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Investigation of collocational priming in tertiary level Turkish EFL learners' mental lexicon

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ABSTRACT

Much research in EFL context investigated language use of the learners in terms of lexical combinations but failed to recognize collocations in terms of psycholinguistic framework. Inspired by Lexical Priming Theory, the current study both emphasizes that collocations are not only textual but also psychological phenomena and underlines that non-native-like language use by EFL learners may stem from the fact that collocations are not mentally represented as a single unit in mental lexicon. Thus, a lexical decision task was designed where the participants were asked to classify the words flashing on their screens as words/non-words. Reaction times concluded that verb-noun collocations are not primed in the learners' mental lexicon. Mixed effects modelling analysis demonstrated the frequency of the prime words in collocations had a significant effect in the process. The findings were discussed in the light of vocabulary acquisition theories, and suggestions were provided for further research.

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Statement of Publication Ethics

The authors hereby declare that the current study was conducted in accordance with the research ethical standards.

Authors' Contribution Rate

This manuscript was derived from the MA thesis of the first author. The second author was the supervisor of the thesis. The third author contributed to the study by providing assistance as regards the experimental design.

Conflict of Interest

None

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Introduction

Having a good command of English has long been acknowledged to be a *sin que non* in EFL countries. As far as the case in Turkey is concerned, it appears that there exists a lack of quality in terms of the use of English by the tertiary level EFL learners for various reasons such as lack of proficiency, anxiety, lack of practice and training, etc. (Alshahrani, 2016; Atay & Kurt, 2006; Aydın, 1999; Ballester, 2015; Çam & Karatepe, 2020; Ekmekçi, 2018; Kara, 2013; Kırmızı & Kırmızı, 2015; Yalçın, 2010). The studies regarding the tertiary level EFL learners suggest that the learners make frequent word-choice errors in their linguistic production and the learners in the higher levels of their English instruction do not conform to the prescribed CEFR guidelines (Kırmızı & Karcı, 2017; Özen et al., 2013). Even though grammar and vocabulary have been considered to be the culprit of the learners' lack of quality in their language production, the picture may be much more complicated in this case. The study, therefore, is concerned with unnatural and non-native-like language use by the tertiary level Turkish EFL learners. In this study, it is assumed that the learners ignore the naturalness in their target language since they do not process L2 collocations in their mental lexicons as native speakers do. To be more precise, L2 collocations may not be represented as a single unit in the mental lexicon of tertiary level Turkish EFL learners. According to Hoey's (2005, p. 1) influential lexical priming theory, which he claims to be "a new theory of language", priming phenomenon is the reason why collocations exist in the first place. He argues that every time native speakers encounter a word in language, they acquire its accompanying context including words and grammar structures. As a result, they come to be conditioned to recognize specific words occurring together, which is spelled out as collocational priming. For instance, a language user would be likely to recognize the word *commit* more quickly if they have already seen that it occurs together with *crime*. Even though the language user can offer several alternatives occurring together with *commit*, his/her linguistic experience may prime the word *crime* in his/her mental representation in an endeavour to sound rather natural compared to other alternative ways to express the same concept. In this sense, *commit* can be said to prime *crime*, and such priming effect would be found in language user's mental representation. Similarly, Durrant (2008, pp. 105-106) puts forward that priming exists when a language user recognises a semantically related word faster as opposed to a semantically unrelated word; "the word girl is recognised more quickly when it comes soon after the word boy than it does when it follows a semantically unrelated word." The authors assume that naturalness in language is achieved through priming of collocation pairs, and embark on seeking whether such relationship is found in the mental lexicon of tertiary level Turkish EFL learners. The study investigates collocational knowledge of the learners through the medium of a psycholinguistic construct, collocational priming. As far as psycholinguistic nature of collocations is concerned, Hoey's (2005) definition could manifest that they are indeed psycholinguistic constructs. He suggests:

> It is a psychological association between words (rather than lemmas) up to four words apart and is evidenced by their occurrence together in corpora more often than is explicable in terms of random distribution. This definition is intended to pick up on the fact that collocation is a psycholinguistic phenomenon. (ibid., p. 5)

It has been long assumed that the proficiency levels of learners do not improve even after years of instruction where grammar is in the center of attention (Lu, 2016). Based on

our EFL experience, we have come to observe that grammar is prioritized over vocabulary in EFL classrooms. Turkish EFL students learn English in teacher-centered classrooms where grammar is taught traditionally (Uysal & Bardakci, 2014) and grammar instruction is prioritized (Süzer, 2007) before learners enter ELT and ELL departments of universities. Even if those learners are able to produce grammatically correct and perfect sentences, the naturalness in language is still a matter of question. Wolter and Gyllstad (2011) suggest that competent use of English depends on organized and relevant intra-lexical connections between words in the mental representations of those learning a second language. The intra-lexical links between words are collocations. In this sense, the study investigates whether collocations are mentally represented as a single unit in Turkish EFL learners' mental lexicon. The reason why Turkish EFL learners tend to produce ill-formed and non-nativelike language could be their lack of collocational knowledge, and the study seeks such knowledge in the first place; namely, learners' mental lexicon. Durrant (2008, p. 2) suggests that if collocations are mentally represented in native speakers, they are then sound targets to be taught, and they are really "known" by language users. Such equation underpins the goal of the study in that Turkish EFL learners' mental lexicon is investigated through the lens of priming phenomenon to find out about their collocational knowledge. Much research has been done with a focus on Turkish EFL learners by investigating their collocational knowledge. However, none of those studies except two (Cangır et al., 2017; Cangır, 2018) approach the issue from a psycholinguistic perspective. More specifically, there is not a single study investigating L2 collocations in L1 mental lexicon in Turkish context. The two psycholinguistic studies mentioned above were not concerned investigating English collocational knowledge in Turkish mental lexicon. Therefore, taking the paucity of psycholinguistic research regarding English collocational knowledge of Turkish EFL learners into consideration, it is worth investigating whether collocations hold psychological reality for Turkish learners of English, and the influence of Turkish as L1 on L2 English mental lexicon. Therefore, discovering whether collocations are mentally represented in Turkish EFL learners may hold evidence manifesting learners' collocational knowledge.

