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Article

Vocabulary Building on the Move with the Prime Machine: Evaluation of a Cross-platform Corpus-based Game for English Vocabulary Learning

Ting Yang
Stephen Jeaco*
Xi'an Jiaotong-Liverpool University, China

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Abstract
The development of corpus methods has led to a deepened understanding of the patterning of vocabulary, with positive impacts on learner dictionaries, vocabulary profiling and text analysis, as well as hands-on language learning with concordancers. While learning activities based on corpus data have been used in English language teaching for many years, these have tended to be generated by textbook writers and teachers manually selecting and organising corpus data. This paper evaluates a new corpus-based game which was developed based on the data-driven learning exercise "One Item, Multiple Contexts" (Johns, 1997) or "spot the missing word" (Hanks, 2013). This kind of exercise was gamified in a learner-friendly corpus tool – The Prime Machine. To evaluate the language learning potential of the automatically provided materials, a corpus-based analytical approach was employed, categorizing the patterning of the target items and distractors. The primings of lexico-grammatical features involving collocation, semantic association, and colligation were categorized and compared. The corpus-based analyses found reoccurring patterns and primings in the concordance lines across the learning phase and the gaming phase. Interviews with 5 Chinese university EFL students who had played the game were conducted. The interview questions focused on asking participants' noticing behaviours, the compatibility of difficulty levels, and their perceptions towards the game. The responses showed that respondents noticed reoccurring language patterns and measured the difficulty level specific to their gaming experiences. A request was made for more explanation on missed patterns when the incorrect item was selected, and improvements on the reward system were suggested. All participants perceived the game to be beneficial for learning lexico-grammatical features of English vocabulary.

Keywords
Data-driven learning, corpus-based game, vocabulary learning, CALL evaluation

*Corresponding author. Email: steve.jeaco@xjtlu.edu.cn

1 Statement of the Teaching Context

Teachers and students recognise the need to develop academic vocabulary over the course of undergraduate studies. While this is probably true for students who are studying in their native language, it is certainly keenly felt by second language learners who are international students or studying in English as a Medium of Instruction (EMI) institutions. It is hoped that the innovation described in this paper will be of use in a broad range of English for Academic Purposes (EAP) contexts, but here it is described within the context of an EMI university located in China, for users of the software who are typically even more acutely aware of the linguistic demands of academic writing – namely English majors. The purpose of this paper is to assess whether The Prime Machine's (tPM) gamified Data Driven Learning (DDL) activity could assist and promote English vocabulary learning. The group of students first introduced to the Game Mode of tPM were studying or had studied an academic course on corpus linguistics where it was the major corpus tool to be used. As students enrolled in an international university in China, they were receiving or had received EAP credit-bearing modules. One of the important marking criteria for their academic performance across their degree programmes is the use of Academic English. In other words, they were faced with the challenge of learning and grasping English for academic achievement at the undergraduate level. This research aims to evaluate this corpus-based game to ascertain whether it has the potential to reflect language patterns within automatically selected concordance lines, and to explore how learners perceived the difficulty levels of this game and what other impacts it had on their thinking and learning.

2 Rationale for the Innovation

In recent decades, research on integrating corpus results and methods into language learning has been growing. Corpus tools have indirectly influenced language learning through advances in lexicography, language descriptions, and the development of corpus-informed language learning materials. Research has demonstrated that language learners' direct or indirect access to authentic language use in corpora could enhance different aspects of language learning (Johns, 1991; Stevens, 1991; Chen and Flowerdew, 2018). In particular, the development of vocabulary knowledge for both reception and production through a deepening of the lexico-grammatical patterning shows the benefits of such integration. Language learning through the use of corpora is termed Data-Driven Learning since learners are encouraged to observe language data to answer questions about language. As well as helping language learners distinguish between words with similar meanings, appreciating the collocations and grammatical elements which are often used with particular words helps language learners formulate meaningful and appropriate combinations. However, when dealing with language data and statistics about language, learners and teachers can be easily overwhelmed by the complexity of corpus software. To tackle this issue, tPM was designed to make access to and interpretation of corpus data easier (Jeaco, 2017a). In this corpus tool, authentic language examples from a variety of sources and relevant information about the contexts and patterns of language use are combined. For instance, collocations of the node word are presented on a card that contains the concordance line with its wider context of one sentence before and after the sentence containing the node, allowing users to get access to contextual information beyond Key Word in Context (KWIC). In addition, the statistical weight of collocations is visualized either in the size of clouds or statistics in tables. In these ways, vocabulary items can be explored and distinguished through the observable patterns of co-text and context. While vocabulary learning software or applications that employ traditional materials such as dictionaries or grammar references have enjoyed popularity, the use of concordance lines in mobile vocabulary learning seems to have received little attention in China or elsewhere. There is a lack of software or applications integrating corpus-based exercises in games for language learners.

