3L: Language, Linguistics, Literature® The Southeast Asian Journal of English Language Studies
Vol 30(1), March 2024 http://doi.org/10.17576/3L-2024-3001-13

Assessing the Roles of L1 and Meaning Knowledge in Processing and Production of English Collocations among Chinese EFL Learners

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ABSTRACT

The present study examined the roles of first language (L1) and meaning knowledge of nodes in the processing and written production of English collocations among Chinese EFL learners. Twenty-four congruent collocations (can be expressed by a literal L1 translation equivalent) and 24 incongruent collocations (cannot be translated into L1 word by word) were examined by a timed phrase acceptability judgment task and a productive test. Based on the method of the Word Associates Test (Read, 1993), a meaning recognition test was developed to examine learners' knowledge of multiple meanings of nodes. Results of pair-sample t-tests revealed that learners had better performance on congruent collocations than on incongruent collocations in both processing and written production, with shorter response times, fewer error rates in processing and higher production scores. A two-tailed Pearson correlation analysis indicated that learners' meaning knowledge of node words had a moderate positive correlation with congruent collocation processing, incongruent collocation processing, congruent collocation production and incongruent collocation production, respectively, and the correlations with incongruent collocations were stronger than that with congruent collocations, especially in processing. The results implied that L1 and learners' meaning knowledge of nodes played positive roles in both the processing and written production of L2 collocations. Some direct implications for L2 collocation teaching practice were discussed.

Keywords: L1 congruency; meaning knowledge; L2 collocations; processing and production; Chinese EFL learners

INTRODUCTION

In the literature on second language (L2) learning, the importance of collocations, along with other types of formulaic sequences (e.g., idioms, lexical bundles, phrasal verbs), has been well recognised (e.g., Laufer & Waldman, 2011; Nesselhauf, 2003; Vu & Peters, 2023). Wu et al. (2021) conducted a systematic review of the studies of L2 collocation learning and found that there had been a significant increase in the number of studies exploring the use of English collocations among L2 learners in the last two decades (e.g., Halim & Kuiper, 2018; Namvar, 2012; Siyanova & Schmitt, 2008). Some studies found that L2 learners were apt to use collocations in a non-native way, such as underusing or overusing (Durrant & Schmitt, 2009; Fan, 2009).

There are many factors that affect the production of L2 collocations. L1 plays a vital role when learners produce L2 collocations (Nesselhauf, 2003), exerting both positive and negative effects (Wang, 2011). Learners often produced L2 collocations by resorting to the L1 translation

strategy and preferred to use collocations that have literal translations in L1 (Peters, 2016). L2 learners often fail to notice the culture-specific word of collocation and produce some unacceptable combinations (Chen, 2017). They might have a general sense that a collocation can always be expressed by an equivalent translation in L1. According to Wolter (2006), identical patterns between L1 collocations and L2 collocations may assist L2 learners in understanding, memorising and retrieving the target collocations. These findings indicate that L2 learners might have habitual reliance on L1 translations in L2 collocation production.

Due to the cross-linguistic property of collocations, some studies took L1 congruency as a proxy to examine L1 influence on L2 collocation processing (e.g., Wolter & Gyllstad, 2011; Wolter & Yamashita, 2015; Yamashita & Jiang, 2010). A congruent collocation is one that can be expressed by a literal L1 translation equivalent, whereas an incongruent collocation is one that cannot (Nesselhauf, 2003; Peters, 2016). For instance, *strong wind* may be expressed with an identical collocation in many languages (Yamashita & Jiang, 2010). According to the authors' knowledge, the instance is applied to the Chinese language since *strong wind* can be directly translated into a Chinese collocation (*qiang feng*). However, as too *strong tea* in English, the Chinese used a different lexical combination (a literal translation might be *dense tea*) to express the concept. These studies provide us with a precise and delicate perspective to observe the role of L1 in L2 collocation processing. However, the number of studies of this kind is still limited, and they mainly focus on Japanese English learners, Korean English learners and Swedish English learners. Chinese scholars have conducted a few similar studies on Chinese EFL learners and also found an L1 congruency effect on collocation processing, though their studies were not published internationally. These studies mainly focused on students from first-class Chinese universities. China has a large number of EFL learners. Learners at different levels of universities have distinct levels of English proficiency. The congruency effect on collocation processing among Chinese EFL learners needs further investigation.

