Comparing the Effect of Morphological Analysis and Incidental Learning on the Acquisition of TOEFL Vocabulary[1]

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Abstract

Morphological analysis and incidental learning are two vocabulary learning strategies that language learners may use in order to acquire the meanings of new words. To date, however, few studies have compared the effectiveness of these two strategies. Hence, the current study was carried out to compare the effect of morphological analysis and incidental learning of words that appeared in ten actual TOEFL reading passages from 2010 to 2018 (henceforth, TOEFL vocabulary/words). Eighty upper-intermediate Iranian foreign language learners participated in the study. A pretest was administered to determine the TOEFL words the participants could not supply a synonym, a similar expression, or a translation for at the onset of the study. Next, the participants were randomly divided into two groups: the Morphological Analysis (MA) group, who learned the vocabulary through learning the meanings of Greco-Latin roots in the words, and the Incidental Learning (IL) group, who learned the TOEFL vocabulary through multiple exposures to the words in different contexts. Then, a posttest was administered to investigate the effect of each of these strategies on recognizing the meanings of the TOEFL words. Running a t-test, the groups' mean scores on the pretest and posttest were compared. The results of the study indicated that the MA had a more significant effect on vocabulary retention than the IL. Based on the findings of the study, it is recommended that MA be employed as a valuable source for TOEFL vocabulary learning and teaching by both teachers and learners, and as a strategy for vocabulary teaching in ESP or EAP courses as the vocabulary in such courses is heavily loaded with Greek and Latin roots.

Resumen

El análisis morfológico y el aprendizaje incidental son dos estrategias de aprendizaje de vocabulario que los estudiantes de idiomas pueden utilizar para adquirir los significados de nuevas palabras. Sin embargo, hasta la fecha, pocos estudios han comparado la efectividad de estas dos estrategias. Por lo tanto, el presente estudio se llevó a cabo para comparar el efecto del análisis morfológico y el aprendizaje incidental en el aprendizaje de los significados de las palabras que aparecieron en 10 pasajes de lectura de exámenes TOEFL reales de 2010 a 2018. Participaron en el estudio 80 estudiantes de idiomas extranjeros de nivel intermedio-alto [de nacionalidad]. Se administró una prueba preliminar para determinar las palabras del TOEFL para las que los participantes no podían proporcionar un sinónimo, una expresión similar o una traducción al inicio del estudio. A continuación, los participantes se dividieron aleatoriamente en dos grupos: el grupo de Análisis Morfológico (AM), que estudió el vocabulario aprendiendo los significados de las raíces grecolatinas en las palabras, y el grupo de Aprendizaje Incidental (AI), que estudió el vocabulario TOEFL a través de múltiples exposiciones a las palabras en diferentes contextos. Luego, se administró una prueba posterior para investigar el efecto de cada una de estas estrategias en el reconocimiento de los significados de las palabras del TOEFL. Al ejecutar una prueba t, se compararon las puntuaciones medias de los grupos en la prueba previa y posterior. Los resultados del estudio indicaron que el AM tuvo un efecto más significativo en la retención de vocabulario que el AI. Con base en los hallazgos del estudio, se recomienda que se emplee AM como una fuente valiosa para el aprendizaje y la enseñanza del vocabulario TOEFL tanto por parte de los profesores como de los alumnos, y como una estrategia para la enseñanza del vocabulario en los cursos de inglés especializado o académico ya que el vocabulario en dichos cursos. están muy cargadas de raíces griegas y latinas.

Introduction

Knowledge of vocabulary has always been one of the most significant elements in educational and professional success of EFL learners. Brown (2016) described vocabulary as the cornerstone of language. In addition, pointing out the role of vocabulary in communication, the importance of vocabulary in learners' perception, and the significant position of vocabulary knowledge, Barcroft (2015) argued that vocabulary acquisition is a principal aspect of SLA. Research studies have indicated that vocabulary plays a significant role in learning and teaching other language skills. Likewise, vocabulary has long been associated with developing reading skills (Capin et al., 2020; Khezrlou et al., 2017; Levesque et al., 2019), speaking (Uchihara & Clenton, 2020; Amini et al., 2020), writing (Barcroft, 2015; Wu et al., 2019), and listening

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(Kusumawati & Hasan, 2019; Masrai, 2020) . The synopsis of these studies concludes that greater vocabulary knowledge will lead to better language perception and production.

Nevertheless, “words may seem like simple entities, but they are not. Their surface simplicity” carries “a deeper complexity (Pearson et al., 2007, p. 286). Encountering superficially simple, yet deeply complex words in a foreign language, learners may draw upon a wide range of strategies to recognize and learn their meanings. For instance, they may try to infer the meaning of a new word from the context (i.e., through incidental learning, henceforth IL) or try to deduce it by *decomposing the word into its constituent parts, and learn its meaning on the basis of these constituents* (that is, morphological analysis, henceforth MA). Numerous studies have investigated different aspects of IL (e.g., Rodgers & Webb, 2020; Sauer, 2017; Webb & Chang, 2015). MA has also been analyzed by many researchers (for example, Azad, 2008; Crosson et al., 2019; Kieffer & Lesaux, 2012) as an advantageous vocabulary learning and teaching strategy. Yet, there have been few studies carried out to compare the efficiency of these two strategies. The following review of literature explicates the findings of the studies that investigated MA and IL separately and tries to find a research gap indicated in the literature.

Literature Review

Vocabulary knowledge and how to expand it

Knowing a word does not solely involve knowing the meaning of the word; it also encompasses the form and the use of that word. All other aspects of a word such as its pronunciation, spelling, knowledge of word parts (i.e., MA), spoken and written forms, its concepts and referents, as well as its associations, collocations, and grammatical functions also constitute word knowledge (Nation, 2013). Yet, “not all aspects of word knowledge are equally important”. The most significant aspect of knowing a word is “being able to recall a meaning when meeting a word” (Nation 2020, pp. 15-16).

Two of the most important ways to recall the meaning of the words are MA and IL. MA is “at the intersection of breadth and depth of vocabulary knowledge and needs to be an important learning focus in the beginning and intermediate levels of language learning” (Nation, 2020, p.25). It can help leaners learn and remember the meaning of a myriad of low-, mid-, and high-frequency words (Laufer, 2017; Web & Nation, 2017; Wie & Nation, 2013). Thus, teachers are advised to invest in teaching the frequent stems and affixes to their students, and to require learners to know these stems and affixes (Nation, 2007, 2013; Webb & Nation, 2017). IL on the other hand, is another helpful strategy to learn the meaning of the new words and to expand one’s vocabulary knowledge. Repeated encounters with words (i.e, IL) can present an opportunity to eventually learn the meaning of words although it takes longer than deliberate learning instruction of vocabulary (Hulstijn, 2012; Nation, 2012).

English language morphology

Analyzing the morphological structure of a word into its constituent meaning elements (i.e., its roots and affixes) is often referred to as morphological analysis (Crosson et al., 2020; Laufer, 2017). Despite the fact that the studies on Latin and Greek roots and affixes confirm the frequent and prevalent occurrence of such roots and affixes in English words (Eviyuliwati et al., 2019; Goodwin et al., 2020), there is no consensus over the exact percentage of English words with Latin and Greek origins. As Rasinski et al. (2008) stated , “more than 70 percent of the words in [any] English dictionary and more than 90 percent of English words with two or more syllables’ have Latin and Greek origins” (p. 142). In most of the other studies, it is proposed that at least more than 55 percent of all English words derived from Latin and Greek (Van Cleave, 2019).