According to Fernández and Schmitt (2015, p. 96), "if EFL learners aspire to use language in an accurate and fluent fashion, they must have collocational knowledge". Rather than doing the third conditional again, EFL learners must add to their existing collocation repertoire as it is "the only achievable way to reach advanced levels" (Lewis, 2000, as cited in Ying & O'Neill, 2009, p. 182). However, setting goals for EFL learners to reach native-like language standards has long been a hotly debated issue in literature (Jaworska et al., 2015). Comparing EFL learners with native speaker norms in a fashion where they are supposed to use language like native speakers do has been a controversial theme among scholars. Although it may be argued that it is not equitable to expect learners to reach native-like standards in terms of their language production, EFL learners should be aware of the fact that erroneous collocational use in their language production may result in dire consequences. Gass and Selinker (1994) state that collocational errors in language production lead to communication breakdowns. More precisely, wrong word choice in collocation sets is likely to change the meaning that is attempted to be conveyed through spoken or written medium. With that in mind, the study utilizes the terms natural/unnatural and native-like/non-native-like language production as two ends of a continuum rather than a goal that EFL learners must achieve. Therefore, the study attempts to unearth the psycholinguistic reason behind EFL learners' unnatural and non-native-like language use by investigating priming effect in their mental lexicon rather than setting an unrealistic goal for the learners. The authors argue that the aim is not to find out whether EFL learners are doing better in terms of linguistic output in the study. Considering the

fact that corpus is mainly concerned with descriptive picture and organic development of language, it would be reasonable to claim that what counts in corpus linguistics is not a "standard" language according to which we can judge the linguistic performance of a non-native speaker against a native one. On the contrary, by doing so we have tried to provide the readers with a reasonable interval of acceptable collocations and their priming sequences with considerable frequency. This should not be considered as an imposition of a norm or standard language or a priming sequence but equipping the learners with reliable data so that they can be more confident in language use and better at making language related decisions. The use of contrastive analysis is due to the fact that it is "the most frequently used method of investigating formulaic language in a learner corpus that compares the results of a learner corpus analysis with those obtained from the analysis of a comparable native corpus and identifies errors and patterns of learner over- and underuse of formulaic sequences" (Paquot & Granger, 2012, p.132).

Literature review

Much research has been done in terms collocations and collocational knowledge. However, various definitions of collocations have been put forward by linguists depending on their study. As a result, there seems to be much confusion as to how collocations are approached. Durrant and Mathews–Aydınlı (2011) gave a description of three main approaches to collocations named phraseological, frequency-based, and psychological approaches.

From the perspective of phraseological approach, one of the constituents of the collocations does not have a literal sense (e.g. *meet deadlines, go green*) or in which the constituents of the collocations are so restricted that they cannot be easily replaced by another constituent (e.g. *flunk* cannot be easily followed by any noun other than *an examination*, *test*, or a course of study). More specifically, phraseological approach which is also called "Russian school of phraseology" (Durrant & Schmitt, 2009) is inclined to define collocations as frequent word combinations containing transparent meaning and restricted elements. According to phraseological approach, at least one of the words in collocations needs to be transparent or compositional; otherwise they are considered free combinations (Gyllstad, 2009). For example, in phraseological approach, *comb hair* is considered to be a free combination because both of its elements are transparent or compositional in meaning and the interpretation of the pair can be extracted from its elements. If, on the other hand, both of the elements are non-transparent or opaque, that would be an idiom in accordance with the guidelines of phraseological approach (e.g. *hit the sack* is and idiom rather than a collocation as the meaning is not possible to be understood from the constituent words.)

It must be noted that the boundaries between those types of word clusters described above are not clear-cut. It is not possible to clearly set the limits and they should be seen as a continuum rather than as explicit types. In this sense, Cangır et al. (2017) also assert that the fundamental problem with the classification described by phraseological approach is that it is not easy to set limits between the classifications suggested by phraseological approach. In a similar vein, another disadvantage of phraseological approach is that telling free combinations from restricted ones can only be made qualitatively. Quantitative criteria cannot be applied to distinguish free combinations from restricted collocations in phraseological approach. Even though statistical association measures such as t-score are possible to be used to determine how salient and significant a collocation is in a corpus, thresholds and values of those measures are determined subjectively (Lu, 2016). In the present study, phraseological approach is not taken into consideration.

The second approach is "frequency-based approach" (Sinclair, 1991) in which collocations are viewed as word combinations statistically tending to co-occur in spoken or written discourse. Collocations are approached the same way as in the phraseological approach and they may not necessarily have a restriction. For example, the word pair *make a cake* may be considered as a free combination in phraseological approach, whereas it may be a collocation in accordance with the guidelines described by the frequency-based approach.

Frequency based approach posits that the more frequently word combinations occur together in language, the more probable they are to be established in the mental lexicon and are possible to be considered as collocations (Cangır, et al., 2017). The advantage of frequency-based approach compared to phraseological approach seems to be quantitative criteria such as frequency measurement rather than intuitions with which phraseologists decide what is considered as a collocation and what is not. However, a major disadvantage of frequency-based approach is that it takes performance into account while ignoring competence (Howarth, 1998). Focusing on observable frequency data in a corpus without taking notice of semantics may unearth word pairs not considered as collocations by native speakers.