Additionally, very few studies have investigated the L1 congruency effect on the production of L2 collocations, and there are inconsistent findings about the issue (e.g., Cao & Badger, 2021; Nesselhauf, 2003). What is more, we noticed that, for incongruent collocations consisting of two content words, the node words usually express specific meanings between languages. For instance, *strong tea* (adjective-noun) and *kill time* (verb-noun) are two incongruent collocations where the node word "strong" or "kill" cannot be expressed by a literal L1 translation equivalent for Japanese English learners or Chinese English learners. The node word "strong" in *strong tea* means "nong" (dense) in Chinese, and "kill" in *kill time* means "xiao mo" (spend time in a pleasant, lazy way) in Chinese. In this sense, the meaning knowledge of a node word is quite important for L2 learners to understand the concept of an L2 collocation, especially for an incongruent collocation which cannot be translated into L1 word-by-word. As Webb and Kagimoto's (2009) study indicated, meaning knowledge and collocational knowledge may have interactive effects on L2 vocabulary learning. However, we know little about the role of meaning knowledge of node words in the processing and production of congruent collocations and incongruent collocations.

With these gaps, the present study intends to generalise and extend the previous findings concerning L1 congruency effect by examining the following three areas among Chinese EFL learners: a) L1 congruency effect on processing of English collocations, b) L1 congruency effect on written production of English collocations, and c) relationship between meaning knowledge of node words and congruent collocation processing, incongruent collocation processing, congruent collocation production, and incongruent collocation production. By investigating these three areas, we hope to provide a deeper understanding of the roles of L1 and meaning knowledge in the

processing and production of L2 collocations and yield some valuable implications for L2 collocation learning and teaching practice.

LITERATURE REVIEW

THEORETICAL FRAMEWORKS

Some models and theories were proposed by scholars to explain bilingual representation (e.g., Kroll & Stewart, 1994; Potter et al., 1984). The Word Association Hypothesis (WAH) assumed a direct association to link words for two languages and that L1 mediated the only way in which learners understood concepts of L2. The Concept Mediation Hypothesis (CMH) assumed a direct connection between L2 and the conceptual system and that L1 linked with L2 through the conceptual system. Based on the WAH and the CMH, Kroll and Stewart (1994) proposed the Revised Hierarchical Model (RHM), which assumed that lexical connections and conceptual connections worked simultaneously in bilingual representation, but the strengths of these connections were asymmetric. For lexical connections, the path from L2 lexicon to L1 lexicon is stronger and more stable than that from L1 to L2. For conceptual connections, the association between the L1 lexicon and the conceptual system is stronger than that between the L2 lexicon and the conceptual system.

Jiang (2000) postulated three stages for L2 vocabulary acquisition. According to the theory, L2 lemma knowledge is borrowed from L1 at the very beginning of L2 learning. As L2 lemma space is occupied by L1 lemma information, it develops to the second stage called the "L1 lemma mediation stage". With increasing language exposure, L2 lemma knowledge is integrated into the L2 lexical entry, and it goes to the third stage called the "L2 integration stage". At this stage, L1 transferred knowledge is diminishing, and an L2 independent lexical entry system is gradually being built up.

To sum up, RHM described more comprehensive connections among concepts, L1 lexicon and L2 lexicon than what the WAH and the CMH did. Based on the RHM and Jiang's (2000) Model of Development in L2 Lexical Representation, we have a better understanding of the role of L1 in L2 lexical representation and development. The present study was designed mainly based on the RHM and Jiang's (2000) theory of development in L2 lexical representation.

L1 INFLUENCE ON L2 COLLOCATION PRODUCTION

Many studies about the use of collocations by L2 learners showed evidence of L1 influence in learners' production (e.g., Laufer & Waldman, 2011; Nesselhauf, 2003). In general, these studies identified learners' L1-induced collocational behaviour by analysing deviant or erroneous combinations or overused combinations. In the following, we review some key studies with important findings on L1 influence.

As the corpus analysis technique was introduced into L2 research, scholars began to explore the productive knowledge of L2 collocations in learners' free writing based on a large amount of data. Nesselhauf (2003) conducted an exploratory study to investigate the use of verb-noun collocations in freely written English production by German-speaking learners by using the corpus analysis technique. She found that almost half of the mistakes were influenced by L1. She classified all of the combinations into a congruent group and an incongruent group and then

compared the percentage of mistakes between the two groups. It was found that learners produced congruent collocations more than incongruent ones, and the percentage of mistakes in the former group (11%) was much lower than that in the latter group (44%). According to Nesselhauf (2003), she was the first scholar to conduct this type of analysis for L1 influence. In this way, we could observe the positive role of L1 with regard to the correct collocations produced by learners rather than only focusing on erroneous combinations.

Cao and Badger (2021) examined the L1 congruency effect in their study but showed an inconsistent result. They explored the productive knowledge of English verb-noun and adjective-noun collocations in argumentative essays written by Vietnamese learners of English. They examined L1 influence on the unacceptable collocations and compared the percentage of the unacceptable collocations between the L1 congruent group and the non-congruent group. The results showed that learners' first language was a noteworthy factor that resulted in the unacceptable collocations, but unexpectedly, the unacceptable collocations in the congruent group (65%) were more than that in the non-congruent group (35%).

