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Investigating Iraqi EFL University Students' Productive Knowledge of Grammatical Collocations in English

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***Abstract*—**Grammatical collocations (GCs) are word combinations containing a preposition or a grammatical structure, such as an infinitive (e.g. *smile at, interested in, easy to learn,* etc.). Such collocations tend to be difficult for Iraqi EFL university students (IUS) to master. To help address this problem, it is important to identify the factors causing it. This study aims at investigating the effects of L2 proficiency, frequency of GCs and their transparency on IUSs' productive knowledge of GCs. The study involves 112 undergraduate participants with different proficiency levels, learning English in formal contexts in Iraq. The data collection instruments include (but not limited to) a productive knowledge test (designed by the researcher using the British National Corpus (BNC)), as well as the grammar part of the Oxford Placement Test (OPT). The study findings have shown that all the above-mentioned factors have significant effects on IUSs' productive knowledge of GCs. In addition to establishing evidence of which factors of L2 learning might be relevant to learning GCs, it is hoped that the findings of the present study will contribute to more effective methods of teaching that can better address and help overcome the problems IUSs encounter in learning GCs. The study is thus hoped to have significant theoretical and pedagogical implications for researchers, syllabus designers as well as teachers of English as a foreign/second language.

***Keywords*—**Corpus linguistics, frequency, grammatical collocations, L2 vocabulary learning, productive knowledge, proficiency, transparency

I. Introduction

DUE to its importance, an increasing amount of research has been devoted to the study of collocation in recent years. As defined by [1], "collocation is the way words combine in a language to produce natural-sounding speech and writing. [Collocation] runs through the whole of the English language. No piece of natural spoken or written English is totally free of collocation" (p. v). Knowledge of collocation is essential for fluent and convenient language use [2]. Without selecting the right collocation, L2 learners' spoken and written production does not sound native speaker-like or natural [3], and consequently, this might affect comprehensibility [1, p.v]. It is thus important for L2 learners to have a good knowledge of collocations in their target language (TL) and this has led to an increasing interest in conducting collocation studies, especially in the field of L2 language learning.

Collocations can be either lexical or grammatical. Lexical collocations contain various combinations belonging to open-class words: nouns, verbs, adjectives, and adverbs, for example, take a look (verb + noun), current account (adjective + noun). GCs (they are also called colligations [4, pp.181-83]) are word combinations including an adjective, a noun, or a verb followed by a closed-class word such as a preposition e.g. adjacent to (adjective+ preposition), account for (noun + preposition), depend on (verb + preposition), or a grammatical structure such as a clause or an infinitive, e.g. to be afraid that (adjective + that), easy to do (adjective + to-infinitive), etc. [5, pp.xv-xxxiii], [6, pp.xix-xxx], [7, p.12]. The present study is concerned with GCs involving prepositions. Based on the researcher's experience as a teacher of English as a foreign language and on some relevant previous studies (e.g. [8], [9]), such GCs tend to be particularly difficult for L2 learners of English to master.

Although the importance of collocation was highlighted many years ago by [10] and later by [4], [11], it is not until more recently that the study of learners' L2 collocational knowledge and the factors affecting it received a surge of attention by researchers. L1 has been found to play an important role in L2 learners' performance (e.g. [12]-[15]). Some studies have also revealed that L2 proficiency can play an important role in learners' collocational knowledge (e.g. [9], [16]). Another influential factor identified in previous research is the frequency of L2 collocations (e.g. [17], [18]). Based on the results obtained from their study, [18] have drawn attention to the importance of making use of multiple second language acquisition (SLA) theoretical perspectives, including the linguistic ones (which mainly emphasize the role of the L1) and the usage-based ones (which highlight the role of TL items frequency) to better understand the processes involved in L2 collocational acquisition (see [18, pp.22], [28], [19, p.5]).