As a learner-friendly corpus tool, tPM was developed in accordance with Hoey's (2005) hypotheses about the priming of words and language and it aims to help learners overcome some of the operational difficulties of other corpus applications and provide more statistical information about language features (Jeaco, 2017a). From the perspective of vocabulary learning, the basic KWIC format of concordance lines can be employed effectively to present lexico-grammatical patterns of the node word (Chen and Flowerdew, 2018). Namely, the patterns formed by the node word with the words to its left and right have the potential to maximize opportunities for observation of the patterning of specific vocabulary items. In addition to this basic interface, some functions of tPM were specifically devised to measure and draw learners' attention to patterns of language use in accordance with Hoey's (2005) theory of lexical priming. Hoey drew on lexico-grammatical patterns, including collocation, semantic association, and colligation, to explain how language users form and evaluate expressions, drawing on the patterning of language they have previously encountered. Hoey defines collocation as "a psychological association between words … up to four words apart and is evidenced by their occurrence together in corpora more often than is explicable in terms of random distribution" (2005, p5). Similarly, semantic association can be recognized when a semantic class or set could be observed and categorized for a word or word sequence. In addition, a word can be primed to occur with or avoid certain grammatical company, grammatical functions, or positions in a sequence. Hoey (2005) notes that the patterning of words and combinations of words differ across different domains and genres. Furthermore, Hoey's hypotheses include the claim that synonyms can be systematically differentiated through analysis of their lexico-grammatical patterns. Based on these hypotheses, it can be argued that the combination of lexical meanings and grammatical patterns in concordance lines should provide learners with exemplification for comprehension, and with readymade building blocks of language for production (Jeaco, 2017b).

The development of the game is in line with the general aims of tPM to present learners with the opportunity to observe, notice, and develop their knowledge of the primings of words and combinations of words. Although not all language users will share all the primings of words, corpora can be used to uncover the major patterns which must exist in the minds of language communities because they are so strongly represented in the texts produced by those discourse communities. The process of encountering language use in a particular context and generalizing from it is essential in the context of language learning. Krashen's (1981) Input Hypothesis emphasizes the importance of providing learners with language inputs that provide opportunity for comprehension just beyond the threshold of their competence to permit more learning. Furthermore, one of the theories that underpin the studies of DDL is the Noticing Hypothesis that addresses the positive impacts of the use of corpus-based activities or materials (Flowerdew, 2015). The Noticing Hypothesis might provide a plausible explanation for the prerequisite cognitive conditions of acquisition (Schmidt, 2010). The insights into language features, the role of learners, and a plausible cognitive mechanism behind second language acquisition appear to be emphasized in a concordancer such as tPM. From a pedagogic perspective, essential shortcuts of priming can assist learners to accelerate priming in language learning (Hoey, 2005). Namely, a focused encounter that allows for generalization of language patterns could help them develop primings of language patterns. Within the field of Computer Assisted Language Learning (CALL), a concordancer could be used to meet the significant principles from Second Language Acquisition including the importance of noticing through accessing language inputs (Jeaco, 2017a). Indeed, empirical studies using a variety of corpus tools and corpus materials have demonstrated the benefits of DDL for language learning. At the initial phase of DDL research, Johns (1991) took the first step to use concordance lines to guide classroom discussion. With the KWIC format and examples from authentic language use, learners were able to act as linguistic researchers to identify and generalize the patterns of the words that confused them. Besides classroom discussions on language use, Stevens (1991) took multiple concordance lines and hid the node word to create an alternative to the traditional gap-filling exercise. Results revealed that students could better match the correct words and enhance understanding of vocabulary when doing the corpus-based alternative compared to the gap-filling test. Boulton and Cobb's (2017) meta-analysis

of DDL recognized the theoretical underpinning of making patterns salient for noticing and found the effectiveness of DDL approaches for language learning. In DDL activities, learners are capable of discerning language patterns, and the goals for learning are not limited to vocabulary and collocation.