The research methodology employed may have contributed to the contradictory result on the L1 congruency effect reported by Nesselhauf (2003) and Cao and Badger (2021). Both of these studies utilised bottom-up approaches because they mainly focused on the use of L2 collocations in learners' freely written production. In free writing, participants may produce their preferred collocations, and their production might present specific lexical features according to different topics. Thus, based on the unstructured data, it was hard to compare the use of congruent collocations and incongruent collocations in a precise way. Due to the inconsistent findings, it is necessary to conduct more research using a top-down approach to the issue.

L1 CONGRUENCY EFFECT ON L2 COLLOCATION PROCESSING

A series of studies have probed into the effect of L1 congruency on L2 collocation processing by psycholinguistic experiments and found that L2 learners showed an advantage in processing congruent collocations in comparison with incongruent collocations (e.g., Jiang, 2022; Lee, 2021; Wolter & Gyllstad, 2011; Wolter & Yamashita, 2015, 2017; Yamashita & Jiang, 2010).

Yamashita and Jiang (2010) examined the L1 congruency effect on L2 collocation processing among Japanese EFL learners and ESL learners by comparing their reaction time and error rate between congruent collocations and incongruent collocations in a phrase-acceptability judgement task. They found that both L1 congruency and language exposure exerted effects on the acquisition of L2 collocations, and L2 learners were able to process L2 collocations independently from L1 once the concepts of target collocations were memorised, but it was hard to acquire incongruent collocations even after a considerable amount of exposure. By using a primed lexical decision task and a test of receptive collocation knowledge, Wolter and Gyllstad (2011) conducted a study among Swedish English learners. The study found that learners had better performance in processing and recognising congruent collocations than incongruent collocations. The result suggested that L1 had a great influence on the development of L2 intralexical links and the processing of L2 intralexical links. Comparing the two types of methods respectively used by Yamashita and Jiang (2010) and Wolter and Gyllstad (2011), the phrase-acceptability judgement task seemed to be a more effective way to examine the influence of L1 semantics on the processing of L2 collocations because, in the primed lexical decision task, the orthography of a word would be highlighted rather than the semantic link between two component words (Wolter & Yamashita, 2017).

Further studies were conducted to explore the influence of L1 congruency and other variables on L2 collocation processing. Some studies examined the effect of L1 congruency, phrasal frequency and word frequency (Lee, 2021; Wolter & Gyllstad, 2011; Wolter & Yamashita, 2017). The findings in these studies further confirmed the influence of L1 congruency on L2 collocation processing and additionally showed that learners were sensitive to the frequency effect of L2 collocations. Additionally, Jiang (2022) investigated the influence of L1 congruency, collocation types and collocational restrictions on L2 collocation processing and found that learners were significantly affected by L1 congruency, but they were not sensitive to the effects of collocational restrictions and collocation types. In general, the findings in these studies indicated that L1 presented mental reality in L2 collocation processing and exerted great influence. In order to generalise the findings and have a comprehensive understanding of the role of L1 in L2 collocation processing, we need to involve more participants of different L1 backgrounds and take some special cases into account.

Based on the previous studies examining the L1 congruency effect, we noticed that some congruent collocations and incongruent collocations have common node words. For instance, in Yamashita and Jiang's (2010) study, a few pairs of corresponding collocations with common node words were included, such as *kill animals* and *kill time*. The node word "kill" expresses an L1 identical meaning in *kill animals* whereas it expresses an L2 specific meaning in *kill time* for Japanese English learners. The collocation pairs, like the example, were special cases where the node words usually have multiple meanings, some of which are identical with L1 while some of which are not. Examining the corresponding collocation pairs that possess common nodes makes it possible for us to look at the L1 congruency effect in a more precise way, and it is more likely to investigate the relation between learners' meaning knowledge of node words and L2 collocational knowledge. However, to our knowledge, the L1 congruency effect on this kind of collocation pair was not specifically examined in one study, and no study has explored the role of learners' meaning knowledge of node words in the processing and production of L2 collocations.

RESEARCH QUESTIONS

Based on the above research gaps, the present study proposes research questions (RQs) as follows:

RQ1: To what extent does congruency affect the processing of English collocations with regard to those with common nodes among Chinese EFL learners?

RQ2: To what extent does congruency affect the production of English collocations with regard to those with common nodes among Chinese EFL learners?

RQ3: What is the relationship between meaning knowledge of nodes and congruent collocation processing, incongruent collocation processing, congruent collocation production, or incongruent collocation production, respectively?

METHODOLOGY

PARTICIPANTS AND SETTINGS

We conducted research at an undergraduate university in China. According to admission scores of the College Entrance Examination, it is an intermediate-level university in China. We recruited 60 volunteers from the university. We had permission from participants to collect and store data for research and publishing. With regards to the exposure effect, students who had overseas study experience or had ever stayed abroad more than one month were excluded. The participants had studied English as a foreign language since Grade Five in primary school. Their ages were between 20 and 22 years old (mean=20.95, standard deviation=.87).