Some other studies have shown an important effect of the transparency of collocations (i.e. whether the meaning of the collocation is clear or retrievable from the literal or non-extended senses of its constituents) on learners' collocational knowledge (e.g. [19], [20]). As there is very little research involving transparency, [19, p.318] have called for studies to investigate the learning of collocations which vary in semantic transparency, which is among the main aims of the present study. Previous studies, however, tend to give only a partial picture of what is involved in the acquisition of L2

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collocations by limiting themselves to the investigation of mainly one or two factors, making it difficult to identify and fully understand the sources behind learners' difficulties in acquiring GCs. The present study is hoped to focus on more factors affecting learners' knowledge of GCs than previously investigated. In addition, it attempts to overcome the methodological limitations associating previous relevant studies.

The present study seeks to answer the following research questions:

1. To what extent do the following factors influence IUSs' productive knowledge of GCs:
- Frequency of GCs
- Transparency of GCs
- IUSs' L2 proficiency
2. What are the main and combined effects of the above-mentioned factors on IUSs' productive knowledge of GCs?
3. Which factor has the strongest impact in the presence of others?

II. Methodology

The present study involves administering a productive knowledge test, where there are blanks to be filled in with the missing components of the GCs, as well as the OPT to a homogenous sample of Iraqi university students (IUS) after they have filled in a consent form. The sample consisted of third-year IUSs of both sexes majoring in English in the college of education at Wasit University, Iraq. The number of participants was 112, which is sufficiently large to ensure reliability. The choice of third-year IUSs is based on the assumption that proficiency in using GCs in English requires long-term exposure to English, a condition which such participants are supposed to more readily meet. The L1 of all participants is Iraqi Arabic and the study did not include bilinguals. This requirement is to minimize distortions arising from any possible side-effect due to the differences in the participants' linguistic background.

In the productive knowledge test, the sentences presenting the test items were taken from the BNC. Presenting the targeted test items within such a linguistic context is intended to make the task more authentic and natural (see [21, p.156]). As stated by [18], "a sufficiently large and adequately representative corpus can give us an indication of the types and regularity of input a language user is likely to have been exposed to" (p.7). The frequency of each GC was obtained by searching the BNC using the software at [22]. In this study, GCs having raw frequencies equal to or higher than 1000 in the BNC were regarded as having higher frequency, whereas the ones having frequencies below that were considered as having lower frequency. The GCs involved in the present study were delimited to prepositional collocates that are immediately adjacent to and following their nodes in the case of verb/adjective nodes, or preceding/following their nodes in the case of noun nodes to help exclude words that do not have a collocational relationship. Moreover, the nodes of the lexical words in the GCs searched for were lemmas rather than other word forms to ensure that all the relevant inflectional forms of the GCs under investigation are included and taken into consideration in obtaining the frequency estimates. In addition, the 'Log-likelihood' was involved as a statistical measure of collocational strength, where a Log-likelihood value more than 10.83 was looked for, as it shows that the probability that a given collocate occurred by chance is less than 0.001 (see [23, p.85]).

In each of the GCs selected, the individual words forming the GC belong to the New General Service List (NGSL) developed by [24]. This list has been chosen as it is regarded as more reliable and up-to-date than the original General Service List (GSL) developed by [25]. It is based on 4 corpora of standard English (LOB, BNC, BE06, and EnTenTen12) of over 12 billion running words (in total), which contributes to its representativeness. It contains 2494 items and "covers between 80.1 and 81.7 per cent of the text in the source corpora" [24, p.1]. The reason behind selecting the NGSL rather than academic English vocabulary is that the NGSL can more readily serve the purpose of the present study than academic vocabulary, the acquisition of which on the part of the learners comes at a later stage. In addition, the study participants are training to be EFL teachers at secondary and pre-secondary schools, where the focus is mainly on general English and they are more likely to have learned the NGSL vocabulary than academic English vocabulary. To ensure that all the individual component words of the GCs belong to the NGSL, the list relevant software available at [26] has been made use of, using the 'Analyze' or 'Search' options. Moreover, all the individual words forming the GCs as well as the words used in the sentences presenting such GCs were selected from among the 3000 most frequent words of the BNC to ensure, as far as possible, that participants were already familiar with them and to make it easier for the participants to comprehend the sentences containing the GCs. This can be achieved by copying and pasting all the sentences for the test in the 'VocabProfiler' software tool in the Compleat Lexical Tutor website at [27], using the BNC word frequency bands by selecting the 'BNC 1-20k' option. This software color codes words in terms of the BNC frequency band they come from. Words that are shown by the 'VocabProfiler' software tool to belong to word bands other than the first 3000-word bands were replaced by more frequent ones belonging to the first 3000-word bands. In this respect, the present study has followed the rare studies that have used corpora for the selection and development of the content of the collocation knowledge tests (see [28, p.142]).