Additionally, Schmitt et al., (2001) asserted that more than 91 percent of the words in the Academic Word List (AWL), developed by Coxhead (2000), are derived from Latin and Greek. Furthermore, almost all of the English prefixes, according to White et al. (1989), are derived from Latin. On the other hand, Sasao and Webb (2017) maintained that 118 affixes are found in the most frequent 10,000 word families and that knowing the form, meaning, and use of such affixes can help learners reach a desirable vocabulary level.

Research on morphological analysis (MA)

Research has indicated the importance of root word knowledge and MA boosting vocabulary knowledge . Nagy and Anderson (1984), for example, estimated that approximately 60% of novel words learners come

across can be figured out through MA. Henry (2003) also argued that as grade level rises, cases of basic morpheme arrays of Latin and Greek origins (i.e., roots and affixes) become more persistent in content-area textbooks. He further mentioned that older learners reading problems are not familiar with these patterns they do not know the meanings of the word parts. Moreover, they have inadequate involvement with the parts they already know to derive the meanings of the words they do not know. Schmitt and Zimmerman (2002) in concurrence stated that affixes should be *directly taught* to the learners.

In addition, knowledge of roots and affixes not only can generate everyday words that learners understand and actively use, but also newer and harder content words that learners may encounter. Moreover, vocabulary that learners have already learned can be reinforced through teaching roots. Subsequently, roots will activate background knowledge and promote learners to advance from the known knowledge of root words to the unknown meanings of words (Ghasemi & Vaez-Dalili, 2019; Rasinski et al., 2011). In addition, Deacon et al. (2017), conducting research on the relationship between MA and reading comprehension in children in Grades 3 and 5, concluded that MA plays a significant role both in reading the words and in determining their meanings. Pacheco and Goodwin (2013) found that middle school learners' use of MA can deepen their understanding of new words. Goodwin et al. (2017) found that MA can facilitate vocabulary building, vocabulary knowledge, and reading comprehension for adolescents, particularly in case of morphologically complex words.

Juxtaposing the results of various studies on methods and strategies of vocabulary learning and teaching, Laufer (2017) called for decontextualized and explicit vocabulary instruction to foster vocabulary learning. She considered analyzing and teaching of word parts (Morphological Analysis) as one of the most important strategies in vocabulary retention. Not surprisingly, a vocabulary instruction strategy to teach the meanings of roots and affixes is recognized as an instructional approach to help learners determine and learn the meaning of words (Stahl, 2005; Villamar Ramirez, 2020).

Biemiller (2005, 2011) pointed out that despite using MA as a strategy, it is usually set aside for upper-grade or content-area classrooms. However, research (Brandes & McMaster, 2017; Kieffer & Box, 2013; Maria, 2019) indicates that introducing MA to lower grades can also be beneficial. As research projects have supported, this is of greater significance when it comes to comprehending and learning vocabulary since it is in this "arena that learners will come across an influx of content specific vocabulary throughout the curriculum". Consequently, recognizing and using the knowledge of the roots and affixes can help learners "make sense and attempt to retain the meanings of this deluge of new words," particularly when the specific and academic words are concerned (Bellomo, 2009, p. 3).

Research on Incidental Learning (IL)

Another strategy for learning and teaching new vocabulary is IL. Hulstijn (1992) defined L2 incidental vocabulary retention as the learners' ability to "infer the meaning of an unknown word occurring in an L2 text" (p.113) and the possibility of word retrieval and recall in the future. Stahl and Nagy (2006, p. 173) argued that "much, if not most, of learners' vocabulary knowledge is gained through encountering words in *context* (italics ours)," which is the core of incidental vocabulary learning. Likewise, Rasinski et al. (2011) emphasized that IL can be a significant strategy for vocabulary development because many English words have multiple meanings, and context can help them decide which meaning is most likely to be correct. Therefore, given that context is central in recognizing which meaning should be used, learning how to take advantage of the context can also help learners develop their vocabulary knowledge.

Most of the research on the effects of IL on vocabulary learning has mainly focused on three main research emphases: (a) the comparison between the effect of IL and that of intentional learning (Bahari, 2019; Lessard-Clouston 2013; Sauer, 2017); (b) the investigation of the effect of IL per se (Malone, 2018; Rodgers & Webb, 2020; Teng, 2015); and (c) the frequency of word exposure in L1 and L2 vocabulary acquisition through IL (Horst et al., 1998; Mohamed, 2018; Rott, 2007; Teng, 2019). The extent to which vocabulary acquisition through IL can lead to vocabulary learning has varied among the studies.

Pitts et al. (1989) carried out one of the first research on L2 vocabulary acquisition through IL. They explored the learning of Russian slang via reading practices. The results of their study displayed 6.4% to 8.1% vocabulary acquisition through reading, an indispensable part of IL. Nevertheless, higher percentages of vocabulary acquisition have been reported in other studies. The percentages range from 15% after reading

a set of graded readers (Brown et al., 2008), to almost 22% through a multiple-choice meaning recognition test and a word association test (Horst et al., 1998). The highest vocabulary acquisition rate, however, was reported by Waring and Takaki (2003) as 42%. This percentage was achieved through an immediate multiple-choice test and a translation task after reading. Yet, in the studies running a delayed posttest, the results of vocabulary learning were sharply reduced in the delayed posttests. For instance, after a three-month interval, the vocabulary learning rate in Waring and Takaki's (2003) study decreased to as low as 4%.

Research has also demonstrated that frequency of occurrence of L2 vocabulary can affect vocabulary learning through IL. Beck et al. (1983) proposed that all learners should be familiar with four major types of contexts (directive, general, non-directive, and misdirective) in order to understand the meanings of the words based on the context. Focusing on the effect of IL on vocabulary learning, Huckin and Coady (1999) pointed out that incidental vocabulary learning is not 100% incidental because in incidental learning settings, learners are usually exposed to the new words for a number of times, and they will eventually pay at least a minimum attention to the words they encounter. So, the incidental learning process cannot be "completely" incidental. The number of encounters suggested to learn the vocabulary has been diverse among different studies. The suggested frequencies include six encounters (Rott, 1999), eight exposures (Horst et al., 1998), 10 encounters (Webb, 2007), and 20 encounters (Waring & Takaki, 2003). Cobb (2016) asserted that the borderline of learnability" for the new words through IL is "lately averaged at 12 encounters". (p. 299)

The research gap

As presented above, numerous studies have investigated the effect of learning and teaching L1 and L2 vocabulary through MA and IL separately. What is surprising, however, is the paucity of research providing empirical evidence to compare the effect of these two strategies on learning of vocabulary in the same study (Elleman et al., 2019; Nunes et al., 2006; Oz, 2014; Trussell, 2020). Therefore, the present study was conducted to answer the research question: "is there any difference between the effect of learning vocabulary through MA and through IL on remembering the meanings of TOEFL vocabulary?" That is, the paper tries to find out which of these scenarios (MA or IL) can better help learners to retain the meanings of the newly learned words after the experiment. The null hypothesis of the research was: there is no difference between the effect of MA and IL on the acquisition of TOEFL vocabulary. The following section explicates the materials and the method of the study.

