levels, units and unit sections from ABA English.

Even though the application suggests that learners go through the sections following the order in which they are presented (see figure 34), they can access these sections in any order they want. For this study, I analyzed all the activities in unit 97, from the advanced level. Now, I will present and discuss the sources the application has for the presentation of new lexical items.

### 4.4.1 Sources for the presentation of new lexical items.

The first and major source for the presentation of lexical items from ABA English is the section called *ABA Film*. Every unity from the application has its own short-film. These short-films are recorded for the application and they show people in everyday situations. In the case of unit 97, the situation was called *The invitation*, and it portrayed a man inviting his coworker to go out for dinner. Learners can watch it without

subtitles, or with subtitles in their L1 or in English, as evidenced in figure 35.

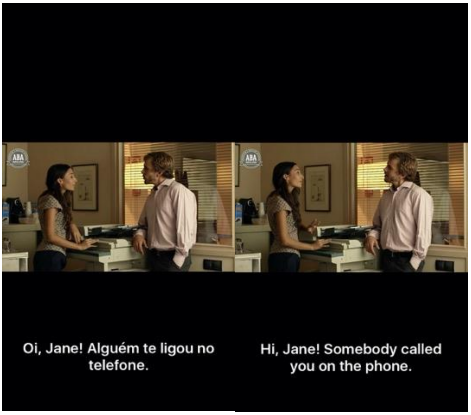


*Figure 35*. Short films from the ABA Film section, with Portuguese and English subtitles.

At this stage, learners are not asked to complete any extra activities. Once the short film is finished, the application does not provide any comprehension questions. Considering the ways of presenting lexical items proposed by Takač (2008), these short films consist in a presentation through context as it involves the creation of a situation in which vocabulary is contextualized.

### 4.4.2 Sources for the review and consolidation of lexical items in ABA English.

After watching the *ABA Film*, the application suggests that learners do the next activity, entitled *Fale* (speak). In this activity, the application has learners repeat the exact same sentences from the short film they watched previously. They can also check word meanings by referring to the translated sentences below the original one. Once learners have repeated the dialogs, they can compare their pronunciation to the one recorded in the application. However, they do not get feedback on this, meaning that it is up to the learners to decide whether their pronunciation was appropriate or not. This can be considered as a source for the review of vocabulary since the vocabulary used was previously presented. Taking into consideration the ways of reviewing lexical items by Takač (2008), this activity falls under the mechanical repetition of

words as learners only have to repeat the sentences, not having to manipulate them in any way.

The following section, named *Escreva* (write) also uses the dialogues from the *ABA Film*. Here, the application asks learners to write the sentences they hear using the keyboard from their smartphones, which is shown in figure 36.

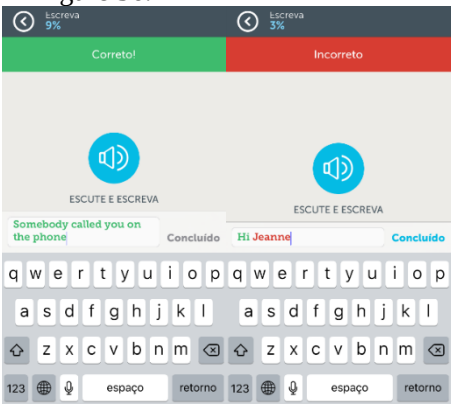


*Figure 36*. Learners write the sentences they hear in ABA English.

As figure 36 shows, once the learners hit the finished button, the application tells them whether their sentences are correct by coloring what is right in green and what is wrong in red. Nonetheless, it does not provide a more detailed feedback, and because of this, learners may have to try multiple times until they find the correct answer. *Escreva* is a clear source for consolidating the form of lexical items, which is an important step towards learning vocabulary according to Brown and Payne (1994, as cited in Hatch & Brown, 1995). As the authors point out, this step should prevent the confusion of one word with others, which is often the case in English because of its many heterographs. Moreover, this section also provides additional encounters with the words presented previously, which can help learners consolidate them.

The following section, entitled *Interprete* (interpret), allows learners to reenact the *ABA Film* with their own voices. They choose the character they want to play in the dialogue and the application plays the other one, using the same sentences from the short-film previously presented. For this unit, I chose to play Jane, as shown in figure 37.

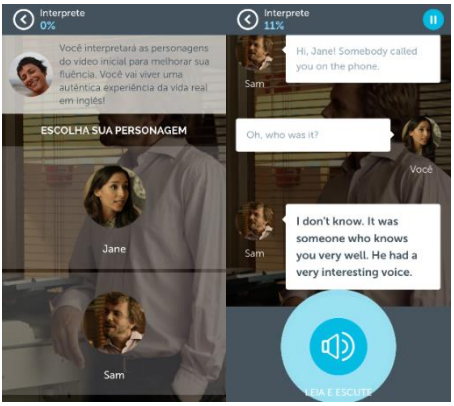


*Figure 37*. *Interprete*, from ABA English, which allows learners to play a character in a conversation.

As can be seen in figure 37, learners record themselves as a character in the conversation using the recording button at the bottom of the screen. Once learners have recorded all sentences from one of the characters, they can listen to the whole conversation containing their own voices. Although the application provides the dialogues which learners are supposed to read, they do not necessarily have to do so. For example, whereas the character Jane originally said 'Oh, who was it?', when recording my dialogue, I said 'I wonder who it was'. In other words, the activity allows for language output, which, according to Swain (1995), helps language learners improve their fluency and accuracy by leading them to reflect about their own learning.

The following section in ABA English is a video lesson recorded by an English teacher. Although the videos often focus on grammatical aspects present in the *ABA Film*, some of them can assist in the learning of lexical items too. The application states that the videos are designed to 'consolidate what you have learned', as figure 38 evidences.

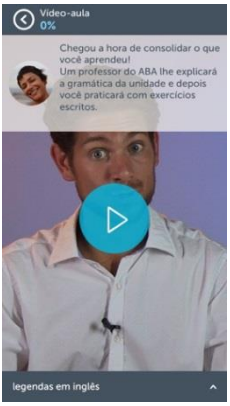


*Figure 38*. First part of a video lesson from ABA English.

Interestingly, the application itself makes it clear that the videos aim at consolidating the content presented previously. In this regard, the application understands that it is possible to learn the target language without the need of more explicit instruction and that the video lesson is meant to consolidate the learnings from implicit learning. Therefore, this application is designed to instruct English inductively, that is, examples of the target language are presented prior to rules or more explicit instruction. In the case of unit 97, the video lesson had the objective of instructing compound nouns with some, such as *someone/somebody*, *something* and *somewhere* (as figure 39 shows), lexical items which were part of the previous sections but had not been instructed explicitly.


*Figure 39.* A video lesson on compound nouns with ‘some’ in ABA English.

As can be seen in figure 39, the video lessons can be watched with subtitles in English or in the learners L1 (Portuguese, in my case). In the video, the application recommends that learners watch the lesson until they are able to understand it without any subtitles. After watching the video lesson, the application provides fill-in the gap exercises for learners to practice the content from the unit, as shown in figure 40.

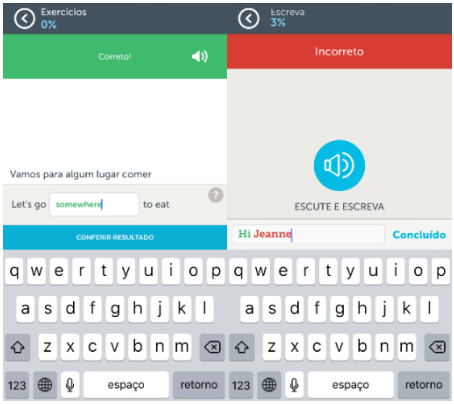


Figure 40. A fill in the gap exercise provided by ABA English.

As figure 40 exhibits, the correct answer can be achieved by reading the sentence and choosing the appropriate word to fill it in or by reading the translation of the sentence and simply translating the missing word into English, which in the case of figure 40 was somewhere (from Portuguese *algum lugar*). The figure also shows that coloring incorrect words in red is the only feedback provided.

The section called *Vocabulário* (vocabulary) aims at reviewing lexical items that appeared in the unit. In the case of unit 97, there were only three items to be reviewed, as figure 41 evidences.