Taking only observable frequency data into consideration without noticing semantic aspects could mislead researchers if they aim to investigate why collocations exist in the first place. Frequency based approach is helpful in spotting collocations in language rather than explaining why there are collocations in language (Hoey, 2005). The existence of collocations according to Hoey is that statistical measures are not sufficient in explaining why there are collocations in language. Discontent with frequency-based definitions of collocations, he addresses psycholinguistic definitions (Vural, 2010). In a similar vein, Cangır, et al. (2017) say that collocations described by frequency-based approach have a tendency to be insufficient in terms of psycholinguistic explanation. The problem with the phraseological and frequency-based approaches is that neither of those gives an account of why collocations exist in spoken or written discourse. As Hoey (2005, p. 4) puts forward, the reason "why collocations should exist in the first place" is not adequately explained with frequent co-occurrence phenomenon. According to him, collocations should be acknowledged not only as textual but also a psycholinguistic phenomenon. The author suggests that the decision of which word to use following a certain word is determined by our experiences with those words. Thus, all our knowledge regarding a word including collocational knowledge is a product formed as a result of our encounters with that word. Since every human being has a unique experience with the language, it is quite inevitable that the language use of EFL learners sound non-native-like and unnatural to their readers or listeners. In other words, the priming of a particular word for an EFL learner may not be in harmony with that of a native speaker. This may indicate that much as EFL learners are able to produce grammatically perfect sentences, their performance is likely to be odd compared to native speaker standards.

Past research on psycholinguistic framework shows that there are a few studies looking into collocations and collocational competence by making use of priming theories (Durrant, 2008; Frenck-Mestre & Prince, 1997; Hodgson, 1991; McKoon & Ratcliff, 1992; Williams, 1996; Wolter & Gyllstad, 2011; Wolter & Yamashita, 2014).

Hodgson (1991) made use of a lexical decision task (LDT) in which subjects are displayed a word or non-word for them to make a decision in between, the methodology of which was described by Jiang (2012), to investigate priming in antonyms (e.g. *hatred-love*), synonyms (e.g. *company-business*), conceptual associates (e.g. *dove-peace*), phrasal associates (e.g. *foul-ball*), co-ordinates (e.g. *mist-rain*), and superordinates-subordanites

(e.g. *symbol-letter*). Unfortunately, the author does not provide any information as to how those prime-target pairs were constructed for his study, but he states that the pairs employed in the study were supposed to be unequivocal examples of the categories they belonged to. Regarding the participants, they were all native speakers of English. The results were that priming could be found in all types of prime-target pairs mentioned above.

Another early study in which LDT was employed to investigate priming between semantically related pairs was conducted by McKoon and Ratcliff (1992). The study aimed to find grounds for collocational priming. To this end, the authors made use of a small-scale corpus, compiled from the news items, and chose 40 target words from it. For each target word, there was a highly related free-association prime, a prime with a high t-score, and another prime with a low t-score (e.g. *baby: child, hospital, room*). There were also 309 filler words and 600 non-words in the study. The study included 52 participants responding to both the target and prime words in the LDT. The study revealed that the fastest response times were found within the highly related free-association prime, while the slowest response times occurred with the unrelated prime. Although the corpus used was questionable in terms of representativeness, it was tentatively suggested that statistical measures such as t-score calculated from larger corpora could predict priming effects.

Williams (1996) employed an LDT and pronunciation tasks in a series of experiments to measure priming within prime-target pairs composed of semantically similar sets (e.g. *suitcase-bag*), coordinates (e.g. *chair-stool*), collocates (e.g. *salt-pepper*), and associates (e.g. *hammer-nail*). The participants in the experiments were university learners. The findings revealed that the collocates rated to be highly familiar by the participants retained significant priming (*Experiment 1*). Unfortunately, Williams does not provide sufficient corpus and frequency data to draw conclusions as to the effects of co-occurrence on priming. In addition, the language backgrounds of the participants were not clearly provided by the author.

Another study carried out by Frenck-Mestre and Prince (1997 dealt with priming taking the second language acquisition into account. The authors employed a LDT to deal with the question how mental lexicon is constructed in the target language (*Experiment 1*). To serve the purposes of the study, antonyms (e.g. *dead-alive*), synonyms (e.g. *wide-broad*), and collocations (e.g. *cook-meal*) in particular were investigated as those pairs were considered to form the word meaning for a native speaker. The number of the participants taking part in the study was 60, and they were distributed into three different groups. Each group consisted of 20 participants who were native speakers of English, proficient non-native speakers, and non-proficient non-native speakers. The word pairs used were all frequently occurring ones, and they were presented in English in the LDT. There were 60 prime-target pairs evenly distributed into the groups of antonyms, synonyms, and collocations. The collocations employed in the study consisted of verb and noun pairs, and they were highly frequent in COBUILD Direct. The findings demonstrated that there was a restricted amount of collocational priming in non-native speakers

Another study handling collocational knowledge was conducted by Wolter and Gyllstad (2011) in which the authors investigated the effect of native language on second language. The aimed was to find out whether congruent verb+noun collocations enabled faster recognition compared to incongruent verb+noun collocations. 33 of the collocations used were congruent, meaning that they had direct equivalents in the native language of the participants (e.g. *give an answer – ge ett svar*). There were also 33 incongruent collocations in the study. Finally, 33 unrelated verb+noun collocations were used to compare priming effect for the congruent and incongruent collocations. The participants

were native speakers of English. In addition, there were non-native speakers whose native language was Swedish. The results of the study demonstrated that not only the congruent but also the incongruent collocations were facilitated faster for the native speakers. There was a significant priming effect in the mental lexicon of the native speakers. As regards the non-native speakers, there was a significant priming effect for only the congruent verb+noun collocations. The conclusion drawn by the authors was that congruent collocations had processing advantages over incongruent ones.

Wolter and Yamashita (2014) investigated the potential influence of collocations found in Japanese on the representation of English collocations. The authors used an LDT to measure such effect and the items were formed taking the native language of the participants into consideration. It was found out that the native speakers processed both types of collocations faster than the non-native speakers. That is, Japanese EFL learners were not found to be processing collocations faster than native speakers, implying that collocations are not mentally represented in non-native speakers. Therefore, the conclusion drawn by the authors was that the lexicon in non-native speakers is not activated when incongruent collocations are being processed.