Each GC item involved in the productive knowledge test was selected to serve a purpose in the place where it appears in the test, which is decided by the relevant criteria of frequency and transparency, and their matching requirements. The test includes GC items representing higher-frequency GCs and more transparent GCs, and, in contrast, other GCs items in the same test representing lower-frequency GCs and semi/less transparent GCs, respectively. The total number of items in the test is 48. They are arranged in descending order in terms of their frequencies (as GCs) in the BNC. When it comes to

testing frequency effects, the test can be divided into two equal halves that are different only in terms of frequency: higher frequency items (1-24) and lower frequency ones (25-48). Each of these frequency halves is matched in terms of congruency and transparency and consists of an equal number of congruent items (12 items) and incongruent ones (12 items), which in turn include an equal number of more transparent items (8 items), semi-transparent items (8 items), and less transparent ones (8 items). The effect of frequency can be tested by comparing learners' performance (scores) on both halves, assuming that the two halves are well matched and balanced in terms of other variables, such as congruency and transparency. When it comes to testing transparency effects, the test as a whole can be divided into three equal thirds: more transparent items (16 items), semi-transparent ones (16 items), as well as less transparent items (16 items). Assuming that the number of items involved in each transparency level is sufficient and that they are well-matched and balanced (e.g. consisting of equal numbers of congruent/incongruent items and frequent/less frequent items), the effect of transparency can be tested by comparing learners' performance on each transparency type. When it comes to frequency matching, a lot of time and effort has been spent to get the two congruency item types to have as close/equal average raw frequencies as possible to each other (1857.83 vs.1857.83). This is almost also the case when it comes to the three transparency item types as shown in Table I. This was among the hardest and most time-consuming tasks of the study as it had taken so long to get each item type well matched in terms of the other variables.

TABLE I
AVERAGE RAW AND PER MILLION FREQUENCY FOR ITEM TYPES

Item type	Level	Frequency in the BNC	
		Raw	Per million
Congruency	Congruent (C1)	1857.83	18.578
	Incongruent (C2)	1857.83	18.578
Transparency	More transparent (T1)	1857.44	18.574
	Semi-transparent (T2)	1857.06	18.571
	Less transparent (T3)	1859	18.590

When it comes to congruency matching, in addition to making use of my knowledge of Arabic as my L1, I consulted a jury of four PhD specialists in Arabic and translation to get the final refined list of GCs approved by them as being suitable and adequate for the intended purpose, i.e. getting item types balanced in terms of congruency. Three of them are from Wasit University (where I work as a teacher of English in Iraq) and one is from Mustansiriyah University in Baghdad/Iraq.

As far as transparency is concerned, this has to do with the extent to which the meaning of the collocation is clear, or retrievable, from the literal senses of its constituents (see [20, p.127]). The GCs of each test are classified into three major groups: more transparent GCs (where both constituents forming the GC are used in their literal sense, as in in June), semi-transparent GCs (where one constituent is not used in its literal sense, as on holiday, where *on* is not used in its literal sense), and less transparent (where neither word is used in its literal sense, as in on purpose). In addition to the BNC, the researcher has made use of some dictionaries, including [6] and [29], when it came to searching the meanings of the individual words involved in the GCs as well as the meanings of the GCs themselves. As stated by [20, p.127], "the senses of a given lexical entry in the OALD are generally organized such that the literal come before the extended". The researcher has also made use of the expertise of experts in the area (including his supervisors), three of whom are native speakers, to work out a clear system for distinguishing literal from non-literal senses. The researcher has classified items in the top half of senses as literal and the ones not belonging to the top half as extended.