Research Methodology

The study used a pretest-posttest experimental design in the span of ten weeks. Each week, three 105-minute sessions were held on odd days. Various activities were carried out in both MA and IL groups, along with some procedures especially designed and conducted for the individual groups, which are explained in the following paragraphs.

Participants

The participants of the study were 80 male Iranian engineers, ranging from 41 to 50 years old. They held MS degrees in different subfields of chemistry and worked in Shazand Arak Petrochemical Company, Arak, Iran. They studied English at a language institute under the supervision of the Arak University, Arak, Iran, preparing themselves to take the TOEFL test with instrumental motivation to live and work abroad. The informed consent of all of the participants was obtained that their scores and class performances may be used and analyzed in some studies; yet, their personal information would always remain confidential.

Materials and instruments

Oxford Placement Test

A total of 120 candidates enrolled to take part in the TOEFL preparation classes of the institute. 40 candidates were excluded from the study since they did not meet the inclusion criterion of the study which was to pass the Oxford Placement Test (2004) as upper-intermediate learners. Thus, all the 80 participants of the study were homogeneous in terms of their English proficiency level. The OPT was used thanks to its relative ease of administration and scoring procedure in comparison with other standard placement tests. Using the lottery

method of simple random sampling, they were randomly divided into two groups (one receiving the vocabulary through MA and the other through IL).

Pretest

The pretest was a list of 147 words administered as a word recognition and production test to determine the TOEFL words that the learners were familiar with and those for which they could not supply a synonym, similar expression, or translation. All the words were extracted from the reading sections of 10 actual TOEFL reading passages of test versions used from 2010 to 2018 as the learners were preparing to take it. The main purpose of the pretest was to distinguish a number of words whose meanings the participants did not recognize. Then, to teach these unknown words to the participants through MA and IL and find out which strategy leads to better retention of new words.

The pretest was administered in the first session of the semester for both groups. The instructions for the test were in Persian. It was also described orally for the learners in Persian at the time of administration to minimize any ambiguity with the instructions (see Appendix 1). First, the learners were asked to tick the appropriate squares to indicate whether they had ever seen that word before and/or if they knew the word's meaning either in Persian or English. If the learners ticked the square number 1, they were required to write an equivalent for the word in any way they could convey the meaning, including Persian or English equivalents, definitions, and/or English synonyms in the space provided. Otherwise, they needed to tick square number 2 to indicate that they had not ever seen the word and/or they did not know the meaning of the word in any sense.

Upon their request, the participants were allowed to have extra time to answer the test. That was due to the fact that the main purpose was to test the accuracy of recognition and production of the words' meanings, not the speed of recognition and production. Then, the learners' answers to the pretest were evaluated. Twenty words were detected as "unknown" by the learners: those were the words learners were not able to recognize and define. Therefore, the pretest scores for all the participants was zero since none of the participants were familiar and/or knew the meanings of any of these words.

Posttest

A 40-item teacher-made test was administered to the groups as the immediate posttest after the experiment (see Appendix 2). The Cronbach's alpha formula was used to establish the reliability index of the test (r = 0.89). Content validity of the posttest was also verified by an expert panel consisting of five Arak University faculty members, validating that the test items were consistent with the objectives of the study and that all the test items were answerable based on the content provided. The test consisted of 20 target words and 20 non-target words. The target words, i.e., the even-numbered words on the test sheet, were the very words none of the learners had recognized and did not know their meanings in the pretest. Non-target words were used in the posttest in order to not allow the participants to know what the focus of the study was. This intended to remove the possibility of the halo effect (participants' general impression of the experiment influencing their behavior), the John Henry effect (members of the control group's awareness of being compared to the experimental group affecting their behavior), and the Hawthorne effect (members of the experimental group's awareness of being under study influencing their behavior). The posttest was an open-ended test where some space was provided for the participants to write any English or Persian equivalents, definitions or synonyms for the words given.

Teaching materials

The words presented to both groups were extracted from actual TOEFL tests. In the IL group, the words were presented through authentic paragraphs extracted from the digital version of the Encarta Encyclopedia (2007) in which there were some clues to find out the meaning of the words. For the MA group on the other hand, the same words were presented through direct decontextualized instruction of the meanings of word roots (bases, prefixes, and suffixes) to the participants.

Data collection procedures for the MA group

For the MA group, in the second session of the semester, a brief explanation on the etymology of English words was introduced to the learners to make them more involved in the process of vocabulary learning through morphological analysis and to let them know why the words were instructed through MA in their

class. During the study, the learners spent nine sessions on affixes. The 11 prefixes and six suffixes which, according to White et al. (1989), are most likely to occur in 80 percent of all English affixed words (see Table 1) were taught to the learners.

Prefixes	*% of All Prefixed Words (Cumulative)*	*Suffixes*	*% of All Suffixed Words (Cumulative)*
l. Un-	26	1. -s, -es	31
2. Re-	40	2. -ed	51
3. In-, im-, il-, ir-	51	3. -ing	65
4. Dis	58	4. -iy	72
5. En-, em-	62	5. -er, -or	76
6. Non	66	6. -ion,-tion, -ation, ition	80
7. In-, Im-	69		
8. Over-	72		
9. Mis-	75		
10. Sub-	78		
11. Pre-	81		

Note. Adapted from Tables 1 and 2 of White et al. (1989, p. 112).

Table 1: Prefixes and suffixes that account for approximately 80% of all affixed words

During each session, two affixes were taught to the MA group, except for the second session in which a brief explanation on the etymology of English words was presented to the learners and just one prefix was taught. For the following 21 sessions, all the roots included in the pretest words were taught to the learners with their meanings. Once the learners encountered Latin- or Greek-based words, they were taught how to decode the words into their roots, and use the meanings of the roots to reach the meanings of the words. The word *convene*, for instance, was divided into two parts: [*con-*] and [*–vene*]. The learners were taught the roots [*con-*] meaning "together" and [*–vene*] meaning "come" in Latin join each other to make the word *convene* in English, meaning "come together".

In addition, the class made use of *word play* and *neologisms*. The instructions took 60 minutes of the class. Utilizing the roots and affixes, students were required to make at least one new word not present in today's English by himself, and check and share it with his peers and the teacher. To make sure that their neologisms did not exist in today's English, they were called to check their newly coined words in paper and digital advanced learners' dictionaries (e.g., Longman, Oxford, or Webster's Dictionary), and also to check online to see whether there is such a word in English. It should be further mentioned that all the tasks were initially modeled by the teacher for five minutes, i.e., the teacher explained to the learners how to do the task and he did it himself first.

Data Collection Procedures for the IL Group

For the IL group, in the second session of the semester, the learners were made cognizant of the effectiveness of learning from major types of contexts (temporal, spatial, descriptive, and functional). The instructions took 60 minutes of the class. The teacher modeled for the learners how to use context for 5 minutes. They were also taught how to monitor their ability to predict and verify the new word meanings. They were persuaded to use their prior knowledge and relate the new words to other words in the context to derive the meaning of a new word.