The description of studies above suggests that there is little research measuring to what extent verb+noun collocations are facilitated and represented in the mental representations of non-native speakers. Although Frenck-Mestre and Prince (1997) suggest that there is limited amount of priming in terms of verb+noun collocations among non-native speakers whose first language is French, it may be instrumental to see whether and to what extent verb+noun collocations are processed for Turkish learners. It is because Turkish verb+noun collocations are constituted differently from English and French. For instance, a verb+noun collocation like *make a call* is translated into French as *lancer un appel*, indicating that the word order is the same in both languages. However, the same collocation in Turkish is *görüşme yapmak*, in which the word order is in the opposite direction. Therefore, the study is instrumental in reinforcing what Frenck-Meste and Prince's study manifested by bringing another first language under the spotlight. Likewise, two similar studies conducted by Wolter and Gyllstad (2011) and Wolter and Yamashita (2014) can be theoretically interesting when the potential yield of this study is taken into consideration. As far as those two studies suggested, incongruent verb+noun collocations, which are not found in the first language of the participants, appear to be partly primed in Swedish learners of English while incongruent verb+noun and adjective+noun collocations do not show such effect in Japanese learners of English. From this point of view, this study could contribute to the abovementioned studies with similar methodology and participants from a different L1 background.

In Turkish context, much research has been done with a focus on Turkish EFL learners by investigating their collocational knowledge. However, with the exception of Cangır et al. (2017) and Cangır (2018), none of those studies approach the issue from a psycholinguistic perspective. More specifically, there is not a single study investigating L2 collocations in L1 mental lexicon in the Turkish context. Regarding that, the two psycholinguistic studies mentioned above were not concerned with Turkish EFL learners. Therefore, taking the paucity of psycholinguistic research regarding English collocational knowledge of Turkish EFL learners into consideration, it is worth investigating whether collocations hold psychological reality for Turkish learners of English, and the influence of Turkish as L1 on L2 English mental lexicon.

The present study particularly addresses the questions listed below to investigate collocational knowledge of tertiary level Turkish EFL learners by examining their mental lexicon within a psycholinguistic framework.

1- Does collocational priming exist for academic verb-noun collocations in Turkish EFL learners?
2- To what extent does collocational (and word level) frequency play a role in collocational priming process, if any?

Methodology

In this study, a lexical decision task (LDT) was used to measure collocational priming. The task was employed in an experimental design to investigate whether verb-noun collocations are processed as single units in the mental representations of Turkish EFL learners. An LDT is a typical task where participants are required to categorize visual stimuli as words or non-words (Jiang, 2012). In LDTs, participants are shown a single word, which is the prime word (the first collocate in a collocation), via a computer screen (See Figure 1). At this stage, they are not required to show any overt reaction. Following the prime word, participants are shown an item which may be a real word or a non-word. The second item is called the target word (the second collocate in a collocation). Here, participants are required to classify the target as a word or a non-word. Eventually, if the target words belonging to the target words of collocations are reacted in significantly shorter time compared to the target words of non-collocations, it is concluded that priming exists between the word pairs. Collocations are primed for those who take part in the LDT when the reaction times in response to the target words of collocations are significantly faster than reaction times belonging to the target words of non-collocations. To illustrate, the first collocation in the study was *draw attention*. During the LDT, the participants were first shown the prime word *draw* for a very brief amount of time. Then, they were shown the target word *attention,* which they were supposed to classify as a word or a non-word in English by pressing the right and left control buttons on the keyboard. The right control button meant it was a word, whereas left control button meant it was a non-word. The same process took place for the non-collocation, which was *cause attention*. The participants were required to classify the target as a word or a non-word after having been shown the prime. In this fashion, the participants reacted to all the target words belonging to the collocations, non-collocations, fillers, and non-words by opting whether they are words or non-words in English. The software DMDX (Forster & Forster, 2003) used for the LDT recorded all the data regarding the reaction times given to the target words in each pair.

Table 1. A Sample of Prime and Target Words and Their Reaction Times

Prime Word	Target Word	Reaction Time
Shown for 67 milliseconds participants do not show any overt reaction	shown for 83 milliseconds participants react as word or non-word	how long it takes to make a decision
draw	ATTENTION (collocation)	X milliseconds
cause	ATTENTION (non-collocation)	Y milliseconds
knit	EMPHASIS (filler)	Z milliseconds
obey	STROUCHE (non-word)	T milliseconds

If there is a significant difference between X and Y, collocations are acknowledged to be primed for the participants.

To investigate collocational priming in terms of academic verb-noun collocations, the LDT in the study included collocations, non-collocations, fillers, and non-words. More

precisely, each verb-noun collocation in the study (e.g. draw attention) was accompanied with a non-collocation (e.g. cause attention), a filler (e.g. knit emphasis), and a non-word (e.g. obey strouche) (see Table 1). There were significant differences in terms of reaction times between the collocates and non-collocates, while reaction times in response to the fillers and non-words were ignored. The software DMDX was put into service to carry out the LDT. Before starting the LDT, the participants were thoroughly informed in preparation for the task, however, they were not briefed regarding the relationship between the word pairs to prevent them from using strategies. It has been asserted that automatic priming is more satisfactory in terms of reflecting mental lexicon compared to strategic priming (Frenck-Mestre & Prince, 1997; Lucas, 2000). Therefore, the participants were not aware of what relationship the word pairs exactly entertained during the task.