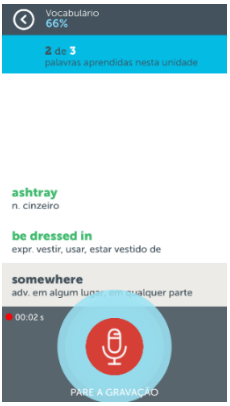


*Figure 41*.Vocabulary review in ABA English.

In this section, the application does not ask learners to do much. The lexical items are simply presented alongside their translations into learners' L1, and there is an icon for them to listen and repeat these items. Nevertheless, no feedback is provided in regards to learners' pronunciation, which means that they themselves have to judge whether they pronounced the items correctly.

The final section in every unit of ABA English is a test entitled *avaliação* (assessment). Before starting the test, the application suggests that learners go to a quiet place so that they are not interrupted. To complete this test, learners have to choose one of the three alternatives, as exhibited in figure 42.

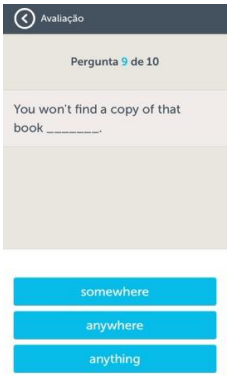


*Figure 42*. A question from a test in ABA English.

To pass the test, learners have to score eight points out of ten, which should not be difficult considering its simplicity. If they are unable to score eight points, they can retake the test until this score.

### 4.4.3 ABA English - general discussion.

Having presented the sources for the presentation, review and consolidation of lexical items in ABA English, the analysis other aspects related to the instruction of vocabulary in the application is now provided in accordance to the framework of this study.

With regards to the research question 2 "what aspects of word-knowledge do the applications develop?" ABA English has more sources to develop the knowledge of the written and spoken form of words as well as their meanings. Nonetheless, there are few opportunities for learners to develop their knowledge of other aspects such as knowledge of syntactic behavior and lexical behavior.

With respect to the research question 3 "do the applications provide a number of encounters with target vocabulary?", ABA English provides multiple, planned encounters within one unit, and unplanned encounters in subsequent ones.

As explained in sections 4.4.2, every unit in ABA English begins with a video called *ABA Film*, in which situations are enacted using the target vocabulary or grammar. In the case of units that are more vocabulary oriented, the lexical items presented in the introductory video are reencountered multiple times within those units. For this study, unit 97 was analyzed, from the advanced level of the application. This unit, which aimed at instructing compound nouns with *some*, offered multiple opportunities for learners to encounter the target vocabulary in different activities. In unit 97 alone, the words *someone* and *something* appeared more than 20 times each. Therefore, the application does provide a number of encounters with the target vocabulary, which should help consolidate the vocabulary presented into memory. Although there are more reencounters within the unit they are presented, vocabulary learned in one unit can be encountered in others. For example, compound nouns with *some*, which were the target words from unit 97, can be reencountered in subsequent units, as exhibited in figure 43.


*Figure 43*. Target words from unit 97 could be also met in other

As figure 43 shows, the words *something*, *somewhere* and *sometime*, which were all dealt with in unit 97, could also be encountered in other units. Considering the importance of repetition for vocabulary learning, the fact that words instructed in one unit can be seen in others is an advantage. As Baddeley (1990) explains, when learners retrieve what they know from a word, they are strengthening the path which links form and meaning, thus making following retrievals easier. The reencounters are not, however, planned by the application. Therefore, the time elapsed between encounters depends entirely on learners. Nation (2001) claims that if "if too much time has passed between the previous meeting and the present encounter with the word, then the present encounter is effectively not a repetition but is like a first encounter with the word" (p.103). Considering this, the application would benefit from having alerts to remind learners that certain lexical items should be reviewed.

In regards to the research question 4 "what are the nonverbal representations employed to instruct vocabulary?" ABA English employs videos[1] to do so. As explained, the videos show situations in which the target vocabulary or grammar is used. The videos serve as a way of contextualizing the use of the target vocabulary. In the ABA film from unit 97, in which compound nouns with *some* are instructed, a man says "*somebody called you on the phone*", to which a woman responds "*oh, who ways it?"* with an expression of doubt on her face. The expression of doubt in the face of the actress contributes to the comprehension of the word *somebody*, which is used to describe a person you do not know.

[1] Mayer (2009) explains that videos, illustrations, animations and background sounds are all considered nonverbal stimuli under the presentation-mode approach. For more on this approach, please refer to Mayer (2009).

Therefore, the videos can enhance the learning of vocabulary in ABA English.

ABA English explicitly states that it has been developed following the principles of a language learning approach. In its website, one can read that the following:

Learn to speak English with the natural approach. Just like in real life, you will use your mobile to listen speak read and write in English: your subconscious will gradually absorb new vocabulary and English expressions and you will make progress without even realizing it! (www.abaenglish.com, 2017).

This means that the application should follow the basic tenets from the Natural Approach, which would include focusing on communication rather than form, on vocabulary rather than grammar, and having comprehensible input as the main source for language acquisition (Brown, 1994; Richards & Rodgers, 1986). As explained previously, every unit in the application has a short film in which everyday situations are enacted. Under the light of the Natural Approach, these films are sources for comprehensible input as they provide the opportunity for learners to 'pick up' language. As Brown (1994) points out, the Natural Approach had the goal of developing interpersonal communication skills, which should include 'everyday language situations – conversations, shopping, listening to the radio and the like' (p. 77). Because ABA English works with these everyday language situations, it is possible to understand that the Natural Approach has influenced its development.

All things considered, ABA English is an application which a) presents and contextualizes new lexical items with videos in which portray situations from real life; b) reviews and consolidates the lexical items presented in the videos with a number of sources, with some activities that allow a more productive use of language; c) provides multiple, planned encounters within the unit they are presented, with possible, unplanned encounters in subsequent units; and d) employs videos to contextualize the use of the target vocabulary, which are likely to enhance its learning.

## 4.5 HELLO ENGLISH

*Hello English* is an application for English learning developed by *Culture Alley*, an Indian technology startup. Although the estimate number of downloads on Google Play is of 605.000, Ashish claims it had over 15 million downloads in January 2017. One of the reasons for the

popularity of the application is its availability in 22 languages, including Portuguese.

Hello English can be downloaded free of charge. Nevertheless, each lesson costs a number of coins to be accessed. These coins can be obtained in two ways: by purchasing them with real money or by doing exercises that give them as a prize for successful completion. This makes Hello English a type of freemium application.

The content of the application is divided into 6 phases, being the first phase the most elementary and the last phase the most advanced. Each phase has 25 lessons with different goals, some which aim at developing communicative goals while others are more concerned with grammar. At the beginning of each lesson, the application shows the activities available and how many coins learners can get by doing them. Learners can also access other resources in a tab called *practice*, which contains videos, games, news articles, audio files and books. A description of how the application presents new content is now provided.

### 4.5.1 Sources for the presentation of lexical items in Hello English.

The first step for presenting new lexical items in most of the lessons is to show sentences containing the target items. Figure 44 shows the first part of lesson 78 from the 4th phase of the application, entitled *conversas em um restaurante* (conversations in a restaurant).

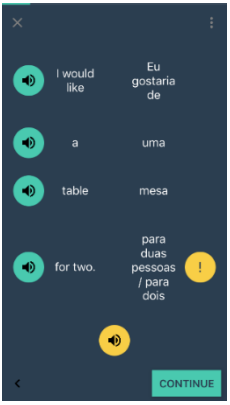


*Figure 44*. Presentation of new lexical items is done by showing them in sentences.

As can be seen in figure 44, the lexical items to be learned are presented with sentences divided into smaller chunks of language, such as *I would like* and *for two*. The translation of each chunk is also shown in the learners' L1. Also, it is possible to hear the pronunciation of the whole sentence or of each chunk individually.

The application often provides tips regarding the lexical items presented. For the sentence *I would like a table for two*, for example, the application explained the difference between *I want* and *I would like*, as figure 45 shows.