In order to examine whether the congruency effect varies among learners of different English levels, we recruited two groups of participants. There are 30 third-year students majoring in English in one group and 30 second-year students who are not English majors in the other. The Oxford Quick Placement Test (Syndicate, 2001) was used to measure participants' English proficiency. According to the classification of the test results, the scores of the group of non-English majors (mean=27.77, standard deviation=1.25) fell at the elementary level, and the scores of the group of English majors (mean=47.33, standard deviation=3.73) fell at the upper intermediate level and the advance level. Thus, the participants of non-English majors were assigned to the low-level group, and the participants of English majors were assigned to the high-level group.

TABLE 1. Results of the Oxford Quick Placement Test

Participants	Non-English majors		English majors			
Scores	25-27	28-29	43-45	46-47	48-50	52-54
Number of participants	11	19	11	7	6	6

DEVELOPMENT OF RESEARCH ITEMS

To serve the research objectives, the research items of the present study covered the collocations that consist of two content words or three words in the case of articles. Considering that verbs and adjectives have multiple meanings, the present study decided to take verbs and adjectives as target nodes. British National Corpus (BNC) and Corpus of Contemporary American English (COCA) are two reliable native linguistic corpora that are two of the largest corpora in the world. Considering that Chinese EFL learners usually learn British English in English class, we decided to get research items from BNC. Except for some collocations that were borrowed from previous studies (Wolter & Yamashita, 2017; Yamashita & Jiang, 2010), most of the items were developed through concordance in the BNC. In all, the study obtained 24 pairs of congruent collocations and incongruent collocations, in a total of 48 collocations. The research items were developed according to the following procedures.

Firstly, we searched for candidate node words. Chinese EFL learners generally have learned more than 3000 English vocabularies when they are in their second year. To make sure that the node words are well known to participants, verbs and adjectives in the top 2000 in the wordlist of BNC are under consideration as node words. We conducted a concordance search on each of the candidate node words in BNC to retrieve their collocating words. We took account of the L1

translational congruency of collocations during the concordances. Only when a node word possesses at least one congruent collocation and one incongruent collocation do we put the node word and its collocations into the candidate list? Then, we carried out a familiarity judgment test on the candidate combinations among 45 students of the same proficiency level as the participants. The combinations that were marked "unfamiliar" by the students had been excluded from the candidate list.

Secondly, we rechecked the L1 congruency of candidate collocations, resorting to Yamashita and Jiang's (2010) method. We invited five native Chinese scholars of high English proficiency to write down Chinese translations for the candidate English collocations. The English collocations were further selected if (a) at least four of the translators were able to recognise the meanings of collocations, (b) at least four of the translators, in the case of congruent collocations, gave L1 translations that were directly translated from L2 word-for-word, or (c) at least four of the translators, in the case of incongruent collocations, gave L1 translations where at least one component word was not translated from L2 literally.

Thirdly, the length of phrasal strings and frequency of candidate collocations were checked. We tried to match the length and the frequency of congruent collocations with that of incongruent collocations as closely as possible. T-tests were done on the length and the frequency between the group of congruent collocations and the group of incongruent collocations to make sure that there was no significant difference between the two groups. The t-test results were 1.402 ($p=.174$, $p>.05$) for the frequency, and .769 ($p=.450$, $p>.05$) for the length respectively. The t-test results indicated that there was no significant difference in the string length and the phrasal frequency between the two groups of collocations.

INSTRUMENTS

REACTION TIME EXPERIMENT

To investigate L2 collocation processing, the present study conducted a Reaction Time (RT) experiment with a phrase acceptability judgment task. E-Prime (2.0) was used in the present study to carry out the RT experiment.

A PRODUCTIVE TEST

A fill-in-the-gap productive test was developed to examine the production of target collocations. The target collocations were 24 pairs of congruent collocations and incongruent collocations. 48 English sentences with the target collocations were obtained in BNC or the Oxford Advanced Learner's Dictionary (2013). The node words of target collocations were taken away, leaving sentences with gaps. As is shown in example 1, the node word "lose" was taken away from the sentence. Participants were required to fill in the gap to produce a collocation under the elicitation of the remaining component word and the sentence context.

Example 1

The problem is that if opposition to him grows because of economic problems, he may _____ control of his own party.

Three experts who were native English speakers and English teachers in China were invited to assess the appropriateness of the sentences. Additionally, we carried out a pilot study to examine the validity of the instrument. Fifteen participants in the pilot study were interviewed. In the interview, we tried to determine whether all of the sentences could be understood by the participants well. Some students mentioned that some expressions were hard to understand, and some collocations were hard to decide due to a lack of sufficient context. We made some necessary revisions to some expressions of target sentences that were hard to understand and supplemented with more explicit contexts according to the feedback and the suggestions of experts.