A set of software codes used in the present study aimed to trigger DMDX to run and present stimuli for the participants. During the task, the participants were required to classify the target words in the collocations (N=34), non-collocations (N=34), fillers (N=34), and non-words (N=34) as words or non-words via DMDX. In other words, the participants decided whether the target word in each pair was a word or non-word in milliseconds. Two breaks were available for the participants to ease their concentration on the task and prevent them getting tired. All the items were presented in a random order for each participant to avoid repetition effects which may have a negative influence on the priming process (Wolter & Yamashita, 2014). As can be seen in Table 1, after entering their name and completing the practice session, the participants were first shown an asterisk (*) for 250 milliseconds. After that, they were shown a mask (##########) for 500 milliseconds. Finally, they were shown the prime and target words of all the items in a randomized fashion for 67 and 83 milliseconds, respectively. The asterisk and mask were utilized to get the participants to focus on the task. The fact that the fixations points were shown for 250 milliseconds in this study was built on the study conducted by Wolter and Gyllstad (2011). The fixation points in their priming experiments were shown for 250 milliseconds with non-native speakers. Thus, it was considered that such duration could also work well with the non-native participants in this study. As to the length of masks, it is widely accepted that the number of hash marks should be equal to the longest word in LDT experiments. For instance, the longest word used in the present study included 10 letters, so the same quantity of hash marks was employed in the task. Regarding the use of masks, Forster and Davis (1984) assert that masks used in priming experiments prevent participants from using strategies. In other words, masks ensure that participants process prime words in LDTs in a subconscious fashion. As stated above, automatic priming has been acknowledged to be more satisfactory in terms of measuring priming. Therefore, it was vital in the study that the participants would not develop strategies while processing the prime words. As far as the duration of the masks in the study is concerned, 500 milliseconds were considered to be appropriate as masks are suggested to be shown much longer than prime words. In addition, Frenck-Mestre and Prince (1997) who also conducted priming experiments with non-native speakers opted to use masks shown for 500 milliseconds in their study. The stimulus onset asynchrony (SOA) was the main consideration in deciding on the duration of the prime words. SOA has been described as the duration "between the initial presentation of prime words and the presentation of target words" (Wolter & Gyllstad, 2011, p. 433). In this sense, Frenck-Mestre and Prince (1997) suggest that SOA must be as many as 150 milliseconds to accurately measure priming. Bearing this consideration in mind, the prime words in the study were opted to be presented for 67 milliseconds. It is because a long display such as 100 milliseconds risks making the prime words apparent for the participants, in such a way that they would develop strategies. A shorter display such as 25 milliseconds, however, prevent the

participants to process the prime words (Jiang, 2012). Therefore, in the light of the suggestions by Jiang as well as Frenck-Mestre and Prince, who presented the prime words for 67 milliseconds in their study, this study allowed the prime words to be shown for 67 milliseconds. Finally, since SOA, which is the duration between the onset of primes and onset of targets, was opted to be shown for 150 milliseconds to obtain a priming effect, the target words were displayed for 83 milliseconds in this study. As a result, the duration of the prime words (67 milliseconds) and the target words (83 milliseconds) constituted a 150-millisecond of SOA.

Table 2. A Sample of the DMDX Screen Displayed for Each Participant

The Fixation Point (*) 250 milliseconds	Masking (##########) 500 milliseconds	Prime Words 67 milliseconds	Target Words 83 milliseconds	Type of Items
*	##########	draw	ATTENTION	Collocation
*	##########	cause	ATTENTION	Non-Collocation
*	##########	knit	EMPHASIS	Filler
*	##########	obey	STROUCHE	Non-word

Participant Characteristics

The participants were 71 Turkish learners of English who study English Language and Literature (ELL) in a mid-size university in the eastern part of Turkey. All the participants took a placement test designed by Cambridge University Press (2010). Only those learners who were at B1 and B2 language proficiency levels as outlined Common European Framework of Reference for Languages (CEFR) took part in the study (Council of Europe, 2001). None of the participants had been to an English- speaking country before. All the participants took an end of experiment questionnaire after the LDT, which included items addressing their physical states (e.g. vision, dexterity, short term memory) as well as the experiment itself. Those who were eligible to take part in the study took a consent form indicating that they were volunteers to contribute to the study.

Item Development

The collocations employed in the LDT were above 2.0 t-score and 3.0 MI score to ensure that the items have been encountered by the participants before. With respect to that, Fernández and Schmitt (2015) assert that t-score and MI score are among the widely used frequency measurements to identify collocations. From this point of view, t-score reveals frequently used collocations. MI score, on the other hand, does not necessarily identify highly frequent collocations, but it brings out strongly linked collocations.

To find out whether collocations are primed in Turkish EFL learners, the verb-noun collocations in Pearson International Corpus of Academic English (PICAE) described by Ackermann and Chen (2013) were utilized. Regarding that, verb-noun collocations were under the scope as they are the most frequent and important type of collocations and pose great difficulty for learners (Nesselhauf, 2005). They are also problematic considering Turkish EFL learners (Bıçkı, 2012).

To determine the items to be used in the LDT, only those collocations which enjoy a minimum 2.0 t-score and 3.0 MI score were chosen. Then, cognates (e.g. role, goal, method), also found in the native language of the participants, were eliminated from the list. The assumption behind the redundancy of the cognates was that they are considered to attain a stronger priming effect than non-cognates (De Groot & Nas, 1991). Since it was not the aim of the present study to investigate priming effect in cognates, they were not exploited in the study. Afterwards, recurrent elements in either of the collocates were also left out. For example, elements such as "achieve, become", and "consider" take place more than once in the list, so only one sample from those recurrent elements were included in the LDT. Then, taking the English proficiency levels of the participants into consideration, collocations under B1 and above B2 levels were also excluded from the list. The decision regarding the level of the collocations was made in accordance with the English Vocabulary Profile (2012) which frames the words learners know at each level of CEFR. Finally, there were 34 collocations to be used in the LDT. Each collocation was assigned with a non-collocation, a filler, and a non-word for the experiment (see Table 1).