As far as data analysis is concerned, data collected using the productive knowledge test and the OPT were converted into numbers. For scoring purposes, each correct answer was given one score, whereas an incorrect answer received no score. When two answers are provided or when no answer was provided, no score was given. The data obtained were then put into SPSS (24). Parametric statistical tests were used in analyzing the data of the present study as normality tests showed that the data obtained do not differ significantly from a normal distribution. As shown in Table II, different parametric tests were used including t-tests, repeated-measures ANOVA, and correlation, depending on the requirement of each research question. Table II presents an overview of the study research questions, their relevant data collection instruments, and data analysis methods.

TABLE II
OVERVIEW OF THE STUDY RESEARCH QUESTIONS, DATA COLLECTION INSTRUMENTS, AND DATA ANALYSIS METHODS

Research Question	Data Collection Instrument	Data Analysis Method
1. To what extent do the following factors influence IUSs' productive knowledge of GCs: a) Frequency of GCs b) Transparency of GCs, c) IUSs' L2 proficiency?	A productive collocational knowledge test OPT	• Statistical analysis using SPSS 24.0 software • paired-samples t-test • Repeated-measures ANOVA • independent-samples t-test • Pearson correlations
2. What are the main and combined effects of the above-mentioned factors on IUSs' productive knowledge of GCs?	The productive collocational knowledge test and the OPT	Statistical analysis using SPSS 24.0 software • Repeated-measures ANOVA
3. Which factor has the strongest impact in the presence of others?	The productive collocational knowledge test and the OPT	Statistical analysis using SPSS 24.0 software • Repeated-measures ANOVA

An important feature a language test should have is reliability, which has to do with the test ability to measure something consistently (see [30, p.17]). To compute the reliability of the productive knowledge test as a whole (48

items) and its subsections, Cronbach's alpha in SPSS was used as it is regarded as the default option [31, p.711]. The results indicate that the test as a whole and its subsections were highly reliable (see [32, p.679]) as shown in Table III.

TABLE III
RELIABILITY VALUES OF THE PRODUCTIVE KNOWLEDGE TEST AND ITS SUBSECTIONS

Item types involved	Cronbach's Alpha
Whole test items	.953
Higher frequency items	.883
Lower frequency items	.939
More transparent items	.810
Semi-transparent items	.874
Less transparent items	.916

Another important feature of a language test is validity, which has to do with the degree or extent to which the test can successfully or accurately measure what it is intended to measure (see [30, p.18]). One way of obtaining evidence for the validity of a language test involves determining whether the test could distinguish among participants belonging to different proficiency levels by comparing their mean total scores (see [20, pp.133-134). If the different proficiency groups involved in the comparison prove to be significantly different from each other, then this can be regarded as a positive indicator for the test validity. As far as the productive knowledge test is concerned, the results showed that it was able to distinguish between the two different proficiency groups as shown in section 3 and Table IV. Moreover, to help achieve the same purpose, a group of 25 native speakers from the University of Leicester were also requested to participate in the collocational knowledge test as the inclusion of native speakers is thought to be important for test validation. Their mean scores on both tests were not only far better than the ones obtained by the learners belonging to the IUS higher proficiency group, but also very close to the maximum possible scores, which is also another positive indicator of the validity of the productive knowledge test (see [21, pp.159, 161, 166]).

Another way of obtaining evidence for the validity of a language test has to do with the test internal construct in the sense that if the test consists of different sections representing different subcomponents of the relevant factors to be tested, then obtaining such evidence can be achieved by conducting a set of comparisons where participants' performance on the different relevant subcomponents of the test is compared. If such comparisons show that participants' performance on such subcomponents differ significantly, then that can be regarded as preliminary evidence for the validity of the test internal construct (see [20, p.134]), a condition which the productive knowledge test met as shown in Section III and Table IV.