A MEANING TEST OF NODE WORDS

A meaning recognition test was used to examine how well the participants learned about the different meanings of nodes. When we referred to the methods that were developed to measure meaning knowledge, we found that some methods were too subjective, such as the Word Definitions Task (Chow et al., 2005), or some methods merely examined superficial knowledge of words. Comparing the tests developed by previous studies, we thought that Read's (1993) Word Associates Test (WAT) relatively corresponded to the intention of the present study to examine learners' multiple-meaning knowledge of node words (i.e., the paradigmatic associations of words). We decided to employ the WAT method to develop the test for the present study.

The WAT was originally developed to test the associations of a word with other words, such as paradigmatic (e.g., synonymy, polysemy), syntagmatic (collocates) and analytic. Test-takers were required to identify the related words. Read (1993) claimed that identifying more related words suggested that learners mastered a deeper knowledge of the stimulus word. Based on the format and the method of the WAT, the present study developed a meaning recognition test focusing on the paradigmatic associations of words (i.e., synonymy, polysemy). To develop the test for the present study, 24 node words were taken as stimulus words. Four semantically related words and four non-related words were designed for each stimulus word. The semantically related words were selected from the Oxford Advanced Learner's Dictionary (2013). They expressed different aspects of the meaning of the stimulus word. These words were examined in BNC to confirm that they were frequent words. The non-related words were obtained from the top 2000 in the wordlist of BNC. They did not have semantic links or some orthographic or morphological relations to the stimulus word (Read, 1993).

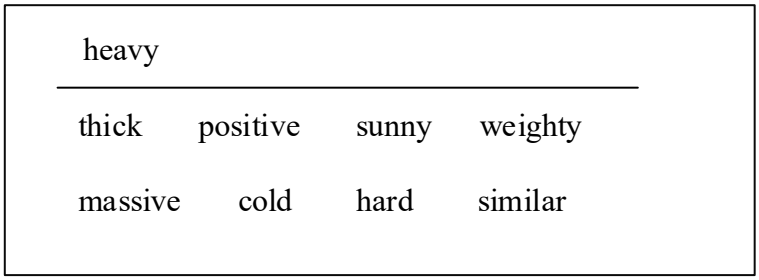


FIGURE 1. An example of the meaning recognition test

Please see an example for the meaning recognition test in Figure 1. In the example, the stimulus word was “heavy”, and the four semantically related words were “thick”, “weighty”, “massive", and "hard". The participants were not told the number of related words or the scoring rules. They were encouraged to pick out as many semantically related words as possible.

After the draft of the test was developed, five experts who were native English speakers and were professionals in English were invited to take the test. We made revisions to related words and non-related words until five experts reached an agreement on the answers to all items. The internal reliability of the test was examined through SPSS software. The coefficient of Cronbach Alpha is .936, which suggests that the test had a high degree of internal consistency of items.

SCORING

The present study involves three different research instruments (i.e., an RT experiment, a productive test and a meaning recognition test). In the RT experiment, participants’ responding time and accuracy of judgments were recorded by E-prime software. The responding time was calculated by milliseconds. In the analysis of reaction time, incorrect responses were removed because only the reaction time of correct responses could present participants’ performance in collocation processing. In the fill-in-the-gap productive test, one collocation scored one point. As long as the target node word was answered, it was scored one point. With the aim to examine the influence of L1 semantics on L2 collocational knowledge in the test, the errors about words' inflexions or grammatical errors were ignored. In the meaning recognition test, identifying one related word scored one point. Wrong judgments did not have points deducted.

RESEARCH PROCEDURES

All of the participants took the RT experiment on computers individually in a quiet room. The experiment involved the following procedures. First of all, participants were given instructions about experiment operation skills and task requirements. Participants had gone through a practice test with 20 extra items before the formal experiment. This session was to ensure that participants were skilled in operating the task. Participants could press "Q" on the keyboard to get into the formal experiment if they became familiar with the operation skills.

In the experiment, 96 items (48 target items and 48 implausible word combinations) were presented in the middle of the computer screen one by one in a random order. Participants were asked to give judgments on the acceptability of the items. They could press “J” on the keyboard if they thought the item was an acceptable English collocation or press "F" if it was not acceptable. They had a maximum of 4000 milliseconds for response, and they were asked to give judgments as quickly as possible.

In order to avoid the memory effect, participants took the fill-in-gap productive test and the meaning recognition test using pens and paper two weeks after the experiment. The tests were carried out in a classroom without a restricted time limit. Participants were not allowed to discuss or look up in the dictionary.