During the term, the learners in the IL group encountered each of the unknown words detected in the pretest 12 times. Thus, the concept of multiple exposures, as the principal part of the incidental vocabulary learning tasks was also met. The learners' use of context clues was encouraged and observed during the course in the control group through interactions between the researchers and learners.

The learners were further asked to present any context that they thought could be valuable for the process of learning. This task was assigned to the learners to make them more involved in the process of learning, and to make use of the potentiality of any helpful context that learners might have brought forward. It was also recommended by the teacher that, if they could, they would identify the kind of the context and the context clues in the context they had presented. They were also called to check the meaning they got from the context with those of digital advanced learners' dictionaries (e.g., Longman, Oxford, or Webster's Dictionary) or to check online to see whether they were correct. Such activities took 15 minutes of the class each session.

Results and Discussion

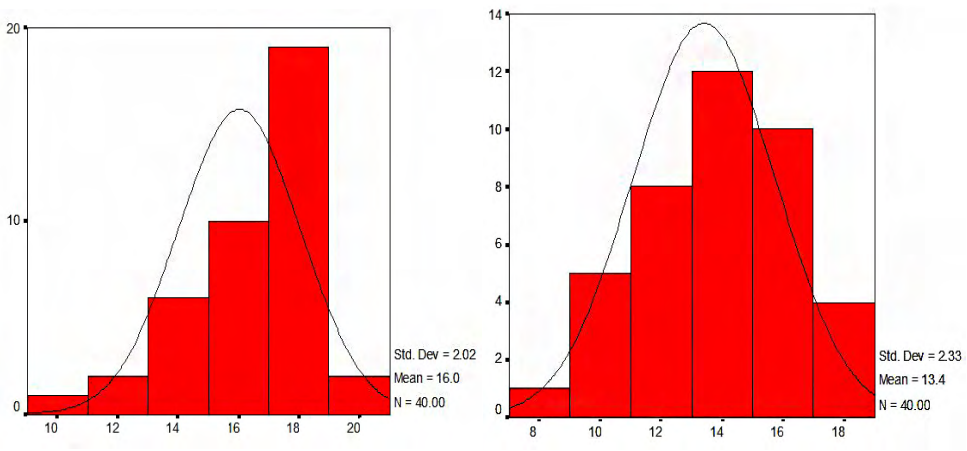
To obtain the descriptive and inferential statistics, SPSS (version 23) was run. The descriptive statistics of both groups' posttests are presented in Table 2 (pretest scores being "zero" for all participants, explained above). As seen, the descriptive statistics of the MA group (M = 16.02, SD = 2.01) was different from that of the IL group (M = 13.40, SD = 2.32) with a higher mean and a lower standard deviation. Moreover, whereas the most frequently occurring score (the Median) in the MA group was 17, achieved by about one third (N = 13, 32.5%) of the participants, the median of the IL group was 15, scored only by 8 people (20% of the participants).

	Morphological Analysis	Incidental Learning
Mean	16.02	13.40
Median	17.00	14.00
Mode	17.00 (F = 13, 32.5%)	15.00 (F = 8, 20%)
Std. Deviation	2.01	2.32
Minimum	10.00	8.00
Maximum	19.00	18.00

Note. F = Frequency

Table 2: Posttest descriptive statistics for both groups

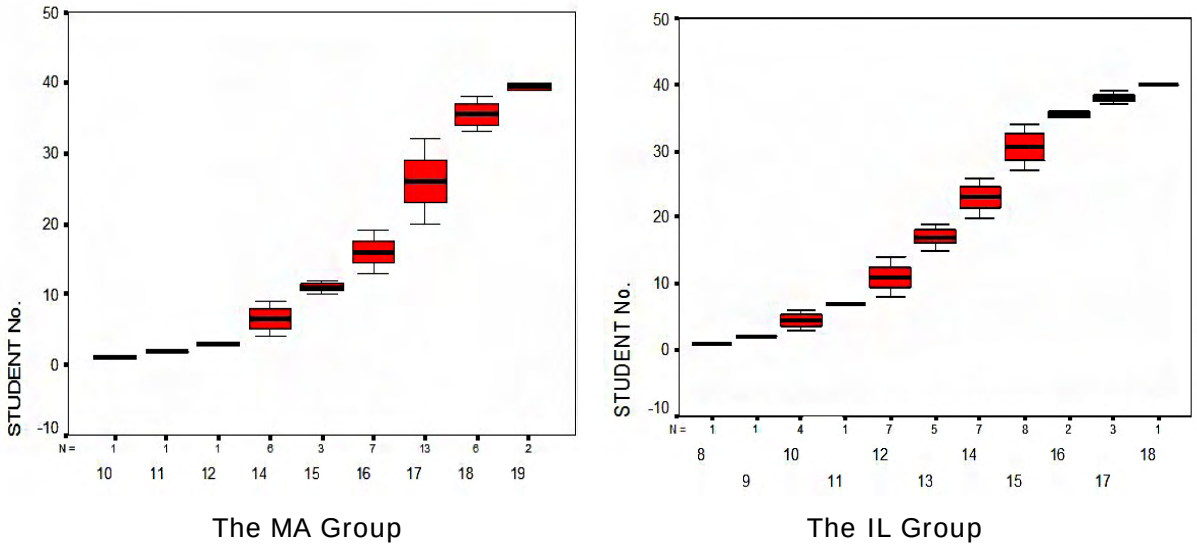
As displayed in Table 2, the mode and the median of the MA group scores were the same (17.00), indicating that the majority of the scores fell above the group mean score (M = 16.02), which results in a slightly negatively skewed curve (see Figure 1) in comparison with the bell-shaped curve of the IL group with the mode of 15.00 and median of 14.00 (see Figure 1).



The MA Group The IL Group

Figure 1: The Distribution curve of the posttest scores in both groups

As can be seen in Figure 2, for both groups there are no circle marks beside the scores presented on the horizontal lines of the SPSS output, which indicates that there are no outliers (extreme scores) in either group due to learner negligence or in consequence of incorrect entry of the data in the learners' scores. This may be attributed to the fact that all the participants were adults, and that they were actively involved in the process of learning because of their instrumental motivation. It can be the foundation for further research to examine whether age or motivation can have an effect on not having outliers in the studies.



The MA Group The IL Group

Figure 2: The Distribution of the posttest scores in MA & IL groups

Taking all the procedures mentioned above into account, it can be seen that the two groups were independent of each other, and that other intervening variables such as age range, sex, race, studying major, motivation to learn, and English proficiency level had been controlled by the researchers. Moreover, based on Figures 3 and 4, there were no outliers in the data. Furthermore, the results of the Levene's Test of Equality of Variance (Sig. = 0.23, $p < .05$, F = 1.45) showed the equal variance of the samples at the critical value of 0.05 (see Table 3). As a result, all the assumptions for conducting a *t*-test were met.

To compare the two mean scores of the two groups' posttest results, and to see if the sample of participants were representative of the larger population, an independent-sample *t*-test was conducted to compare the degree of vocabulary learning between the MA and IL groups. The results are shown in Table 3.