III. RESULTS AND DISCUSSION

The findings of the present study may be summarized in Table IV.

A. Research Question 1

To what extent do the following factors influence IUSs' productive knowledge of GCs:

a) Frequency of GCs,
b) Transparency of GCs,
c) IUSs' L2 proficiency?

TABLE IV
SUMMARY OF THE STUDY FINDINGS

Research Question	Findings
1. To what extent do the following factors influence IUSs' productive knowledge of GCs:	IUSs' performance on the more frequent GCS is significantly better than on less frequent ones.
a) Frequency of GCs,	The effect of transparency on IUSs' performance is statistically significant: all transparency level comparisons proved to be significant.
b) Transparency of the GCs,	There are a significant difference and a highly significant positive correlation between IUSs' scores on the OPT and the ones on the collocational tests.
c) IUSs' L2 proficiency?	There are significant main (relevant to a specific factor) and interaction effects of frequency, transparency, and L2 proficiency.
2. What are the main and combined effects of the above-mentioned factors on IUSs' productive knowledge of GCs?	L2 proficiency has the strongest impact.
3. Which factor has the strongest impact in the presence of others?	

TABLE V
DESCRIPTIVE STATISTICS OF IUSS' SCORES ON THE HIGHER VS LOWER FREQUENCY GCS IN THE PRODUCTIVE KNOWLEDGE TEST

Descriptive statistics	Lower frequency GCs scores	Higher frequency GCs scores
Mean (%)	5.84 (24%)	11.18 (47%)
Std. deviation (%)	2.228 (9%)	3.338 (14%)
Minimum (%)	0 (0%)	3 (13%)
Maximum (%)	12 (50%)	19 (79%)
N	112	112

a) As far as the effect of frequency is concerned, Table V presents the descriptive statistics of the data required to answer research question 1.a, where IUSs' performance on the higher frequency GCs is compared with their performance on the lower frequency ones.

As shown in Table V, IUSs' mean percentage of scores on the lower frequency GCs was 24% with a standard deviation (SD) of 9. The mean score was 5.84 with a SD of 2.228. The maximum percentage was 12%, and the minimum 0%. IUSs' performance on the higher frequency GCs was better than it is on the lower frequency ones. Their mean percentage of scores on the higher frequency GCs was 47% with a standard deviation (SD) of 14. The mean score was 11.18 with a SD of 3.338. The maximum percentage was 79%, and the minimum 13%.

To test how significant the difference between the two types

of GCs items is, a paired-samples t-test was conducted and the findings show that IUSs' performance on the higher frequency GCs in the productive knowledge test (M = 11.18, SE = .315) is significantly better than their performance on the lower frequency ones in the same test (M = 5.84, SE = .211), $t(111) = 17.352$, $p < 0.001$.

This finding is in line with the findings arrived at in [18] study, which showed that the L2 learners involved in the study were highly sensitive to the effects of frequency of the L2 collocations. Such findings have called attention to the importance of making use of multiple SLA perspectives, including the usage-based ones, to help better understand the processes involved in the acquisition of L2 collocations.

b) When it comes to testing the effect of transparency on IUSs' performance on the productive knowledge test, Table VI below presents the descriptive statistics of the data relevant to answering research question 1.b, where IUSs' performance on more transparent GCs is compared with their performance on both the semi-and the less transparent ones.

TABLE VI
DESCRIPTIVE STATISTICS OF IUSS' SCORES ON THE TRANSPARENCY LEVELS OF GCS IN THE PRODUCTIVE KNOWLEDGE TEST

Descriptive statistics	Less transparent GCs scores	Semi-transparent GCs scores	More transparent GCs scores
Mean (%)	3.79 (24%)	5.40 (34%)	7.83 (49%)
Std. deviation (%)	1.988 (12%)	1.970 (12%)	2.147 (13%)
Minimum (%)	0 (0%)	1 (6%)	3 (19%)
Maximum (%)	9 (56%)	10 (63%)	12 (75%)
N	112	112	112

As shown in Table VI above, IUSs' mean percentage of scores on the less transparent GCs was 24% with a standard deviation (SD) of 12. The mean score was 3.79 with a SD of 1.988. The maximum percentage was 9%, and the minimum 0%.