RESULTS

L1 CONGRUENCY EFFECT ON ENGLISH COLLOCATION PROCESSING

A pair-sample t-test was employed to analyse the difference in processing performance between congruent collocations and incongruent collocations. Table 2 shows the means, standard deviations and t-test results of reaction time and error rates in the processing task.

TABLE 2. T-test of reaction time and error rates in the processing task

Proficiency	**High-level group**		**Low-level group**	
	Reaction Time Mean (SD)	Error Rate Mean (SD)	Reaction Time Mean (SD)	Error Rate Mean (SD)
Congruent	1237(232)	12.08 (9.49)	1685(448)	22.36(7.13)
Incongruent	1322(287)	22.78(9.46)	1830(502)	30.42(10.67)
Difference	85	10.7	145	8.06
t (29)	-4.734*	-6.93*	-4.27*	-4.138*

Note. Reaction time was counted by milliseconds, and error rates were counted by per cent. "SD" is "standard deviation". "*" means "p<.01".

The results in Table 2 show significant differences between congruent collocations and incongruent collocations both in response time, t (29)= -4.27, p<.01, and in error rates, t (29)=-4.138, p<.01 for the low-level group. Likewise, The high-level group also obtained significant differences between the two groups of collocations in response time, t (29)= -4.734, p<.01, and in error rates, t (29)= -6.93, p<.01. The mean differences present that both groups responded faster to congruent collocations and made fewer errors on them than incongruent collocations. The results suggest that Chinese EFL learners had an advantage in processing congruent collocations.

L1 CONGRUENCY EFFECT ON ENGLISH COLLOCATION PRODUCTION

The difference in production performance between congruent collocations and incongruent collocations was examined by a pair-sample t-test. Table 3 presents the means, the standard deviations and the t-test result of production performance. The high-level group produced a mean of 14.1 congruent collocations and a mean of 9.2 incongruent collocations. There is a significant difference between the two groups of collocations, with t (29)=8.253, p<.001. The low-level group also produced more congruent collocations (a mean of 8.03) than incongruent collocations (a mean of 3.97), and the difference is significant, with t (29)= 7.946, p<.001.

The above results reveal a significant L1 congruency effect on the production of collocations for both the high-level group and the low-level group. In other words, it was easier for L2 learners to retrieve the collocations that had L1 counterparts in the production.

TABLE 3. T-test of production performances in the productive test

Proficiency	**High-level group**	**Low-level group**
	Mean (SD)	Mean (SD)
Congruent	14.10 (3.078)	8.03 (2.895)
Incongruent	9.20 (2.355)	3.97 (2.266)
Difference	4.90	4.067
t (29)	8.253*	7.946*

Note. "SD" is "standard deviation". "*" means "p<.001"

CORRELATION ANALYSIS

A two-tailed Pearson correlation analysis was conducted using SPSS software to explore the relationships among meaning knowledge, congruent collocation processing, incongruent collocation processing, congruent collocation production and incongruent collocation production. The scores of the meaning recognition test (MRT), processing reaction time (PRT) of congruent collocations, PRT of incongruent collocations, scores of congruent collocation production and scores of incongruent collocation production were used as the data of all the variables. The results of the correlation analysis are shown in Table 4.

As Table 4 illustrates, all of the variables are significantly correlated with each other at the 0.01 level. MRT is significantly correlated with PRT of congruent collocations and PRT of incongruent collocations in a negative direction, and the correlation with PRT of incongruent collocations (R=-.458, p<.01) is stronger than the correlation with PRT of congruent collocations (R=-.387, p<.01). The results suggest that learners who got higher scores in MRT responded in shorter time in the timed phrase acceptability judgment task. Additionally, MRT has a significant positive correlation with incongruent collocation production and congruent collocation production respectively, and the R-value of the correlation with the former is .585 (p<.01) which is slightly stronger than that for the latter (R=.582, p<.01). Based on the results of correlation analysis, we concluded that learners' meaning knowledge of node words has positive associations with English collocation processing and production, and the association with incongruent collocations is stronger than that with congruent collocations, especially in processing.

TABLE 4. Pearson correlations among MRT, PRT of congruent collocations, PRT of incongruent collocations, congruent collocation production and incongruent collocation production (N=60)

		1	2	3	4	5
1.	MRT	-	-.387**	-.458**	.582**	.585**
2.	PRT of Congruent collocations	-.387**	-	.940**	-.400**	-.407**
3.	PRT of Incongruent collocations	-.458**	.940**	-	-.460**	-.429**
4.	Congruent collocation production	.582**	-.400**	-.460**	-	.709**
5.	Incongruent collocation production	.585**	-.407**	-.429**	.709**	-