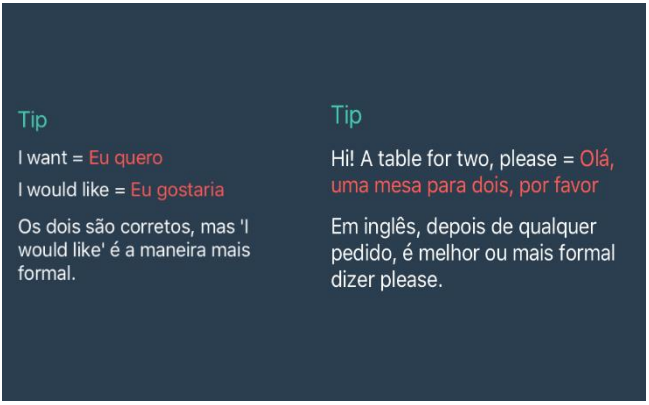


*Figure 45*. Tips on the usage of the target items presented in Hello English.

The tips exhibited in figure 45 can help learners understand the usage of the items they were presented. For instance, the application explains that it is best to use the word *please* after requests in English. This means that the application provides information regarding the pragmatics of the lexical items instructed.

For some lessons, new lexical items are presented with vocabulary lists. This was the case for lesson 85, which focused on the instruction of adverbs of frequency, as figure 46 displays.


*Figure 46.* A vocabulary list with adverbs and their translations into Portuguese, from Hello English.

Figure 46 shows how a number of adverbs of frequency are presented, along with their translations into learners' L1. According to Takac (2008), connecting an L2 item with its equivalent in L1 is a common way of presenting vocabulary. Nevertheless, the application also presents new content without the use of an L1, as figure 47 exhibits.

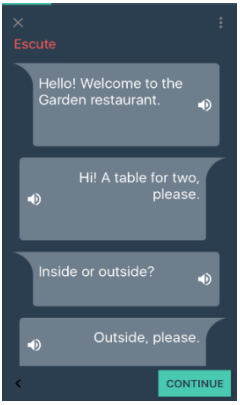


*Figure 47.* Presentation of content using only the target language, in Hello English.

Figure 47 shows how the application uses short conversations to expose learners to the target language. The conversations are made of short sentences which will be used for subsequent activities.

Hello English also presents new vocabulary through push notifications[1] sent daily to learners, as figure 48 illustrates.


*Figure 48*. Lexical items presented through push notifications.

Figure 48 shows examples of notifications sent by the app. They may contain single words, idiomatic expressions or vocabulary lists. If learners are interested in learning these lexical items, they have to open the notification, which will lead them to the lesson itself.

Hello English also allows for vocabulary to be learned more implicitly and incidentally. This is possible because the application provides videos, e-books, news and articles, some of which shown in figure 49.

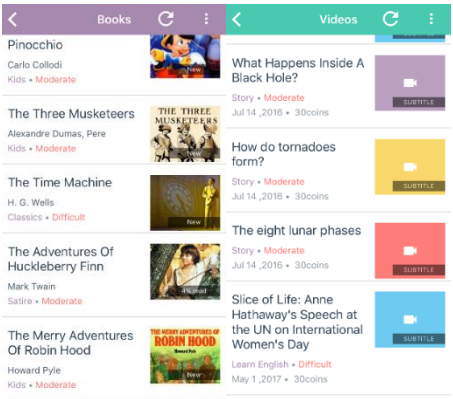


*Figure 49*. Sources for implicit vocabulary learning.

[1] Push notifications are messages that are sent (or *pushed*) from the application to user interface, that is, to the smartphones' screens.

Also known as incidental and indirect learning, implicit learning refers to the learning of words through seemingly natural processes in which words are acquired without direct teaching. In this case, learners "remain unaware of the learning that has taken place, although it is evident in the behavioral responses they make" (Ellis, 2009). By providing access to books and articles such as the ones shown in figure 49, learners might acquire vocabulary through reading in implicit way as the application is not directly instructing the meaning of the words that make up the test. Nevertheless, learners can also select words to check their L1 translations and pronunciation. When this happens, learning becomes more explicit as the application acts as an instructor who directly provides words' meanings.

### 4.5.2 Sources for the review and consolidation of lexical items in Hello English.

Once the target lexical items have been presented and explained, Hello English provides a variety of activities to review and consolidate them. The first ones are done right after the presentation. Figure 50 exhibits some of them.

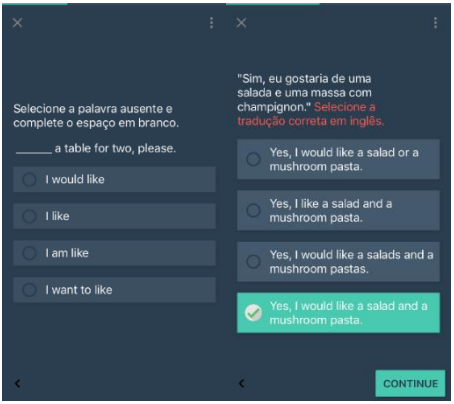


*Figure 50*. Examples of activities to consolidate lexical items in Hello English.

In figure 50, it is possible to see two types of activities. The first one is a simple fill in the gap activity and the second one asks learners to choose an appropriate translation for the sentence. Both types of activities use the lexical items that the application presented beforehand, and that

may be an indication that they function as consolidation activities, not as presentation ones.

Another type of activity that Hello English provides for learners to practice lexical items is shown in figure 51.


*Figure 51*. Examples of unscramble the sentence activities.

As figure 51 illustrates, the application scrambles the sentences and has learners unscramble them. The original sentence is provided only in the learners' L1. The sentences are scrambled into different lexical items, not only into single words. For example, the application segments *would like* as one lexical item. The same happens with *the classroom* and *a portion*. The reason why I believe the application does this will be analyzed in the general discussion section.

Hello English provides a variety of games designed to review and consolidate lexical items. Some of these games work with items from the presentation phase, while others have words that were not presented. The application rewards a number of coins for the completion of the games, which can be used to get access to new lessons. I will now describe the games Hello English makes available. The first one is called *The tea game*, as figure 52 shows.

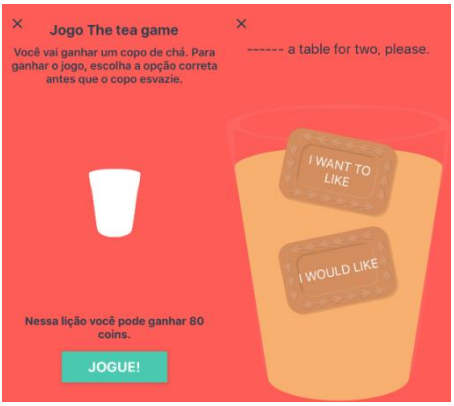


Figure 52. The tea game from Hello English

Figure 52 displays examples of the tea game, in which learners have to select the correct alternative to fill in a sentence. For each correct answer, a number of coins is given based on how long they took to do so. As time passes by, the cups becomes less full, stimulating learners to choose an option quickly.

A second type of game is called *jogo de soletração* (spelling game), and it is designed to consolidate the written form of lexical items. Some examples of this game are shown in figure 53.

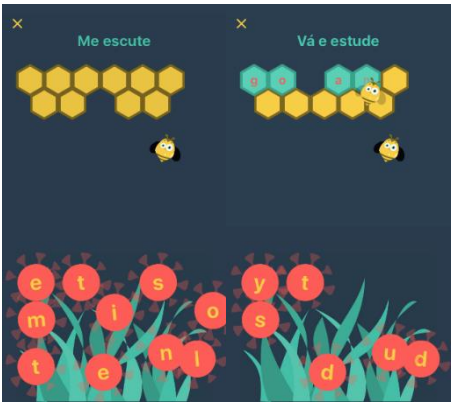


*Figure 53*. A spelling game from Hello English

As can be seen in figure 53, the application provides a sentence in the L1 and the letters that make up this same sentence in the L2. The game has learners spell not only single words, but whole sentences. This

goes in accordance to the conception of lexical item proposed by Lewis (1993), which understands that fixed expressions and idioms are also lexical items. Like in the other games from the app, learners are awarded coins for doing the game, and the faster and more accurately they do it, the more coins they get.

A third type of game is called *Being succinct*. As the name suggests, learners are expected to make sentences shorter by using single words synonyms for the highlighted phrases, which is evidenced in figure 54.