IUSs' performance on the semi-transparent GCs was better than it is on the less transparent ones. Their mean percentage of scores on the semi-transparent GCs was 34% with a standard deviation (SD) of 12. The mean score was 5.40 with a SD of 1.970. The maximum percentage was 63%, and the minimum 6%.

IUSs' performance on the more transparent GCs was the best compared with the other transparency levels. Their mean percentage of scores on the more transparent GCs was 49% with a standard deviation (SD) of 13. The mean score was 7.83 with a SD of 2.147. The maximum percentage was 75%, and the minimum 19%.

To test how significant the effect of transparency on IUSs' performance is, a one-way repeated-measures ANOVA was conducted. The results showed that the effect of transparency on IUSs' performance on the productive knowledge test was statistically significant: F (2, 222) = 177, p. = 0.000., and that all transparency level comparisons proved to be significant as well.

These results confirmed the findings of the very little previous research (e.g. [19], [20]) and suggest that degrees of GCs transparency together with their frequency play an important role in collocational learning.

c) To test the effect of proficiency on learners' performance on the productive collocational knowledge test, IUSs were divided into two proficiency groups, based on their performance on the OPT. Table VII displays the descriptive statistics of the data obtained from the OPT.

TABLE VII
DESCRIPTIVE STATISTICS OF IUSS' SCORES ON THE OPT

Descriptive statistics	OPT scores
Mean (%)	48.29 (48%)
Std. deviation (%)	9.853 (10%)
Minimum (%)	26 (26%)
Maximum (%)	73 (73%)
N	112

As shown in Table VII, the mean percentage of scores obtained by the lower proficiency group on the productive knowledge test was 29% with a standard deviation (SD) of 7. The mean score was 14.03 with a SD of 3.253. The maximum percentage was 22%, and the minimum 7%.

The performance of the higher proficiency group on the productive knowledge test was better than that of the lower proficiency group. Their mean percentage of scores on the productive knowledge test was 42% with a standard deviation (SD) of 8. The mean score was 20.34 with a SD of 3.600. The maximum percentage was 65%, and the minimum 27%.

To test how significant the effect of L2 proficiency on the performance of the two groups on the productive knowledge test is, an independent-samples t-test has been conducted. The findings show that the performance of the higher proficiency group on the productive knowledge test (M = 20.34, SE = .494) is significantly better than the performance of the lower proficiency group on the same test (M = 14.03, SE = .424), $t(110) = 9.74$, $p < 0.001$.

The effect of proficiency on IULs' performance on the productive knowledge test was also clearly indicated by the highly significant positive correlation, obtained by conducting Pearson correlation coefficient, between their scores on the OPT and the ones on the productive knowledge test , r = .85, p <.001. This finding is in line with the findings of previous relevant studies (e.g. [9], [16]) which showed a strong correlation between learners' L2 proficiency and their collocational knowledge.

B. Research Question 2

What are the main and combined effects of the above-mentioned factors on IUSs' productive knowledge of GCs?

To answer this research question, a repeated-measures ANOVA was conducted, with OPT entered as a covariate. Table VIII presents the results of the repeated measures ANOVA.

As shown in Table VIII, when participants' OPT scores are included, they eclipse the effect of frequency as an item variable on IUSs' scores. The effect of transparency, however, is still significant but is far less in size than that of the OPT

and its interaction effects with frequency. This indicates that what score a participant gets is overwhelmingly predictable from their L2 proficiency, way above the effect of anything else. 73% of the variation in scores is due to IUSs' L2 proficiency as measured by OPT.