Data Analysis

The questionnaire

The end of experiment questionnaire dealing with the vision, dexterity, and short-term memory of the participants revealed that all of the participants except two of them had not experienced any problems regarding their short-term memory in their lives. Regarding that, holding a sound short term memory is crucial in priming experiments as prime words are shown for a very brief amount of time for participants, and problematic short-term memory may have a negative impact on the priming process (Cangır, 2018). The two participants who stated that they had experienced short term memory problems were asked to complete a simple digit span test on a separate session. Mathy and Feldman (2012), working short term memory is acknowledged to be capable of recalling between four and seven items. During the digit span test, therefore, the two participants were asked if they could recall six digits they were shown. Ensuring that the participants were able to retain the six digits from their short- term memory on the test, it was concluded that their performance on the LDT was worth analysing.

As far as the vision of the participants is concerned, none of the participants except four of them stated problems regarding their eyesight. Among those four participants, only the performance of one participant was not taken into account during the analysis as she had stated that she was not able to see the prime and target words during the LDT. Table 3 shows all the relevant information regarding the participants' biographical information.

Table 3. The Participants' Biographical Information

Participants	Gender	Dexterity	Vision	Short-term Memory
Turkish EFL Learners (N=71)	58 Female 13 Male	63 Right-handed 4 Left-handed 4 Both-handed	1 had problems with their eyesight	None had problems with their short-term memory

The LDT

The number of the participants who were involved in the LDT was 71, but one of the participants with eyesight problems who claimed that he/she had not detected the target words was considered to be ineligible for the analysis. Therefore, the performance of 70 participants in the LDT was scrutinized for the analysis of the study. Furthermore, only the reaction times between 200 and 2500 milliseconds were taken into account for the analysis, and the erroneous reactions were ignored. That is to say, the reaction times slower than 2500 milliseconds and faster than 200 milliseconds were not found worthy of analysis in accordance with the guidelines of priming research suggested by Jiang (2012).

Results

Table 3 shows the results of the LDT in which mean reaction times in response to the target words of the collocations and non-collocations are presented. In addition, Table 4 displays how long it took the participants to react to the target words in collocations and non-collocations in each academic verb-noun collocation pair in terms of mean reaction times.

Table 4. Descriptive Findings of the LDT

Descriptives	Col. Status	Reaction Times
Missing	Non-coll.	0
	Coll.	0
Mean	Non-coll.	674
	Coll.	671
Standard Deviation	Non-coll.	275
	Coll.	277
Minimum	Non-coll.	223
	Coll.	203
Maximum	Non-coll.	1991
	Coll.	2142

Based on the mean reaction times shown in Table 4, it is evident that the reaction times in terms of the collocates and non-collocates are at close quarters. In fact, as can be seen in Table 5 below, the independent sample t-test revealed that there was no significant difference between the reaction times of the collocates and non-collocates in this study ($p=0.744>0.05$). In other words, the prime words did not facilitate a priming effect for the targets in both collocations and non-collocations, indicating that academic verb-noun collocations were not mentally represented in the learners' mental lexicon. Such finding

conforms to the researchers' assumption at the outset, in which it is postulated that academic verb-noun collocations may not be primed in tertiary level Turkish EFL learners.

Table 5. Independent Samples T-Test Results

Independent Samples T-Test							
		statistic	df	p	Mean difference	SE difference	Cohen's d
RT	Student's t	0.326	4584	0.744	2.66	8.15	0.00964

Mixed Effects Modelling Analysis Regarding Frequency and Proficiency

Having established that academic verb-noun collocations do not constitute a priming effect in Turkish EFL learners' mental lexicon (see Table 4), a mixed effects modelling analysis was implemented to answer the second research question. Mixed effects modelling analysis, providing robust analysis results in connection with second language acquisition data (Cunnings, 2012), was employed to determine what role the frequency of the academic verb-noun collocations play in the process.

The results of the mixed effects modelling demonstrated that proficiency ($p=0.646>0.05$), t-score ($p=0.212>0.05$), MI score ($p=0.347>0.05$), and target word frequency ($p=0.416>0.05$) did not exhibit a significant effect on the dependent variable. However, the results showed that prime word frequency ($p<0.001$) had a significant effect. Among the independent variables shown in Table 6 only the prime word frequency appeared to have a significant effect on the reaction times to the collocates and non-collocates.

Table 6. Fixed Effects Parameters Estimates

			95% Confidence Interval				
Effect	Estimate	SE	Lower	Upper	df	t	p
(Intercept)	671.3367	19.7013	632.7228	709.951	86.4	34.076	< .001
B2 - B1	-16.9488	36.7361	-88.9502	55.053	67.8	-0.461	0.646
t-score	0.0828	0.0656	-0.0459	0.211	62.6	1.261	0.212
MI_score	-1.0819	1.1409	-3.3180	1.154	62.9	-0.948	0.347
Prime Word Freq.	0.7263	0.2022	0.3299	1.123	62.9	3.591	< .001
Target Word Freq.	-0.6214	0.7590	-2.1089	0.866	62.7	-0.819	0.416

Discussion

The results of the LDT demonstrated that Turkish EFL learners did not react to the target words in the collocations significantly faster than the target words in the non-collocations. It was revealed that academic verb-noun collocations do not hold a significant priming effect for tertiary level Turkish EFL learners. To the researchers' knowledge, no research has been done to suggest how and to what extent collocations are primed for Turkish EFL learners. More precisely, the studies investigating English collocational knowledge of Turkish learners have failed to take the psychological reality of collocations into account. However, Cangır et al. (2017) and Cangır (2018), who approached the issue from a slightly different angle, focused on how Turkish collocations are mentally represented for Turkish speakers and Turkish-English bilinguals. The former study investigated collocational priming in Turkish speakers suggesting that Turkish adjective-noun and verb-noun collocations are primed in the mental lexicon of Turkish speakers. Similarly, the latter study demonstrated that collocational priming occurs in the mental lexicon of bilinguals. Such findings when compared to the findings of the study suggest that the learners fail to process academic verb-noun collocations in their mental lexicon. Therefore, it may be argued that they have not acquired formulaic language and collocational knowledge to conform to the native-like standards in their language use and meet the expectations of the academic world. The researchers' hypothesis at the outset of the present study claiming that the reasons behind ill-formed and non-native-like language use of the tertiary level Turkish EFL learners could be attributed to the fact that academic verb-noun collocations are not mentally represented and primed as a single unit in their mental lexicon.