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Equal variances assumed	1.45	0.23	5.38	78	0.00	2.62	0.48	1.65	3.59
Equal variances not assumed			5.38	76.45	0.00	2.62	0.48	1.65	3.59

Table 3: Independent samples t-test for vocabulary learning

As shown in Table 3, there is a significant difference between the scores of the MA group (M = 16.02, SD = 2.01) and those of the IL group (M = 13.40, SD = 2.32), t (78) = 5.38, $p < .05$, (two-tailed) posttests. The mean difference is 2.62 with a 95% confidence interval ranging from 1.65 to 3.59, signifying that at least 95 percent of the scores are around the mean score. The results also indicated a large magnitude of effect size (Cohen's d = 1.21, eta squared (η^2) = 0.52), with MA explaining 52 percent of the variance in learning of vocabulary.

The higher mean, lower standard deviation, negative skewedness of the distribution curve of the MA group as well as the t-test statistically significance value and its large effect size (Cohen's d and eta squared), all indicated that the null hypothesis of the study should be rejected, providing empirical evidence that MA has a more significant effect than IL on the learning of the vocabulary for specific purposes.

The results of the study are in line with Crosson et al. (2019), Deacon et al. (2017), and Goodwin et al. (2017), who found that MA plays a significant role in determining the meaning of words, understanding of unknown words, and facilitating learners' vocabulary building. The reason for this consistency of research results lies in the nature of MA, which is learning new words through the meanings of Latin and Greek roots and affixes in English words. Given that more than half of all English words, almost all of the academic words, and nearly all English affixes are Greek- and Latin-based (Rasinski et al., 2011), and that only 11 prefixes and six suffixes account for *80 percent* of all affixed words in English (Stahl, 2005). Such high frequency, according to researchers, heralds learners' ability to easily learn and recall them when encountering a word having these roots and affixes. In effect, teaching the meaning and the function of the Greco-Latin roots and affixes to learners can essentially be advantageous thanks to the fact that a relatively small number of Latin and Greek roots and affixes are used in a very large number of English words (Crosson et al., 2019; Eviyuliwati, 2019).

Nevertheless, the results of this study are not entirely consistent with Baumann et al. (2003) and Graves et al. (2018) who argued that MA, although viewed by many experts as helpful, is not sufficient in and of itself, and that it needs to be accompanied by using and understanding context clues. We concur with them inasmuch as they maintain that MA is a beneficial vocabulary learning and teaching strategy. However, we do not agree with them on what they contended that MA is not sufficient by itself, considering that in this study we found that MA per se appears to be not only sufficient but also successful as a strategy to learn and teach TOEFL vocabulary.

A reason for the outperformance of the MA group as opposed to the IL group vocabulary learning can be the *constant meaning*, *spelling patterns,* and *function* of the roots and affixes. Prefixes, most of the time, either give a direction to the word, negate, or intensify the meaning of words. Roots (the core meaning of words), in contrast, always have a constant meaning, which can be learned and recollected in subsequent encounters. Moreover, as Rasinski et al. (2008) argued, "roots once learned, are rarely forgotten" (p.33). Thus, knowledge of the meaning and function of roots and affixes can help learners gradually become independent in later stages of their vocabulary learning lives.

Another reason for the effectiveness of MA can be the learners' *word consciousness* as a result of practicing MA. It can be argued that MA is a source of word play (a constituent of *word consciousness*) in the classroom. One can define *word consciousness* as learners' awareness of the meanings carried by word units such as prefixes, suffixes, and roots as well as enjoying vocabulary learning. In the present study, the learners made use of word play and neologisms, and as they often mentioned in the class, they really enjoyed it. As to the researchers, word consciousness can indeed be considered as a by-product of MA.

Another finding of the present study was that IL was relatively less fruitful than MA regarding vocabulary learning. This finding is in line with the findings widely reported by Nation (2007, 2012, 2013, and 2020). These studies reiterate that IL is not as effective as deliberate vocabulary learning strategies (such as MA), especially in L2 classroom settings. One reason for such ineffectiveness of IL as compared with MA, may have its roots in the nature of IL. According to Hulstijn (2001, 2003, 2012), IL hardly ever happens in the classroom since the learners normally expect to participate in a form of final examination, and almost always learn their vocabulary intentionally. An interesting point during the procedure of the study was that the learners were not told that they were part of a vocabulary learning research (in order to avoid the Halo, John Henry, and Hawthorne effects). Yet, the learners in the IL group learners raised such complains as: "how many times this word is repeated?" or "how many times do you explain the meaning of this word? We already know it" because they had 12 encounters to the same word as an incidental vocabulary learning technique. Thus, in this study, we experienced that incidental vocabulary learning is not purely incidental since there is at least a degree of attention among the learners to the frequency of the words they encounter.

The other ground for the relative unproductiveness of IL is that learners may infer *incorrect meanings* from the context; yet, they do not recognize this. They can even be – to a great extent – certain that they have correctly inferred the meaning. Moreover, there is also the possibility of *misinterpretation* of meanings in IL. Idioms, polysemic words, and false cognates can be the main source of such misinterpretations. While inferring the meaning from the text is a *difficult* task for learners to carry out both in their first and second languages, it is extremely difficult to *unlearn* these false meanings learned through IL.

Regarding the practicality of employing IL in the classroom, our teaching experience tells us that when learners come across a new word in the text, they would first ask for the translation or synonym either from the teacher or from their peers. Having failed to obtain it due to other learners' not knowing the word meaning and/or the teacher's refusal to translate, they would rely on their hunches or use their dictionaries, rather than attempt to decipher the meaning. Therefore, the fact is that in practice, however persuasive the rationale behind IL may be, teachers rarely decline to translate the words students ask them and hardly ever make use of IL for teaching vocabulary as it is really demanding to apply, especially due to class time restrictions.

Conclusions and Implications of the Study

The study provided some statistical evidence that MA can be more productive than IL in learning the meaning of unfamiliar vocabulary in TOEFL reading passages. It is possible to conclude that TOEFL vocabulary instruction through MA, as used in this study, can be more helpful in escalating learners' vocabulary skills, and their interest in vocabulary learning than IL.

Based on the results of the study, it is suggested that teachers use MA as an alternative strategy to teach TOEFL vocabulary. Learners, on the other hand, may use MA as a strategy for learning new TOEFL vocabulary. In addition, they can become more independent vocabulary learners, having learned not to rely so heavily on the teachers or even on their dictionaries to back them in learning new TOEFL words.

Moreover, most of the technical terms in many fields of science such as physics, chemistry, astronomy, medical sciences, and many other ESP or EAP courses are heavily loaded with Greek and Latin roots. Thus, it is recommended that MA be employed in learning and teaching ESP or EAP vocabulary as it can relieve the learners from learning thousands of technical words, and can help them in knowing the meanings of a large percent of the words they encounter in their majors.

The researchers also suggest that MA be used as a vocabulary instruction strategy combined with IL in an authentic classroom setting to investigate whether it can generate better results. MA and IL can help learners immerse in words and can be used as valuable lifelong vocabulary learning strategies which enable the learners to consciously learn and retain English vocabulary. Nonetheless, there is still room for conducting similar research with other age ranges, other gender differences, other proficiency levels, and other repertoire of background knowledge and in different fields of studies with larger populations to corroborate or nullify the research findings.