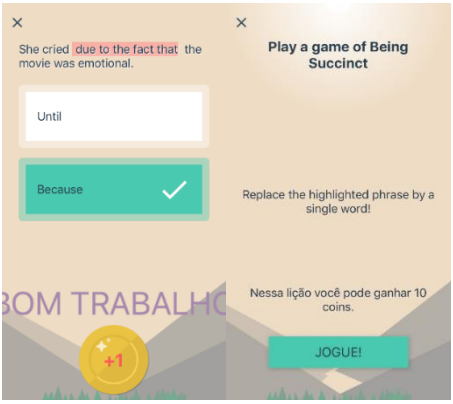


*Figure 54*. An example from the game Being succinct.

As evidenced in figure 54, a part of the sentence is highlighted, and learners have to choose a word that could replace it. In the case of figure 54, the lexical item *due to the fact that* could be replaced by *because* and *it is requested that you* by *please*. With this game, learners are given opportunities to develop their knowledge of the lexical relations of words with other words, an important aspect of word knowledge (Laufer, 1997, Nation, 2001).

### 4.5.3 Hello English - general discussion.

Having presented the sources for the presentation, review and consolidation of lexical items in Hello English, I will now analyze other aspects related to the instruction of vocabulary in the application, in accordance to the framework of this study.

To Laufer (1997), knowing what a word means involves knowing its written and spoken for, its structure, its syntactic behavior, its meaning and its lexical relations. Concerning the research question 2

"what aspects of word-knowledge do the applications develop?", Hello English can serve as a tool to assist the development of most of these aspects. Examples of how written and spoken form are developed were shown in figure 44 and 47. To instruct the spoken form, the application provides audio files with computerized voices. As discussed, one downside of this is that the pronunciation of the words sounds artificial. On the bright side, however, this enables the application to provide the pronunciation for an unlimited number of words, making it possible for learners to hear the spoken form of every word from the books and articles provided. Without the computerized voices, a human being would have to read and record every word from these books, which would probably cause the application to be very expensive.

With regards to the research question 3 "do the applications provide a number of encounters with the target vocabulary?", target vocabulary is encountered multiple times within the same lesson in Hello English, but it is not reencountered in subsequent lessons. Therefore, encounters with target vocabulary are not spaced, which are likely to have better learning outcomes than massed ones (Bloom & Shuell, 1981; Goossens et al., 2012; Ullman & Lovele (2016). Often, identical sentences are part of the presentation phase and of the review phase too, with the only difference being that in the review phase learners must build the sentences with the lexical items provided. The application does not seem to provide multiple encounters in a spaced manner. Learners may incidentally reencounter vocabulary instructed in the readings and the videos, but these are not promoted or organized by the application.

With regards to research question 4 "what are the nonverbal representations employed and how can they assist the instruction of vocabulary"? Hello English does not employ images to assist the instruction of vocabulary. Although is a small number of visual animations, such as the ones in figures 53 and 54, they do not help instruct vocabulary. Rather, they are part of the design of the application, serving aesthetic purposes.

As mentioned previously, Hello English also provides access to videos. Some of these videos are taken from YouTube, and were not created by the application. In these cases, the videos serve as sources for incidental learning, as discussed before. However, there are some videos developed by the application for vocabulary development. The videos contain a narration that explains the words in English, images representing the target vocabulary on the background, and tips of how to pronounce the words. For example, in Hello English (2017), the words *dentist, luxury, jewelry, restaurant* and *breakfast* are instructed. The

images in the background assist the instruction of the target vocabulary because they allow learners to understand the meaning of new lexical items without having to read anything. According to Mayer (2009), this is optimal as "people learn better from graphics and narration than from graphics, narration, and printed text" (p.118).

Considering research question 5 "what learning theories and language teaching methods seem to influence the applications?", the analysis of Hello English suggests that it has been influenced by Behaviorism, by the Lexical Approach and by the Natural Approach.

As previously shown, the application offers rewards for the completion of its activities. Generally, more accurate responses are awarded more coins. Under a behaviorist paradigm, the application gives positive reinforcement to strengthen behavior which is considered good (a correct answer, in this case). The idea is that the reward will increase the chance of this behavior happening again. As VanPatten and Williams (2007) say, within behaviorism, "learning requires repeated engagement in the target behavior" (p.2). Following this line of thought, the application works with the belief that if the target behavior is repeated multiple times, it should become automatic and free of errors. That is, the application has learners repeat activities with the target vocabulary until the correct answer is provided multiple times, under the belief that if this has happened, learners have learned the word.

One feature of Hello English is its work with lexical chunks of language. In the presentation phase, words are chunked together to form larger lexical items. This is in consonance to Lewis (1997), who understands that words should not be learned individually without considering their possible combinations. Examples of this can be found in figures 44, 45 and 51 of this study, which show the instruction and review of the lexical items *I would like* and *Are you ready to order?*. According to Lewis, they are multi-word lexical items and they should be instructed like so, not separately. The author believes that this can lead to better fluency because "fluency is based on the acquisition of a large store of fixed and semi-fixed prefabricated items" (Lewis, 1997, p.15).

Another feature of the application is that it provides access to a number of sources for language development, such as e-books, articles and videos, which can be accessed at any time and are not directly linked to the regular lessons of the app. Essentially, these sources provide input for learners to acquire language, but they do not teach the language directly. Taking this into consideration, the application could have been influenced by Krashen's Natural Approach, which postulates that speech "cannot be taught directly but 'emerges' on its own as a result of building

competence via comprehensible input" (Krashen, 1985, p.3). The videos and the articles available in the application can be adequate materials for the acquisition of language under the Natural Approach because they offer enough context[1] for language to be picked up.

In sum, the analysis of Hello English has shown that it: a) offers a great variety of sources for presentation, review and consolidation of lexical items; b) can help develop all aspects of word knowledge proposed by Laufer (1997); c) provides multiple encounters with the target lexical items, but only with within the lessons the were instructed; d) has some activities which seem to work under a behaviorist paradigm and e) seems to have been influenced by the Lexical Approach, as more attention is given to multi-words chunks than to single words, in consonance to Lewis (1997), and by the Natural Approach because it offers videos and reading materials with no direct instruction of language, which can be seen as sources for comprehensible input.

## 4.6 MEMRISE

With over 1.119.000 downloads as of November 2017, Memrise was the second most downloaded application for language learning at the time this study was conducted. It is available in 25[2] languages, with the possibility of learning more than 150, including less commonly taught ones such as Catalan, Mongol and Suaíli. To start using the app, learners must select their first language (out of the 25 available) and choose the L2 they want to study. It is possible to study multiple languages at the same time. For this analysis, the L1 was Portuguese, and the target language was American English[3].

Once a target language has been defined, several courses are offered. There is a myriad of options to choose from. The first ones are the courses developed by the creators of the app, namely American English 1, the most elementary777 course to American English 7, the most advanced one. Each of these courses is further divided into lessons.

Besides the courses created by the developers of the app, there are also numerous courses (35, at the time this analysis was carried out) created by the community, including courses for understanding song

[1]To Krashen (1985), context enables learners to understand language with unacquired grammar.

[2]

[3] Memrise offers courses in both American and British English. For this study, the American variety was used.

lyrics, courses for language textbooks and many others. I will now present the sources the application has for the presentation of vocabulary.

### 4.6.1 Sources for the presentation of new lexical items.

To present new lexical items, Memrise first provides the target item with its translation into learners' L1 and its pronunciation. No images or other information are provided at this stage. Figure 55 is an example taken from the course entitled *Inglês Americano 6*.


*Figure 55*. A source for the presentation of new lexical items in Memrise.

The next step consists in checking if learners can choose the appropriate translation for the words that had been just presented. Figure 56 shows how the application checks for the meanings of the words *unauthorized, reservado* and *dar caminho*.


*Figure 56*. Choosing a meaning for target words in Memrise.

As can be seen in figure 56, the application sometimes provides the target word and asks for its L1 translation, and other times provides the L1 word and asks for its translation into the target language. This a sort of presentation that involves learners' participation, which should stimulate learners to discover words' meanings from their parts or by elicitation (Takac, 2008). Although it might be seen as a type of assessment, it can also be considered as part of the instruction phase because sometimes this type of activity is the first encounter with the word in the app, meaning it cannot possibly be a review. Moreover, if learners choose an incorrect answer, the correct one is given and they are sent back to the previous presentation activity (shown in figure 55).