** Correlation is significant at the 0.01 level (2-tailed)

DISCUSSION

To answer the first question, the results demonstrate a significant congruency effect on English collocation processing among Chinese EFL learners. In comparison to incongruent collocations, Chinese EFL learners made fewer errors and responded more quickly when they judged the acceptability of congruent collocations in the processing task. The finding is consistent with that of Yamashita and Jiang's (2010) study, as well as Wolter and Gyllstad's (2011) studies. The present study provides proof of the L1 congruency effect by examining the congruent collocations and the incongruent collocations that are pair-corresponding by common node words (e.g. 'lose control' and 'lose weight'). The processing advantage on congruent collocations reveals that learners relied on lexical links from L2 to L1 to access the conceptual system in processing. For a congruent collocation with word-for-word translation in L1, learners can access the conceptual system with less effort and more accurately by the lexical link. While for an incongruent collocation lacking a direct lexical link, learners need to spend more time searching for its specific meaning. They were more likely to make an error if the specific meaning of the collocation was not finally accessed.

To answer the second question, the results show that L1 congruency affected Chinese EFL learners when they produced English collocations. In the productive test, both groups of learners produced more correct congruent collocations than incongruent collocations. The finding supports Nesselhauf's (2003) claim that it was more difficult for L2 learners to produce incongruent collocations. It indicates that learners relied on L1 semantics and L1 collocational patterns when they produced L2 collocations. In the productive test, the node words of target collocations were taken away. To produce the target collocations, learners need to activate the concepts of target collocations based on the understanding of the sentence contexts and the elicitation of the remaining component words. Then, learners need to retrieve the missing words based on collocational connections. The L1 congruency effect in the productive test suggests that the collocational links of congruent collocations were more easily accessed than incongruent collocations by learners.

When learners recognise the English component word, its L1 lexical networks are activated simultaneously (Lesniewska, 2006). For a congruent collocation which possesses an equivalent L1 collocation pattern, the activated L1 collocational link helped learners retrieve the node word with less effort. An incongruent collocation is relatively hard to retrieve and output before its collocational connection is constructed, even though its concept might be activated with the assistance of L1 semantics. Instead, reliance on the L1 strategy probably caused the production of L1-induced errors owing to the specific collocational patterns between the two languages. The finding, to some extent, verifies Lesniewska's (2006) assumption that cross-language transfer happened to a collocational link.

The congruency effects on L2 collocation processing and production were found in both of the two groups. Though we have found a proficiency difference that the high-level group had better performance in processing and production than the low-level group, the significant congruency effect suggests that the high-level group still depended on L1 when they processed and produced L2 collocations. The finding indicates that L1 has a long-lasting influence on L2 collocation acquisition among Chinese EFL learners. The profound influence of L1 on Chinese EFL learners might be attributed to two major factors. One factor might be the grammar-translation teaching mode, which has been a prevalent instruction method for foreign language teaching in China (Du, 2021). Under the influence of this teaching mode, Chinese EFL learners are apt to use the L1 translation strategy in L2 learning. Another possible reason is contributed to a lack of awareness of L2 collocational restriction. L2 learners often disregarded collocational restriction for co-occurring words (Wray, 2002). A collocation was often deemed as two words combined freely following grammatical rules by Chinese EFL learners (Chen, 2017). In this acquisition pattern, the component words of a collocation are supposed to be stored in memory separately rather than as a holistic unit of meaning. In this condition, L1 collocational links are easy to transfer to L2 as primary learners try to retrieve the component words of L2 collocations.

To answer the third question, the scores of the meaning recognition test have significant correlations with the reaction time of congruent collocation processing ($R=-.387$, $p<.01$), the reaction time of incongruent collocation processing ($R=-.458$, $p<.01$), the scores of congruent collocation production ($R=.582$, $p<.01$), and the scores of incongruent collocation production ($R=.585$, $p<.01$). The results imply that knowledge of multiple meanings of nodes has a positive correlation with understanding of concepts of L2 collocations and output of L2 collocations.

A node word may express various meanings as it collocates with different words. For example, the node word "heavy" in "heavy stones" means "weighing a lot", in "heavy schedules" it means "busy", while in "heavy coats", it means "thick". It is reasonable that learners who master

the multiple meanings of "heavy" well would understand the concepts of the collocations with "heavy" more easily, especially when they encounter an L1 incongruent collocation which lacks a direct L1-L2 lexical link to the conceptual system. In the study, when the concept of an incongruent collocation failed to be accessed by the lexical link from L2 to L1 in processing, the learners who mastered multiple meaning knowledge of the node better may recall the L2 specific meaning of the incongruent collocation more efficiently.