TABLE VIII
RESULTS OF THE REPEATED MEASURES ANOVA, WITH OPT ENTERED AS A COVARIATE

Source	F	Sig.	Partial Eta Squared
OPT	298.955	<.001	.731
Frequency	.333	.565	.003
Frequency * OPT	19.303	<.001	.149
Transparency	4.218	.016	.037
Transparency * OPT	.472	.624	.004
Frequency * Transparency	1.727	.180	.015
Frequency * Transparency * OPT	1.457	.235	.013

Another notable finding is that it is not only the main effect of OPT that is highly significant. Its interaction effects with frequency are also highly significant. This means that although the effect of L2 proficiency works across all the categories of items tested in the productive knowledge test in the sense that better L2 proficiency, in general, helps a participant do better, its effect on the participants' performance on the test items is not a completely independent one. In other words, although the tasks of the productive knowledge test seem to call heavily upon learners' L2 proficiency, its interaction effects with frequency as well as the independent effects of transparency, are also to be taken into consideration.

Table IX shows that the OPT effects on participants' performance on the productive knowledge test are also confirmed by its correlations with the scores on the subsets of the test items. The correlations are in the range of .61 to .78, and are all positive, showing that higher general L2 proficiency indeed leads to better performance on all the item types.

TABLE IX
PEARSON CORRELATIONS OF OPT SCORES WITH THE SCORES RELEVANT TO THE ITEM SUBCATEGORIES IN THE PRODUCTIVE KNOWLEDGE TEST

Level	Frequency	Transparency
High	.784	.674
Semi		.640
Low	.609	.637

When the repeated-measures ANOVA is conducted omitting OPT, however, far stronger effects of both item types can emerge as shown in Table X.

TABLE X
REPEATED MEASURES ANOVA OF THE PRODUCTIVE KNOWLEDGE TEST, WITHOUT OPT

Source	F	Sig.	Partial Eta Squared
Frequency	301.087	<.001	.731
Transparency	177.002	<.001	.615
Frequency * Transparency	2.158	.118	.019

Both item variables now have highly significant effects on scores and, as the effect sizes (eta squared) show, frequency has the greatest effect, followed by transparency. As can be seen in Fig. 1, these effects tend to take the form that one would expect, in that higher frequency and transparency are associated with higher scores. The mean scores for the higher frequency subsets of items are all higher than those for the corresponding sets of lower frequency items. When it comes to transparency, mean scores fall in succession across higher, semi and lower item transparency in each subset.

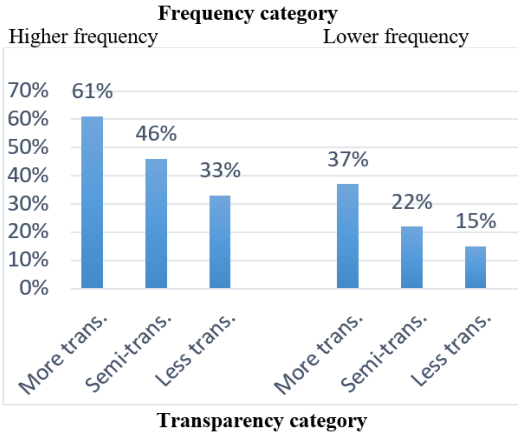

Fig. 1 Score percentages of the productive knowledge test, by item types

C. Research Question 3

Which factor has the strongest impact in the presence of others?

It is evident from Section III.*B* above that of the three factors involved in the present study, L2 proficiency has the strongest impact and is the best predictor of the learners' performance. This finding is in line with the findings arrived at in [16] study, where L2 proficiency was compared with only one other subject-related factor, namely learners' exposure to the TL. [16] study, however, did not take into consideration the effects of item-related factors as the present study did.

IV. CONCLUSIONS

The results obtained showed that all the above-mentioned factors had significant effects on IUSs' performance. It was thus evident that IUS' productive knowledge of GCs was influenced by several factors involving not only L1, to which earlier relevant studies were confined, but also other factors, including but not limited to, GCs frequency and transparency as well as L2 proficiency. To help get a fuller image of what is involved in the acquisition of L2 collocations, and consequently help address the difficulties IUSs encounter, all the main as well as the interaction effects of the relevant factors need to be taken into consideration by researchers, L2 teachers as well as syllabus designers.

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