To promote the development of word form, Memrise has learners spell out the words it had presented. Figure 57 exemplifies how this is done.


*Figure 57*. A source for the development of word form in Memrise.

In figure 57, we can see that the application provides the target word in its L1 form, which in this case was *não autorizado*. Learners should then spell it with the letters given. The application facilitates the activity by providing only a few letters. Once the word has been correctly spelled, Memrise pronounces it.

Throughout the instruction phase, target words are pronounced multiple times. Because of this, the app understands that it is possible to ask learners to choose a pronunciation for a target word, as figure 58 illustrates.


*Figure 58*. Choosing a pronunciation for a target word in Memrise.

In this type of activity, three different words can be tapped to hear their pronunciations. Only one of the sound icons has the correct pronunciation, while the other two have words that do not resemble the target word, thus simplifying the task. Sometimes this activity is the very first contact learners have with a new lexical item, in which case they would have to try to guess the correct answer.

### 4.6.2 Sources for the review and consolidation of lexical items in Memrise.

In Memrise, there is little difference between the sources used for the presentation of lexical items and the ones used for their review and consolidation. The application creates review sessions, called *revisão clássica*, based on the lexical items which have been studied, as illustrated in figure 59.


Figure 59. Memrise review system, entitled revisão clássica.

The incomplete circle in figure 59 shows that although the first level *caminhando por aí* has not been finished yet, the application has already created a review for the words presented so far. Memrise works with a game-like structure called *jardim da memória* (memory garden), which compares the learning of a word to planting a seed. The first time a word is presented, an image of a hand planting a seed is shown in the top-right edge of the screen, as illustrated in figure 55. Each time a lexical item is reencountered, the plant grows, until it blossoms into a flower. This growth is illustrated in figure 60.


*Figure 60*. The growth of the lexical item unauthorized, in Memrise.

Once a target lexical item has been reencountered four times, it 'blossoms' into a flower, and when there are six flowers a review is created. Then, the same sources used in the presentation phase are used again, in random order, with the exception of the one shown in figure 55.

### 4.6.3 Memrise - general discussion.

Having presented the sources for the presentation, review and consolidation of lexical items in Memrise, an analysis of other aspects related to the instruction of vocabulary is now provided, in accordance to the framework of this study.

Out of the 5 aspects of word knowledge considered for this study, only two can be developed with the aid of Memrise, namely the knowledge of spoken and written form and the knowledge of meanings. The knowledge of the spoken form is developed by providing audios with the recorded pronunciation of the target vocabulary. No other resources are employed to do this, such as showing stress patterns or phonemic/phonetic transcriptions. To learn the word form, the application relies on activities such as the one illustrated in figure 56, which has them spell out target words. Word meanings are instructed through translation exclusively. The lack of contextual clues from texts or illustrations prevents less explicit forms of learning from happening, such as guessing the meaning of words from the context.

Regarding research question 3 "do the applications provide a number of encounters with the target?" the developers of Memrise claim that "by tracking when you should review and practise material, we do the hard work for you- making your learning as effortless and fun as possible" (Memrise, 2017, p.1). This implies that the application somehow follows the principles of spaced repetition to distribute content review in an appropriate manner. At first sight, it does not seem to be the case as new words are presented in a rather massed manner. Memrise justifies this by saying that "when you first learn a new word your memory is at its most delicate and requires the most love and attention" (2017, p.1). In light of this, the application tests and reviews new words very frequently so that these words "get a secure root-hold in your brain" (p.1). However, when the application understands that the target vocabulary has been learned[1], then the number of encounters becomes less frequent and more spaced, which is in conformity to the concept of spaced repetition, as discussed in Ellis (1995) and Ullman and Lovele (2016).

With regards to research question 4 "what are the nonverbal representations employed and how can they assist the instruction of

[1] This is symbolized by the icon of a full grown flower, as illustrated in figure 59.

vocabulary"? Memrise does not employ any nonverbal representation to assist the instruction of vocabulary. Even though there are some visual representations, such as the growth of flowers showed in figure 60, they do not help instruct vocabulary, but are simply part of the design of the application.

As for the learning theories that seem to influence the development of Memrise, the researcher could find some traits of behaviorism in its design. One of them is connected to the intensive repetition the application promotes. In a Behaviorist view of SLA, stimuli must frequent enough in order for learning to happen. VanPatten and Williams (2015) explain that, under this theory, "each time a response is made to the stimulus, the association between them is strengthened" (p.18). Memrise aims at promoting learning in a similar fashion, that is, by providing multiple stimulus to strengthen the connection between L1 and L2 words and by giving reinforcement to encourage the continuation of correct language use. The positive reinforcement comes in the form of points, as can be seen on the top of figure 57, for example. The points gained in the activities cannot be used to buy new material or more advanced lessons. In Memrise, they serve only to build a rank with the highest scoring users of the app, as shown in figure 61.

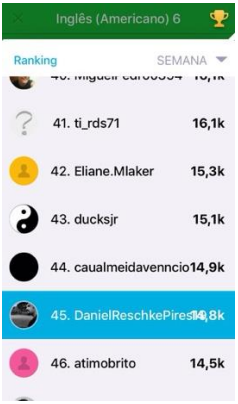


*Figure 61*. Memrise ranking, with the ranking of learners from the same city.

Figure 61 shows the ranking the researcher was in the 45th place in Memrise rank of users. Such ranking system may work as an incentive for learners to do more activities, if they are willing to compete with other learners they know for example. If this is not the case, however, then the ranking and the points awarded by the application serve little purpose.

Concerning the second language teaching methods that seem to influence the application, the analysis of Memrise indicates that the Grammar-Translation and the Audiolingual methods have had an impact on it. Richards and Rodgers (2001) explain that, in the Grammar-Translation method, "much of the lesson is devoted to translating sentences into and out of the target language" (p.6). As illustrated in figures 55 and 56, Memrise has learners translate lexical items from the L1 into the L2, and vice-versa. This is in consonance to the Grammar-Translation method, the only difference being that the application focuses on lexical items rather than on sentence translation. Richard and Rodgers (2001) also point out that, in this method, students' native language is the medium of instruction, which is also the way Memrise instructs new meanings.

When it comes to Audiolingualism, one of the methodological practices of the method is that foreign languages are learned in a process of mechanical habit formation (Richard & Rodgers, 2000). Memrise seems to advocate for this same practice since its activities, many consisting of audio recordings, are repeated exhaustively in order to lead to habit formation, although it does not ask for oral repetition of words, a key characteristic of the method.

All things considered, Memrise is an application which a) offers basically the same sources for the presentation and for the review/consolidation of vocabulary b) has sources for the development of the spoken and written form of words, as well as their meanings; c) provides multiple, frequent encounters with target vocabulary within units, with subsequent, less frequent encounters in subsequent ones; d) seems to be influenced by Behaviorism due to the intensive repetition of activities and use of positive reinforcement to encourage the continuation of correct language use; and e) seems to be influenced by the Audiolingual method, as there are many audio recordings which are repeated exhaustively in order to lead to habit formation.

In this section, an analysis of the applications was conducted, with a focus on how they instruct vocabulary. The following provides the conclusions and final remarks for this study.

## 5. CONCLUSIONS AND FINAL REMARKS

### 5.1 Conclusions

This study aimed at investigating six language learning applications, with a focus on how they instruct English vocabulary. With the results obtained from the analysis the selected applications, it is now possible to discuss them in a more comprehensive manner and provide conclusions to this study. In order to so, the research questions are now readdressed, with explanations given in an attempt to answer these questions.

(RQ1) What are the sources for the presentation, review and consolidation of new lexical items in the selected applications?