It is interesting that meaning knowledge of nodes correlates more strongly with congruent collocations and incongruent collocations in production than in processing. To explain the finding, let us take a look at the cognitive processes in the tasks of L2 collocation processing and production, respectively. The processing task, which had a 4000-millisecond time constraint, may be considered an implicit cognitive process involving minimal conscious thought. Learners might rely more on implicit knowledge in the cognitive process. Many studies have demonstrated that L1 knowledge would activate automatically in L2 processing (e.g., Sebastian-Gallés et al., 2006; Wolter & Gyllstad, 2011). Under such circumstances, the effect of meaning knowledge might be more easily overshadowed by L1 influence in L2 collocation processing, especially on congruent collocations. The productive test, due to the unlimited time, is an explicit cognitive process. Learners may deploy cognitive resources actively (Izumi, 2003). When awareness increases, the cognitive process might shift from the implicit activation of lexical links towards a more explicit process (Izumi, 2002). In the production, though learners might also resort to L1 semantics to understand the meanings of the sentences and activate the semantic representation of the target collocations, the knowledge of multiple meanings of the node words may help learners in searching the target collocations and help to retrieve the node words that were taken away.

To sum up, the finding of the L1 congruency effect on the processing and production of English collocations demonstrates that L1 provides great assistance in L2 collocation learning. Some studies found that L1 congruency also significantly affected incidental learning of collocations (e.g., Vu & Peters, 2023). According to the Revised Hierarchical Model and Jiang's development theory, learners are likely to access the conceptual system through the lexical link from L2 to L1 before L2 establishes a strong conceptual link because L1 has a strong and stable relationship with the conceptual system. This may be the reason why congruent collocations were better learned in both intentional learning and incidental learning (Peters, 2016; Vu & Peters, 2023). Additionally, it is found that knowledge of multiple meanings of node words plays a positive role in understanding English collocations and the output of English collocations.

The findings in the present study yield some direct implications for L2 collocation learning and teaching practice. First of all, both congruent collocations and incongruent collocations should be paid attention to in learning. Though congruent collocations were relatively easier to recognise and understand, participants still made some errors in their production of them. As Yamashita and Jiang (2010) suggested, the recognition of the correspondence of collocations between two languages facilitated learners to learn congruent collocations. Identifying the differences in collocations between two languages is helpful in avoiding negative L1 transfer. Therefore, L2 instructors are suggested to assist learners in identifying the similarities and differences between L1 collocations and L2 collocations. Webb and Kagimoto (2010) found that learning many collocates for a single node word could maximise collocation learning. Based on Webb and Kagimoto's (2010) findings and the findings in the present study, L2 instructors are suggested to teach many collocates for a single node word at a time, explain multiple meanings of the node word when it collocates with different words and point out similar meanings or specific meanings of collocations between two languages. In this way, teachers not only help learners recognise L1

congruent collocations or L1 incongruent collocations but also assist learners in building meaning networks in depth for words. L1 may provide great assistance for L2 learners when they try to understand and memorise congruent collocations at the primary stage of learning. As language exposure increases, node words are supposed to be encountered in different contexts. Learners will have a better understanding of multiple meanings for the words and may structure or restructure the meaning network for the words by relating the words to other words in different contexts, which is more likely to facilitate the construction of independent collocational links.

Additionally, incongruent collocations should receive special attention in learning. As for an incongruent collocation, the concept is expressed by specific lexical items in two languages. It means that learners cannot organise or store the L2 individual component words in their mental lexicon with the assistance of the L1 collocational link. Building up the L2 collocational link requires the L2 individual component words to co-occur repeatedly. Due to a lack of sufficient exposure to the target language, an independent L2 collocational link is quite hard to establish implicitly. Therefore, it seems inevitable that learners should be encouraged to use explicit learning strategies at the primary stage of learning, such as memorising strategies. Memorising strategies help primary learners store a collocation as a lexical unit and increase production accuracy.

CONCLUSION

The present study has examined the roles of L1 and meaning knowledge in the processing and production of L2 collocations. The findings indicate that L1 exerts profound effects on both the processing and production of L2 collocations and is hard to diminish. The knowledge of multiple meanings of node words is positively correlated with English collocation processing and production, playing a positive role in L2 collocation learning. These findings suggest that it is critical to identify the similarities and differences between L1 collocations and L2 collocations in L2 collocation learning. It is suggested that learners should recognise multiple meanings of a node word when it collocates with different words. The findings in the present study mainly reflect the cases occurring in verb-noun and adjective-noun English collocations. It is suggested that future research expands the findings to other types of collocations or formulaic sequences. The present study has carried out exploratory research to examine the relationship between meaning knowledge of node words and L2 collocation processing and production and yielded some interesting findings, but how does the variable affect L2 collocation learning or whether there are interactive effects between the two variables has not been explored by the present study. Additionally, it is suggested that future studies conduct lab-based research to examine how the knowledge of multiple meanings of nodes affects L2 collocation acquisition.

ACKNOWLEDGEMENTS

The publication of this article was funded by the PhD Start-up Research Project at Guangdong University of Petrochemical Technology. We acknowledge the constructive comments by Prof. Anna Siyanova and the anonymous reviewers.

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