Given that the present study uncovered the psychological reason behind unnatural language use of Turkish EFL learners, lack of priming in their mental lexicon may be the outcome of their prior English instruction. The participants who took part in the study may not have been introduced to the formulaic nature of language which has been long pointed out by eminent scholars (Ellis, 2003; Kjellmer, 1991; Pawley & Syder, 1983; Wray, 2002). Accordingly, in a study carried out by Durrant and Schmitt (2009), where native speakers were compared to non-native speakers in terms of their use of collocations, the authors reported that non-native speakers' lack of collocational knowledge could be pinned down to the suggestion implying that learners may be insufficiently exposed to the English language. In a similar vein, Wolter and Gyllstad (2013) also state that second language learners may not be as capable as native speakers in terms of processing frequently occurring collocations in language. This suggests that much as learners frequently seem to use formulaic language and collocations in their language production, and notwithstanding being grammatically acceptable, they do not conform to the native-like standards. As such, taking the findings of the study and relevant literature into account, it can be asserted that EFL learners fail to acquire language input they are exposed to in their classes, and as a result, they produce language in an unnatural and non-native-like fashion.

The mother tongue of the learners may have had an impact on the priming process. Regarding the influence of the first language on collocational priming, the study conducted by Wolter and Yamashita (2014), in which an LDT was conducted with a group of native speakers and two groups of non-native speakers, revealed that incongruent collocations not found in the mother tongue of the learners did not yield significant priming effects in both groups of non-native speakers. In a similar vein with the study, the collocations in their study did not have a significant priming effect in the mental lexicon of the learners. Conversely, in another study conducted by Wolter and Gyllstad (2011), the findings from the LDT demonstrated collocational priming exists in Swedish learners of English. That is,

the collocations in the study had a significant priming effect in the mental lexicon of the Swedish learners. Taking those inconsistent results of two studies into account, it appears the first language may have an influential role in the process. Specifically, the lack of priming effects in the study conducted by Wolter and Yamashita and in the study could be stemming from the first languages of the participants in both studies. Both mother tongues, Japanese and Turkish, are obviously different languages from English in terms of vocabulary, grammar, and word order, while Swedish, which was the mother tongue of the participants in Wolter and Gyllstad's study, belongs to the same language family as English. Moreover, Swedish learners and native speakers of English geographically and historically are related to one another, whereas Turkish and Japanese learners do not have as many opportunities as Swedish learners to be exposed to the English language. As a result, there appears strong reason to suggest that the influence of mother tongue of the learners in the present study resulted in lack of collocational priming.

The potential effects of the first language as described above can be approached from a different angle as well. It may be argued that the lack of priming effects in the learners' mental lexicon as well as the significant single word frequency in the process could also be attributed to the fact that the word order of the participants' first language and that of English are different. In other words, verb-noun collocations are constituted in a distinct manner in Turkish and English. For instance, the verb-noun collocation *görüşme yapmak* in Turkish is directly translated into English as *call make,* which is unacceptable in the English language. Namely, verb-noun collocations are echoed as noun-verb collocations in Turkish, in a fashion where nouns are followed by verbs. Based on such discrepancy between the two languages, the learners in the study may unsurprisingly have focused on the single elements of the collocations used in the study rather than processing them as a whole unit in their mental lexicon. As a result, the reason why a significant effect of collocational frequency was not observed could be the result of such different word orders in both languages.

The Role of Frequency

The fact that collocational frequency did not have a significant priming effect for the participants in the study could be attributed to Sinclair's (1991) distinction as to how language works, termed as the idiom principle and the open-choice principle. He suggests that language is predominantly composed of multi-word units rather than individual items claiming that "a language user has available to him or her a large number of semi-preconstructed phrases that constitute single choices." (ibid., p. 110). What he refers to is the idiom principle is that language users enjoy readily accessible elements at their disposal and retrieve them from their memory when the need arises. In fact, the idiom principle restrains free choice of linguistic items which is what makes language use natural. On the other hand, according to the author, the open-choice principle "is a way of seeing language text as the result of a very large number of complex choices." (ibid., p. 109). Bearing this in mind, the author suggests that language is composed of slots to be filled with any grammatically acceptable linguistic item. While any grammatically acceptable linguistic item to be used for a concept or idea can be applied in the open-choice principle, naturalness appears to be ignored. Therefore, the open-choice principle enables language users to make an infinite number of choices during language processing, resulting in unnatural language use even though it is accurate as far as language grammar is concerned. As a result, based on Sinclair's language framework and the findings of the present study, it can be suggested that tertiary level Turkish EFL learners do not apply the idiom principle in their language processing. More precisely, the learners appear to process language relying on the open-choice principle.