When it comes to presenting new lexical items, the results show that all of the applications analyzed make use of learners' L1 to instruct meanings in the target language. The most common way of instructing meaning is to present a word in the target language and its translation into the L1, or vice-versa. All the apps also aimed at instructing vocabulary through word and sentence translation, that is, words and sentences are produced in the L1 and should be translated into the target language, or the other way around. In the case of Duolingo and Memrise, learners are sometimes asked to translate without any sort of prior instruction. Considering these findings, it becomes relevant to discuss the reasons for the intense use of translation and of the L1, which, in my understanding, include:

- Accessibility of the application: explaining L2 word meanings with the L1 allows for quick, unpretentious and easily understood instruction (Nation, 2001). An application which instructs language in such fashion is likely to be more accessible, especially to individuals who are not experienced with language learning. As the ultimate goal of the developers is to have more users for their apps, accessible and easy-to-use applications are favored.
- Environments of use: MALL involves learning in non-traditional learning environments. This means learners often use their learning applications in environments that do not favor concentration and more elaborate thinking. For example, when using an application in a bus or while waiting in a line, learners

are likely to be distracted and interrupted. This would explain why activities which can be done quickly and without much concentration, such as choosing the translation for words and sentences, are so common in the applications analyzed.

- Profitability: in the case of Duolingo, the application profits from the translations learners do. As explained, websites such as *Buzzfeed* pay Duolingo to translate the content from their website into several languages. The translated content is therefore a by-product of the use of the application.

Another characteristic common to most of the applications is the decontextualized presentation of new lexical items. As can be seen in figures 2, 10, 21 and 55, vocabulary is presented in isolation, without any verbal contextualization. The applications seem to work under the belief that only repetition will suffice to learn these words, and because of this it is not necessary to contextualize the presentations. Applications that do this are Babbel, Duolingo, Lingualeo and Memrise. Some of the apps adopt images to emphasize/complement verbal meanings, but they rarely provide nonverbal contextualization.

One application with a distinctive presentation phase is ABA English. It uses the so-called ABA Films to introduce new content. There are some benefits to presenting new content this way. First, the videos present target vocabulary within a context. In terms of vocabulary learning this is relevant because the meaning of words often depends on their context of use (Nagy, 1995). Moreover, they make for more entertaining sources, especially because the videos often have funny and appealing situations.

In regards to the sources for the review and consolidation new lexical items, the analysis has shown that these sources are often very similar to the ones used for the presentation phase. This means that, in this phase, one usually translates words and sentences, spells them and listens to them in isolated audios. This mostly happens in Duolingo, Lingualeo and Memrise. In Duolingo and Memrise, it is not unusual for the application to ask for the translation of a lexical item or sentence without presenting them, meaning that these applications understand that the act of translating can, in itself, lead to learning. Because of the lack of proper presentation, it is likely that mistakes will be made multiple times. When they do, the applications usually provide feedback to say what is wrong, but not why it is wrong. As previously examined, this might be related to a behaviorist understanding of language learning, which sees that “if the responses receive punishment (in the case of language

learning, error correction), they will be abandoned" (VanPatten & Williams, 2015).

(RQ2) What aspects of word-knowledge do they develop?

All the applications instruct the word form, both spoken and written. Nation (2001) points out that knowing the spoken form of a word implies the ability to recognize the word when it is heard and, at the other end of the receptive-productive scale, "being able to produce the spoken form in order to express meaning" (p.55). In addition, the author says knowing the spoken form of a word also includes knowing its stress. All of the applications analyzed have sources to help with the recognition of words, most of them being audio recordings of words or short sentences, repeated numerous times throughout the lessons. Nevertheless, not all allow for the production of the spoken form. In the case of Duolingo and Babbel, learners can record their pronunciation for the application to give feedback. This may provide a chance for the development of language for productive use, and to get feedback from the app. In reality, however, the applications often fail to understand the pronunciation of learners. For instance, sometimes the target words were carefully pronounced by the researcher and still negative feedback was given. Other times, they were mispronounced on purpose and positive feedback was given.

It is worthy to note that spoken output is limited to repeating words and sentences in almost all the applications, meaning that learners are not provided with chances to produce their own sentences. Taking into consideration the five essential steps proposed by Brown and Payne (1994, as cited in Hatch & Brown, 1995), this means that the last step, which involves using the word, is not often developed. According to Hatch and Brown (1995) the use of the word allows "learners to see if the knowledge gained in the other steps is correct". (p. 390). One application that allows for less controlled oral production is ABA English. As can be seen in figure 37, it is possible to take part in a conversation with the app. Although there are suggested sentences to be used, this is not mandatory. To Swain (1995), production in a second language can help learners process language more deeply and allows them to notice the things they do not know yet.

All of the six applications analyzed in this study have sources for the development of meaning. As discussed, the meaning of an L2 item is predominantly instructed with a correspondent L1 item. An issue regarding this sort of instruction is that the applications are only teaching the labels in the L2 for these words, but they are not enriching one's

knowledge of the word. For instance, in Babbel, the meaning of the word *pretty* is instructed with its translation, *bonita* (in case the learner's L1 is Portuguese). However, affective and pragmatic meanings are not approached. For example, the Cambridge Dictionary defines *pretty* as something "pleasant to look at, or (especially of girls or women or things relating to them) attractive or pleasant in a delicate way" (Pretty, 2017). The application does not mention that the word is especially used for girls or women. Moreover, only one of the possible meanings of *pretty* is approached, that is, polysemic words are not treated as such. Although this example was taken from Babbel, the other applications work in a similar fashion.

Two out of the six applications had sources that could help develop the knowledge of the syntactic behavior of a word, namely Babbel and Lingualeo. Nonetheless, such knowledge was not explicitly taught in any of them. As illustrated in figures 7 and 33, learners had to consider the words preceding and succeeding the gap they were asked to fill, i.e. they had to think about the syntactic behavior. Knowledge of a word's lexical relations seemed to be developed in Hello English only. An example of how this is done can be found in figure 54, which shows how the game asks learners to find synonyms for the highlighted words.

In sum, the applications seem to consider that knowing a word involves primarily knowing its form and its meaning since these aspects are developed by all the applications analyzed. The other aspects are either completely disregarded or briefly developed by some of the apps. To my mind, the applications end up favoring the development of form and meaning because the other aspects are not as easily developed through the traditional activities involving translation and repetition.

(RQ3) Do the applications provide a number of encounters with the target vocabulary? Are these encounters massed or spaced?

All of the applications analyzed provide multiple encounters with the target vocabulary. These encounters were mostly massed within the units which presented the target words. This means that, after introducing a word, the applications provide additional encounters in quick succession until the unit is over.

Although the amount of time required to complete a unit from the application varies, they are not designed to require a lot of time from the users. This can be problematic because if learners are exposed to the target vocabulary only in the unit that presented it, chances are this vocabulary will not be consolidated into memory. In order to avoid this,

some designers of applications have come up with algorithms to promote spaced encounters with vocabulary, namely Babbel, Duolingo and Memrise. These applications reintroduce the words presented previously based on how long it has been since the learner last encountered it. The algorithms also take into consideration the number of mistakes learners have made with the target words, which means that words causing difficulty to learners will be reencountered more often that those that are not. Even though these algorithms can be flawed, their goal is sound and is in accordance to the spacing effect, which has been found to have to have positive effects on vocabulary development (Bloom & Shuell, 1981; Goossens et al., 2012; Kornell, 2009; Ullman & Lovele, 2016).

It is relevant to point out that, in the end, multiple encounters with target vocabulary also depend on the learners themselves. Even if the applications do provide opportunities for multiple, spaced encounters, they will not take place unless learners use the applications. This is a challenge faced by any distance education course that lets learners make their own decisions regarding when and how to study, a challenge that has to be addressed if the quality of distance education is to be improved.

(RQ4) What are the nonverbal representations employed to instruct vocabulary?

Five out of six applications provide nonverbal representations to assist in the instruction of the target words. Babbel, Duolingo and Lingualeo employ images to do so, while ABA English and Hello English make use of videos.

Under the light of the principles for multimedia learning by Mayer (2009), some of the images from Babbel, Duolingo and Lingualeo are extraneous because they are not needed to achieve the instructional goal of the activities, as discussed previously. Besides images, two applications worked with videos, and these appeared to be in accordance to their instructional goal. The ones provided by ABA English allowed learners to encounter the target vocabulary in situations that can happen in real life. Some of the videos from Hello English allow learners to understand the meaning of new lexical items without having to read any printed text, which is in accordance to Mayer (2009), which claims that "people learn better from graphics and narration than from graphics, narration, and printed text" (p.118).