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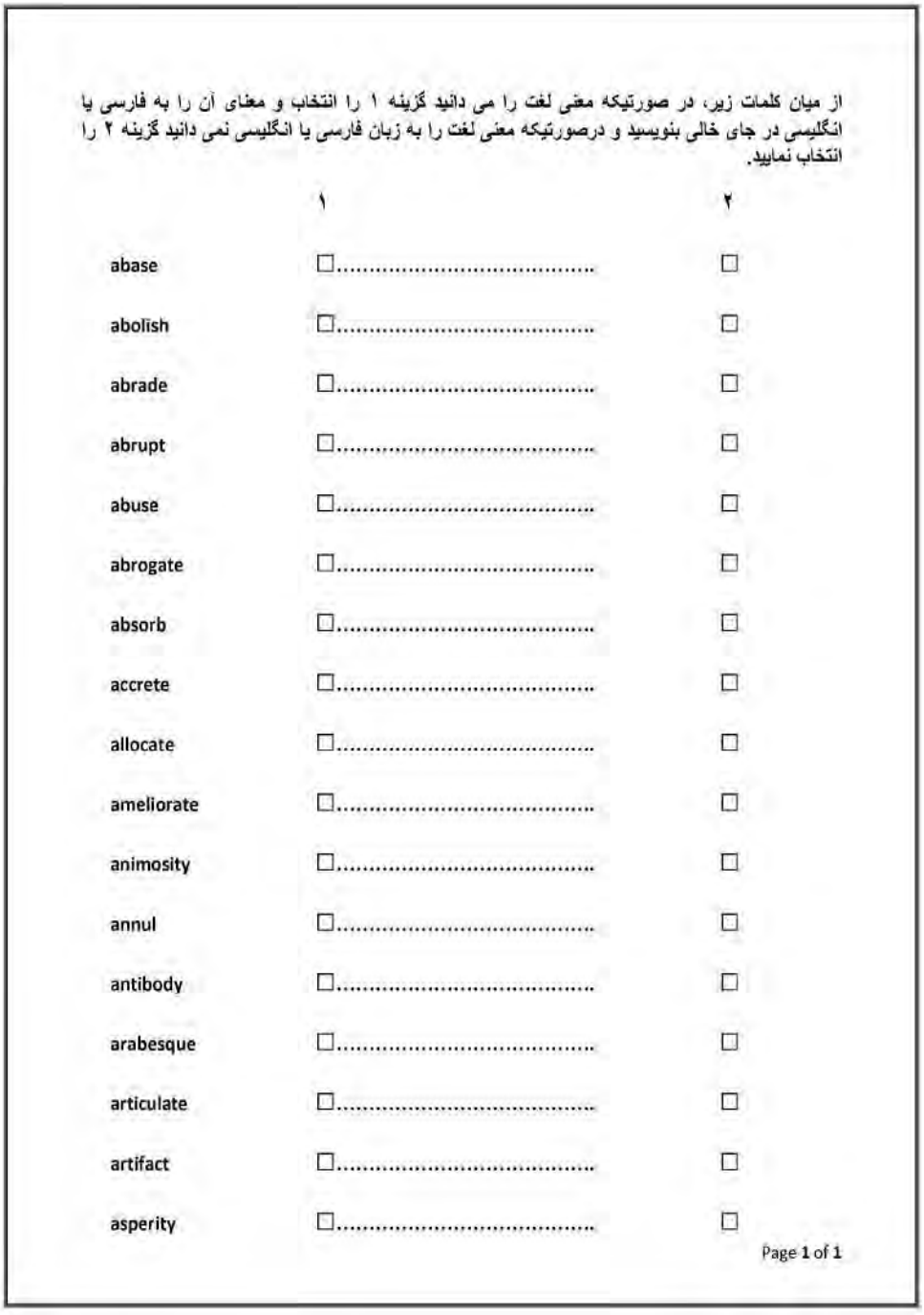
Appendix 1

The Word List Given to the Students to Determine Their Vocabulary Knowledge



از میان کلمات زیر، در صورتیکه معنی لغت را می دانید گزینه ۱ را انتخاب و معنای آن را به فارسی یا انگلیسی در جای خالی بنویسید و درصورتیکه معنی لغت را به زبان فارسی یا انگلیسی نمی دانید گزینه ۲ را انتخاب نمایید.

	۱	۲
abase	☐.....	☐
abolish	☐.....	☐
abrade	☐.....	☐
abrupt	☐.....	☐
abuse	☐.....	☐
abrogate	☐.....	☐
absorb	☐.....	☐
accrete	☐.....	☐
allocate	☐.....	☐
ameliorate	☐.....	☐
animosity	☐.....	☐
annul	☐.....	☐
antibody	☐.....	☐
arabesque	☐.....	☐
articulate	☐.....	☐
artifact	☐.....	☐
asperity	☐.....	☐

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Note. The English version of the pretest direction: 'If you have seen any of the followings words and/or if you know the word's meaning either in Persian or English, tick the square number 1, and write a Persian or an English equivalent for the word in the space provided. If you haven't seen or you don't know the Persian or English meaning of the word, tick square number 2.

Appendix 1 (Continued)

	١	٢
assimilation	☐.....	☐
aver	☐.....	☐
blind	☐.....	☐
benign	☐.....	☐
bolster	☐.....	☐
brace	☐.....	☐
burnish	☐.....	☐
buoyant	☐.....	☐
chemical	☐.....	☐
circumvent	☐.....	☐
clarify	☐.....	☐
coherent	☐.....	☐
component	☐.....	☐
conceivable	☐.....	☐
consistent	☐.....	☐
convivial	☐.....	☐
copious	☐.....	☐
counterpoint	☐.....	☐

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Appendix 1 (Continued)

	١	٢
convince	☐.....	☐
critique	☐.....	☐
crystallize	☐.....	☐
curative	☐.....	☐
decimate	☐.....	☐
defamation	☐.....	☐
degenerate	☐.....	☐
derelict	☐.....	☐
detect	☐.....	☐
desultory	☐.....	☐
detest	☐.....	☐
digress	☐.....	☐
disabuse	☐.....	☐
disinter	☐.....	☐
divert	☐.....	☐
dormant	☐.....	☐
elemental	☐.....	☐
emphasize	☐.....	☐

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Appendix 1 (Continued)

	١	٢
emit	☐.....	☐
epithet	☐.....	☐
equable	☐.....	☐
extant	☐.....	☐
erode	☐.....	☐
exigent	☐.....	☐
extrovert	☐.....	☐
extricate	☐.....	☐
fission	☐.....	☐
flag	☐.....	☐
fixate	☐.....	☐
finite	☐.....	☐
fluctuate	☐.....	☐
forestall	☐.....	☐
formidable	☐.....	☐
functionary	☐.....	☐
gainsay	☐.....	☐

Page **4** of **4**

Appendix 1 (Continued)

	١	٢
genre	☐.....	☐
gist	☐.....	☐
gradually	☐.....	☐
hazardous	☐.....	☐
hormone	☐.....	☐
hypothetical	☐.....	☐
iconoclast	☐.....	☐
impede	☐.....	☐
implacable	☐.....	☐
imperious	☐.....	☐
interpret	☐.....	☐
involve	☐.....	☐
incursion	☐.....	☐
introspective	☐.....	☐
legitimate	☐.....	☐
lever	☐.....	☐
literati	☐.....	☐
lithium	☐.....	☐