Such influence of single word frequency indicates that tertiary level Turkish EFL learners may ignore the holistic nature of academic verb-noun collocations. Bearing this in mind, the results of the study are also in line with Wray's (2002) postulations in that non-native speakers rely on individual elements in collocations contrary to native speakers who focus on collocations as single units. The possible implication behind such consistency between the study and Wray's arguments can be addressed to the suggestion that native speakers and non-native speakers differ in processing collocations. As Kjellmer (1991) and Wray (2002) report, learners do not recognize the most natural selection of collocations compared to native speakers in a given situation. Non-native speakers focus on individual words while processing the language every time they attempt to express their ideas. On the contrary, native speakers naturally retrieve the most formulaic expression in similar situations. As a result, linguistic production of learners turns out to be unnatural and non-native-like since "the classroom learner homes in on the individual words, and throws away all the really important information, namely, what they occurred with" (Wray, 2002, p. 206). From this point of view, since the learners in this study are solely influenced by single word frequency rather than collocational frequency, it can be argued that EFL learners may be less capable of processing frequently occurring collocations than native speakers. As mentioned earlier, since they appear to be less holistic compared to native speakers, they attempt to generate linguistic items from scratch rather than retrieving them from their mental lexicon as a whole unit. Correspondingly, their language production turns out to be non-standard in terms of native speaker norms due to the reliance on individual words.

Suggestions for Practice

The initial implication drawn from the present study is that tertiary level Turkish EFL learners may not have been introduced to the formulaic and holistic nature of collocations. As a result, their language production becomes unnatural and non-native-like. Therefore, it may be argued that they should be taught academic verb-noun collocations explicitly in EFL classrooms. As far as unnatural language use is concerned, Hoey (2005) states that when priming of language users do not match their potential readers and listeners, the outcome will be definitely unnatural. The author also claims that textbooks could yield unnatural priming in the mental lexicon. Linguistic experience encountered in textbooks or language input from the outside world can impair, or improve for that matter, priming phenomenon. Taking this into account, teaching academic verb-noun collocations explicitly could improve learners' priming in such a way that native speakers would find natural, which could hamper the non-native-like language use of the learners.

The study also demonstrated that the learners apply the open-choice principle when they process the language. Considering the distinction in-between, Turkish EFL learners could be argued to ignore the idiom principle model in their language use. Therefore, the findings of this study suggest that learners should be conditioned to take note of the idiom principle in their approach to how language works in mind. Being aware of the holistic nature of the language and the idiom principle, learners can be rather meticulous in their attempts to speak or write, the outcome of which may be natural and native-like language use. As far as raising learners' awareness in terms of collocations and how they are primed in native speakers is concerned, Yamashita and Jiang (2010) report that when non-native EFL teachers who have the same first language as their learners foresee challenging nature of collocations, they can accordingly tune in their instruction, and help learners pay attention to collocational differences between L1 and L2.

Having established that Turkish EFL learners should be introduced to the holistic nature of the language and how language works in mind as the idiom principle postulates, it can

also be argued that teaching collocations with a large amount of exposure may not suffice to make learners acquire them unlike what Schmitt (2008) argues. This study demonstrated that the learners were not significantly affected by the frequency of collocations. Rather, the frequency of the prime word had a significant influence on them. Such significant effect of single word frequency implies that Turkish EFL learners remain analytic towards collocations when they encounter them. Therefore, they break up collocations rather than retrieving them as a whole from their memory. In this sense, since the learners appear to be analytic rather than holistic in their approach to the language, they may not cognitively and innately differentiate which words go together in their linguistic production. As a result, teaching collocations implicitly with extensive exposure may not be enough for the learners. Rather, teaching them explicitly and making learners gain awareness as regards the formulaic nature of collocations may yield native-like language since such knowledge was not readily found in their mental lexicon as far as the study attempted to put forward.

Conclusion

The study bringing the potential role of frequency under the spotlight investigated whether academic verb-noun collocations are primed in tertiary level Turkish EFL learners. As far as priming of collocations is concerned, it is defined as a psycholinguistic association between constituent parts of collocations rather than a manifestation of mere textual co-occurrence of words (Hoey, 2005). Based on this description of collocations, Hoey suggests that they should be defined in psycholinguistic terms since words do not haphazardly occur together in texts. That is, each word in language is primed to be used with certain other words depending on the context, which is spelled out as collocational priming. From this point of view, the choice of a word following another word is in the mental lexicon of native speakers as they happen to be loaded with such knowledge through linguistic encounters in their unique language experiences. In this sense, collocational priming ensures natural language use (ibid). Taking collocational priming into consideration, it was demonstrated in the study that Turkish EFL learners sound unnatural and non-native-like in their language production as academic verb-noun collocations were not found to be primed as a single unit in their mental lexicon.

Given the fact that priming experiments, namely LDTs are time-consuming and expensive to conduct, the study is limited to the findings of a single lexical decision task. Therefore, the findings of the study are not generalizable to all EFL learners, and the findings of this study are advised to be approached tentatively. As stated at the outset, this study was solely concerned with academic verb-noun collocations as they have been argued to be problematic and challenging for EFL learners in the relevant literature (Bıçkı, 2012; Nesselhauf, 2005), which was assumed to be the reason behind the learner's unnatural and non-native-like language use.

It is worth underlining the following points for further studies to conscientiously approach the matter at hand here. First of all, the role of the first language stood out as one of the key findings of the study. Specifically, contrary to the study carried out by Wolter and Gyllstad (2011), it was unearthed that verb-noun collocations did not hold a significant priming effect in the mental lexicon of the EFL learners in this study. In this sense, further research should be done including learners from varying first language backgrounds to reach sound conclusions. It has been discussed above that while the collocations in Wolter and Gyllstad's study had a significant effect on Swedish learners of English, they did not exhibit such effect in Japanese learners of English in Wolter and Yamashita (2014). This may stem from the fact that English and Swedish belong to the same language family while Japanese is both geographically and orthographically distant to English. Likewise, Turkish is different from English in terms of word order, vocabulary, grammar, etc.,

implying that the first language of the learners may have played a crucial role in the absence of priming in their mental representations. Therefore, future studies could include learners not only with syntactically and semantically similar first languages but also those speakers whose languages are geographically distant from English speaking countries to make further arguments on the issue. Furthermore, other collocation alternatives than verb-noun pairs such as adjective-noun and noun-verb pairs as categorized by Benson et al. (2009) can be taken into account.

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