From the findings of this study, it is possible to conclude that the most nonverbal representations employed by the applications do not play a central role in the instruction of vocabulary. As mentioned, many of

images used are not needed to achieve the instructional goals of the activities, and end up having an aesthetic role rather than an instructional one. Considering the many affordances of modern smartphones, nonverbal representations can and should be better explored to assist language learning.

(RQ5) What learning theories and language teaching methods seem to influence the applications?

The applications analyzed mostly seem to work under a Behaviorist paradigm. This means that, for most of applications, learning a second language is a mechanical process that requires constant repetition, with reinforcement being given to strengthen what the applications consider correct behavior, and punishment to prevent mistakes and errors from happening again.

In a Behaviorist view of SLA, stimuli must be frequent enough in order for learning to happen. VanPatten and Williams (2015) explain that, under this theory, "each time a response is made to the stimulus, the association between them is strengthened" (p.18). Most of the applications seek to promote learning in a similar fashion, that is, by providing multiple stimuli to strengthen the connection between L1 and L2 words and by giving reinforcement to encourage the continuation of correct language use. The positive reinforcement usually comes in the form of points, and the punishment consists in losing these points.

In regards to the influence of language teaching methods, the analysis of the applications suggests that most of them have been influenced by the Audiolingual and the Grammar-Translation method. One the tenets of the Audiolingual method is the heavy use of drills, which are a common practice in the apps. Learners often have to repeat what the apps say, and then proceed to do form-focused activities. Because this method was heavily influenced by behaviorism, it makes sense that the applications have characteristics from both the Audiolingual method and behaviorism.

## 5.2 FINAL REMARKS

That mobile devices such as smartphones are used to assist second language learning is no longer a novelty. Motivated by this, the present study sought to investigate applications for learning English via smartphone. Our focus was to better understand how these applications propose to promote vocabulary development. Considering the results aforementioned, it was possible to conclude that the applications promote vocabulary development mainly through translation and drills. Based on this, it is possible to say they have been influenced by the Audiolingual and the Grammar-Translation methods.

Although the literature shows that knowing a word involves learning a number of aspects, most of them are neglected by the applications, which predominantly develop the spoken/written forms of the words as well as their meanings. Because of this, we understand that even though these apps can be used as a tool to assist vocabulary development, they do so with certain limitations. These limitations include the lack of chances for language production, lack of context for presenting new words and insufficient instruction on aspects of word knowledge, especially knowledge of lexical relations and syntactic behavior.

Finally, we understand that the field of MALL is still an emerging one and, expectedly, has lots of room for improvement. The findings of this study show that the applications analyzed, used by countless learners around the globe, rely on methods and learning theories which are outdated. In our current state of affairs, the internet and the advances in mobile technology allow for the growth of MALL, but this growth should be guided be updated and learner centered research on SLA, which does not seem to be the case nowadays.

## 5.3 LIMITATIONS OF THE STUDY AND SUGGESTIONS FOR FUTURE STUDY

This study aimed at investigating smartphone applications for English learning that work with vocabulary instruction. The analysis provided was limited to the objectives of this study, and was based on literature which the researcher understands to be relevant for scope of this study. However, the applications can and should be analyzed with other objectives and under the light of different literature.

Although the applications selected had over 9 million users at the time data was collected, other applications may have even more users in

the future. Because of this, future studies should investigate applications which become prominent in future years, especially because new ones are developed on a constant basis.

Finally, this study did not take into account other factors which might influence language learning and, more specifically, vocabulary learning in a second language. With this in mind, future studies should include the learners' use and perception of MALL, and should collect data from a significant number of users in order to provide valuable information for application developers and language teachers, instructors and researchers.

## 5.4 PEDAGOGICAL IMPLICATIONS

The smartphone applications analyzed in this study are currently used by millions of learners around the world. In spite of the issues mentioned in this study, these applications have the potential to enhance the development of English vocabulary, especially if their use is guided by teachers of the language.

This study can provide valuable information for teachers interested in exploring smartphones as a tool to assist language learning. For example, English teachers who want their students to read in their smartphones will find that, out of the six applications analyzed, only Lingualeo and Hello English could serve this purpose, while teachers looking for language drills would have more options to choose from.

Although this study did not have the goal of finding which application is the best one, those interested in using them with pedagogical purposes can benefit from its findings to select an application that best fits their goals and their curricula.

REFERENCES

Attewell, J & Savill-Smith, C. (2003). M-learning and social inclusion – focusing on learners and learning. *Proceedings of MLEARN 2003: Learning with Mobile Devices, 3-12*. London, UK: Learning and Skills Development Agency.

Bailer, C., & Tomitch, L. (2016). Estudos comportamentais e de neuroimagem sobre multitarefa: uma revisão de literatura. *Alfa, 60 (2),* 403-425. http://dx.doi.org/10.1590/1981-5794-1608-8

Bahrick, H.P., & Phelps, E. (1987). Retention of Spanish vocabulary over 8 years. *Journal of Experimental Psychology: Learning, Memory and Cognition, 4*, 316-321.

Bax, S. 2003. CALL – Past, present and future. *System*, *31*. 13-28.

Beatty, K. (2010). *Teaching and Researching Computer-Assisted Language Learning.* London: Pearson Education.

Bloom, K.C., & Shuell, T.J. (1981). Effects of massed and distributed practice on the learning and retention of second-language vocabulary. *Journal of Educational Research*. *74*, 245-248

Brown, D. H. (1994) *Teaching by Principles - An Interactive Approach to Language Pedagogy*. Englewood Cliffs, New Jersey: Prentice Hall Regents.

Brooks, N. (1964). *Language and Language Learning: Theory and Practice*. New York: Harcourt Brace.

BuzzFeedPress. (2017). BuzzFeed expands internationally in partnership with Duolingo. Retrieved March 6, 2017, from Culture, https://www.buzzfeed.com/buzzfeedpress/buzzfeed-expands-internationally-in-partnership-with-duoling?utm_term=.koE4Kq0Z#.eoXw6nk8

Cameron, K. (1999). *CALL: media design and applications*. Lisse: Swets & Zeitlinger.

Carter, R. (2012). *Vocabulary: applied linguistic perspectives.* Abingdon, Oxon: Routlege.

Celce-Murcia, M. (1991). *Teaching English as a second or foreign language* (2nd Ed.). Boston, Massachusetts: Heinle & Heinle Publishers.

Chang, L (2017*). Learn a new language (or 14) with* Babbel *application for desktop, iOS, Android*. Digital Trends.

Chapelle, C. A. (2001). *Computer applications in second language acquisition.* Cambridge: Cambridge University Press.

Chapelle, C., & Jamieson, J. (2008). *Tips for teaching with CALL: Practical approaches to computer-assisted language learning*. White Plains, NY: Pearson Education.

Chinnery, G. M. (2006). Going to the mall: mobile assisted language learning. *Language Learning & Technology, 10,* 9-16.

Collocation. (n.d.). In *Wikipedia*. Retrieved April 13, 2017, from https://en.wikipedia.org/wiki/collocation.

Craik, F. I. M., & Lockhart, R.S. (1972). Levels of processing: A framework for memory research. *Journal of Verbal Learning and Verbal Behaviour, 11,* 671-684.

Crook, C. (1994). *Computers and the collaborative experience of learning*. London: Routledge.

European Commission. (2002). E*uropean report on quality indicators of lifelong learning*. Brussels: European Commission.

Ellis, N. (1995). The Psychology of Foreign Language Vocabulary Acquisition: Implications for CALL. *International Journal of Computer Assisted Language Learning (CALL).*

Ellis, R. (2009). *Implicit and explicit knowledge in second language learning, testing and teaching* (1st ed.). Bristol: Multilingual Matters.

Facer, K., Joiner, R., Stanton, D., Reid, J., Hull, R., & Kirk D. Savannah: a mobile gaming and learning? *Journal of Computer Assisted Learning, 20,* 339-409.

Fageeh, A. (2013). Effects of MALL Applications on Vocabulary Acquisition and Motivation. *Arab World English Journal, 4 (4),* 420-447.

Gairns, R. & Redman, S. (1986) *Working with Words: A- guide to teaching and learning vocabulary.* Cambridge: Cambridge University Press.

Goodman, K. (1988). The reading process. In P. Carrell, J. Devine & D. Eskey (eds.) *Interactive approaches to second language reading*. Cambridge: Cambridge University Press.