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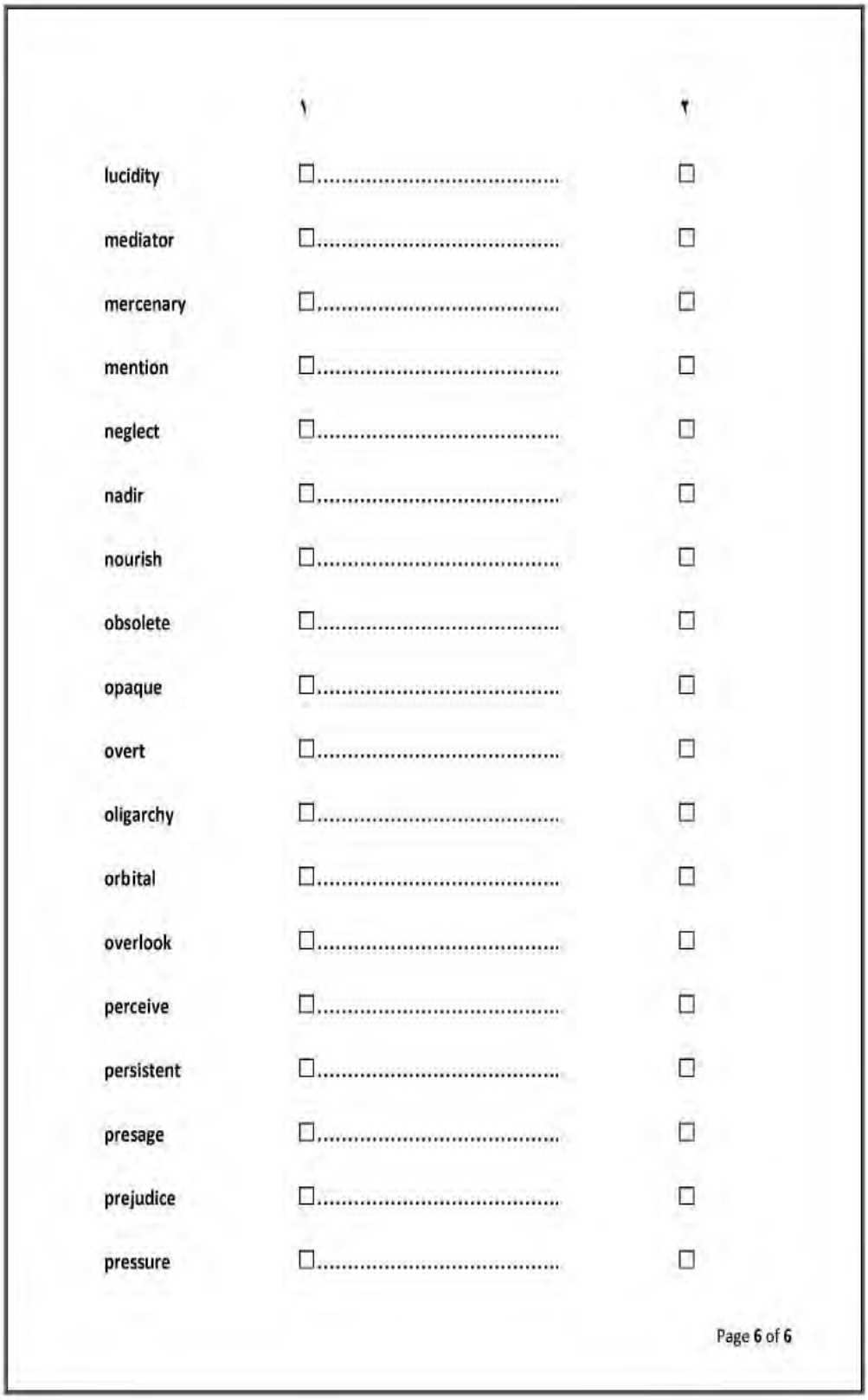
Appendix 1 (Continued)



	١	٢
lucidity	☐.....	☐
mediator	☐.....	☐
mercenary	☐.....	☐
mention	☐.....	☐
neglect	☐.....	☐
nadir	☐.....	☐
nourish	☐.....	☐
obsolete	☐.....	☐
opaque	☐.....	☐
overt	☐.....	☐
oligarchy	☐.....	☐
orbital	☐.....	☐
overlook	☐.....	☐
perceive	☐.....	☐
persistent	☐.....	☐
presage	☐.....	☐
prejudice	☐.....	☐
pressure	☐.....	☐

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Appendix 1 (Continued)

	١	٢
protracted	☐.....	☐
purposefully	☐.....	☐
radiant	☐.....	☐
rationale	☐.....	☐
recede	☐.....	☐
recondite	☐.....	☐
relapse	☐.....	☐
rigid	☐.....	☐
ruthless	☐.....	☐
schematic	☐.....	☐
sedulous	☐.....	☐
scrutiny	☐.....	☐
sordid	☐.....	☐
signatory	☐.....	☐
subsume	☐.....	☐
toxic	☐.....	☐
terrifying	☐.....	☐
tacit	☐.....	☐