Grace, C.A. (1998). Retention of word meanings inferred from context and sentence-level translations: implications of the design of beginning-level CALL software. *The Modern Language Journal, 82 (4),* 533-544.

Goossens N, Camp G, Verkoeijen P, Tabbers H, and Zwaan R (2012) Picture–word learning by spacing the learning sessions. In: de Vries E and Scheiter K (eds.) *Staging knowledge and experience: How to take advantage of representational technologies in education and training?* Grenoble, France 88–93.

Guo, H. (2014) *Analysing and Evaluating Current Mobile Applications for Learning English Speaking.* (Master's thesis). University of London, London, UK. Retrieved from https://englishagenda.britishcouncil.org

Hatch, E. & Brown, C. (1995) *Vocabulary, Semantics and Language Education*. New York: Cambridge University Press.

Heil, C., Wu, J., Lee, J., & Schmidt, T. (2016). A Review of Mobile Language Learning Applications: Trends, Challenges, and Opportunities. *The Eurocall Review*, *24*(2), 32. http://dx.doi.org/10.4995/eurocall.2016.6402

HelloEnglish (2017, Nov 14). *Hello English pronunciation class* [Video file]. Retrieved from https://www.youtube.com/watch?v=fLogVXnryZw.

Kim, H & Kwon, Y. (2012). Exploring smartphone applications for effective mobile-assisted language learning. *Multimedia-Assisted Language Learning, 15(1),* 31-57.

Klopfer, E, Squire, K & Jenkins, H (2002). *Environmental Detectives: PDAs as a window into a virtual simulated world.* Workshop conducted at the International Workshop on Wireless and Mobile Technologies in Education, Vaxjo, Sweden.

Kornell, N. (2009). *Optimising learning using flashcards: Spacing is more effective than cramming*. Applied Cognitive Psychology 23: 1297–1317.

Lave, J. & Wenger, E. (1991). *Situated Learning*: *legitimate peripheral participation*. Cambridge: Cambridge University Press.

Laufer, B. (1997). What's in a word that makes it hard or easy: some intralexical factors that affect the learning of words. In N. Schmidtt & M. McCarthy (Eds.), *Vocabulary Description, Acquisition and Pedagogy*. Cambridge: Cambridge University Press.

Laufer, B. (1998). The development of Passive and Active Vocabulary in a Second Language: Same of Different? *Applied Linguistics, 19(2),* 255-271. Oxford: Oxford University Press

Laufer, B. (2017). The Three 'I's of second language vocabulary learning: Input, instruction, involvement. In E. Hinkel (Ed.), *Handbook of research in second language teaching and learning*, 3, 343–354. London: Routledge.

Laufer, B. & Hulstijn, J. (2001). Incidental vocabulary acquisition in a second language: the construct of task-induced involvement. *Applied Linguistics, 22,* 1-26.

Levy (1997). *Computer-assisted language learning: context and contextualization*. Oxford University Press: Oxford.

Lewis, M. (1993). *The lexical approach*. Hove and London, England: Language teaching publications.

Lewis, M. (1997). *Implementing the Lexical Approach*: *Putting Theory into Practice*. Heinle: Cengage Learning.

Lindaman, D., Nolan, D. (2015). Mobile-assisted language learning: application development projects within reach for language teachers. *The IALLT Journal, 45(1),* 2-21

Littlewood, W. T., & Swan, M. (1981*). Communicative language teaching: An introduction*. Cambridge, Eng: Cambridge University Press.

Mayer (2009). *Multimedia Learning.* New York, NY: Cambridge University Press.

Meara, P. (1980). Vocabulary acquisition: A neglected aspect of language learning. Language Teaching and Linguistics Abstracts, 13, 221-246

Memrise (2017). *About Memrise*. Retrieved 31 October, 2017, from https://www.memrise.com/about/.

Miangah, T. M., & Nezarat, A. (2012). Mobile-assisted language learning. *International Journal of distributed and Parallel System, 3,* 309-310.

Mvududu, N & Thiel-Burgess, J. (2012). Constructivism in Practice: The Case for English Language Learners. *International Journal of Education, 4 (3),* 108-117.

Naismith, L. (2004). Literature review in mobile technologies and learning. Bristol: Nesta Futurelab.

Nation, I. S. P. (1990). *Teaching and learning vocabulary*. Boston, MA: Heinle & Heinle Publishers.

Nation, I. (2001). *Learning Vocabulary in Another Language* (Cambridge Applied Linguistics). Cambridge: Cambridge University Press.

Nogueira, A. S. (2013). *Percepções de alunos e professores de ILE sobre aprendizagem de vocabulário: um Estudo Q*. Campinas, SP.

Poushter, J. (2016). *Smartphone Ownership and Internet Usage Continues to Climb in Emerging Econoies.* Retrieved from http://www.pewglobal.org.

Parul, G. (2017). Duolingo *Looks To Dominate The Mobile Education Market With New Flashcard Application TinyCards*. Forbes. Retrieved 2017-02-17.

Proctor, N. & Burton, J. (2003). Tate Modern multimedia tour pilots 2002-2003. *Proceedings of* MLEARN *2003: Learning with Mobile Devices.* London, UK: -LSDA

Ranalli, J. (2008). Learning English with The Sims: exploiting authentic computer simulation games for L2 learning. *Computer Assisted Language Learning, 5,* 441-455.

Richards, J. & Rodgers, T. (1996) *Approaches and methods in language teaching*. Cambridge: Cambridge University Press.

Sadoski, M. (2005). A Dual Coding View of Vocabulary Learning. *Reading & Writing Quarterly: Overcoming Learning Difficulties*. *21,* 221-238. Available in http://dx.doi.org/10.1080/10573560590949359.

Sadowski, K. (2012). *The difference between positive and negative punishment*.

Schmitt, N. (2000). *Vocabulary in language teaching*. Cambridge: Cambridge University Press.

Schmidt, R. (2001). Attention. In: Robinson, P. (Ed.). *Cognition and second language instruction*. Cambridge: Cambridge University Press, 2001. p.3-32

Schmitt, N. & McCarthy, M. (2011). *Vocabulary: Description, Acquisition and Pedagogy*. Cambridge: Cambridge University Press.

Settles, B. & Meeder, B. (2016). A Trainable Spaced Repetition Model for Language Learning. *Proceedings of the 54th Annual Meeting of the Association for Computational Linguistics*. 1848–1858.

Skinner, B.E (1957). *Verbal behavior*. New York: Appleton-Cetitury-Crofts.

Sökmen, A. J. (1997). Current trends in teaching second language vocabulary. In Schmitt, N. & McCarthy, M. (Eds.). *Vocabulary: Description, Acquisition and Pedagogy* (237-257) Cambridge: Cambridge University Press.

Sonad, N. (2016). *The language the world is trying to learn, according to Duolingo*. Retrieved from: https://qz.com/677833/the-languages-the-world-is-trying-to-learn-according-to-duolingo.

Stevick, E. (1982) *Teaching and Learning Languages*. Cambridge: CambridgeUniversity Press.

Stockwell, G. (2010). Using mobile phones for vocabulary activities: examining the effect of the platform. *Language Learning & Technology, 14*. 95- 110.

Swain, M. (1995). *Principle & Practice in Applied Linguistics*. Three functions of output in second language learning. Oxford: Oxford University Press.

Takač, V. (2008). *Vocabulary learning strategies and foreign language acquisition*. Clevedon, UK Buffalo, NY: Multilingual Matters.

Tumolo, C. H. S. (1999). *Vocabulary instruction: the text as a source in the classroom*. Florianópolis, SC.

Unesco Institute for Education. (1999). *Glossary of adult learning in Europe*. Paris: UNESCO.

VanPatten, B & Williams, J. (2015). *Theories in Second Language Acquisition*: *and introduction*. New York, NY: Routledge.

The Babbel Method (2017). Retrieved from http://about.Babbel.com/en/

Warschauer, M & Healey, D. (1998). Computers and language learning: an overview. *Language Teaching, 31,* 57-71.

Www.abaenglish.com. (2017). *iOS and Android application to learn English* | ABA English. [online] *Available* at: http://www.abaenglish.com/en/app-for-learning-english/ [Accessed 7 Aug. 2017].