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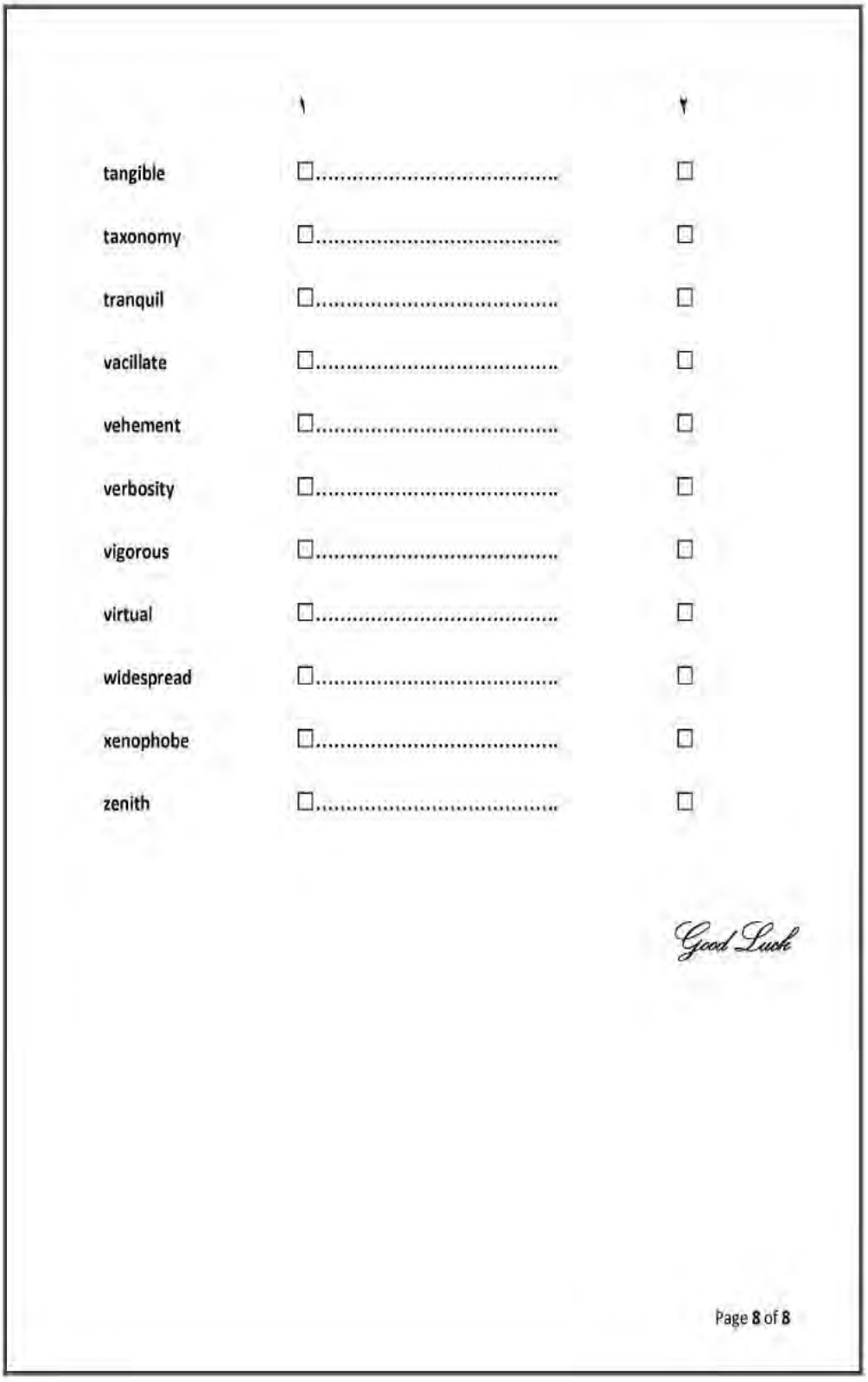
Appendix 1 (Continued)



	١	٢
tangible	☐.....	☐
taxonomy	☐.....	☐
tranquil	☐.....	☐
vacillate	☐.....	☐
vehement	☐.....	☐
verbosity	☐.....	☐
vigorous	☐.....	☐
virtual	☐.....	☐
widespread	☐.....	☐
xenophobe	☐.....	☐
zenith	☐.....	☐

Good Luck

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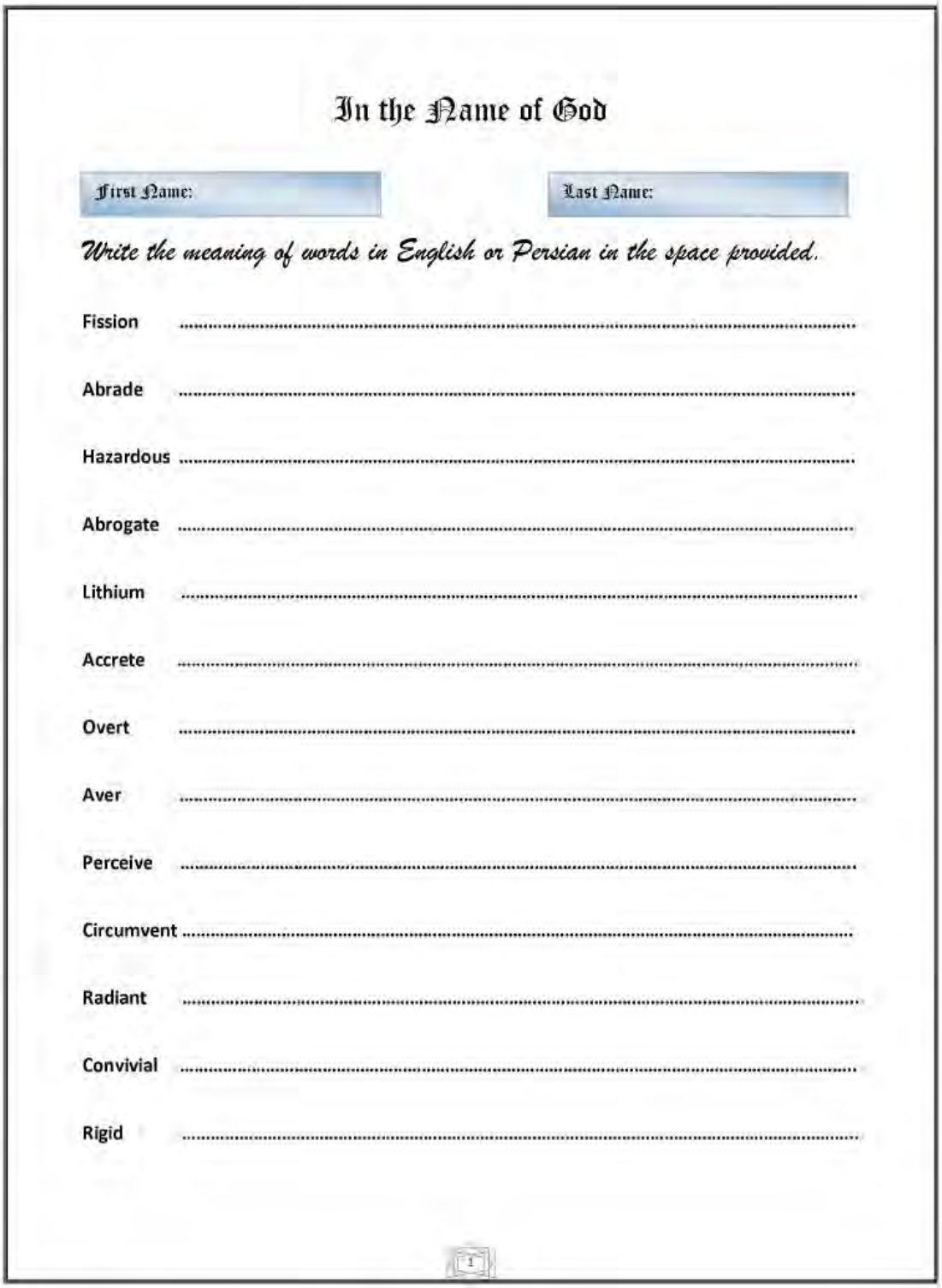
Appendix 2

The Final Exam (Posttest)



In the Name of God

First Name: Last Name:

Write the meaning of words in English or Persian in the space provided.

Fission .....

Abrade .....

Hazardous .....

Abrogate .....

Lithium .....

Accrete .....

Overt .....

Aver .....

Perceive .....

Circumvent .....

Radiant .....

Convivial .....

Rigid .....

1

Appendix 2 (Continued)

Derelict .....

Toxic .....

Disinter .....

Tranquil .....

Extricate .....

Virtual .....

Forestall .....

Widespread.....

Iconoclast .....

Mediator .....

Implacable .....

Erode .....

Lucidity .....

Component.....

Oligarchy .....

Absorb .....

Presage .....

2

Appendix 2 (Continued)

Coherent .....

Recondite .....

Degenerate.....

Sedulous .....

Divert .....

Subsume .....

Extrovert .....

Verbosity .....

Involve .....

Xenophobe .....

Good Luck

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