Table 1

Levels of Game Design Elements (Quoted from Deterding et al. 2011, p. 12)

Level	Description	Example
Game interface design patterns	Common, successful interaction design components and design solutions for a known problem in a context, including prototypical implementations.	Badge, leaderboard, level
Game design patterns and mechanics	Commonly reoccurring parts of the design of a game that concern gameplay.	Time constraint, limited resources, turns
Game design principles and heuristics	Evaluative guidelines to approach a design problem or analyze a given design solution.	Enduring play, clear goals, variety of game styles
Game models	Conceptual models of components of games or game experience.	MDA; challenge, fantasy, curiosity; game design atoms; CEGE
Game design methods	Game design-specific practices and processes.	Playtesting, playcentric design value conscious game design

Another aspect of the rationale for the innovation described in this paper is that it might be beneficial to employ game design elements to gamify the DDL exercise. The definition of gamification has varied over time, but the meaning of this term applied here is "the use of game design elements in non-game contexts" (Deterding et al., 2011). Table 1 summarizes a probable set of characteristics of game elements, which includes five different levels. According to Kim et al. (2018), gamification could imply the use of experience economy in education for encouraging active engagement, enhancing learning effect, and creating a personal experience for students. Furthermore, it is implicated that penalty points and positive reinforcement in an educational setting might induce expected behaviours (Kim et al., 2018).

3 Description of the Innovation

Although, tPM was originally designed for desktop computers, it has recently been released for other platforms, running on mobile phones and tablets too. This cross-platform version includes a corpus-based game, specifically designed to enhance vocabulary learning. The game design incorporates insights from DDL activities and learning through gaming. The focus of this paper is on the exercise named "One Item, Many Contexts (OIMC)" by Johns (1997) or "spot the missing word" by Hanks (2013) which was integrated into tPM and gamified to enhance vocabulary learning. In tPM, the materials to be used are automatically prepared through an algorithm run on the server. When the game is played, concordance lines are downloaded from the server, while progress and scores are stored on the user's device. After gaining familiarity with the patterns, players should be able to compare the patterns in the gaming mode with those previously observed and identify the correct target word from the multiple contexts. The gaming experience is integrated with game design elements such as a reward system of winning or losing points. At the beginning of each game, players are first presented with 200 concordance lines of each word or phrase for learning and familiarizing themselves with its patterns. This stage must last a

minimum of 15 seconds for each item, but there is no maximum time limit. After viewing the learning lines of each word or phrase, players will choose the number of gaming lines they think they will need in order to identify which node word is missing. The options are for 25, 50, 75 or 100 concordance lines to be displayed. The gaming procedure is largely the same following some parts of the original exercise design of "One Item, Many Contexts" proposed by Johns (1997). Hanks (2013) introduces the expected observing and thinking process behind this kind of exercise which he refers to as "spot the missing word". The contextual and grammatical hints involving collocation, semantic association, and colligation should be observed throughout the learning and gaming phases. While the kind of game is not new, the originality of this game in tPM is in its integration into a concordancer and the selection process for creating the games.

Another similar automatic program of cloze tests or gap-filling activities has been evaluated to demonstrate the potential of corpus-based exercises for language learning. To some extent, the basic format of the bundled gap-fill activity put forward by Wojatzki, Melamud and Zesch (2016) seems similar to the OIMC exercise. Both tests ask learners to guess the missing word in a group of multiple concordance lines. The main difference between bundled gap-fill and tPM's game and tPM's game is in terms of its in terms of its design and emphasis. In the bundled-gap test, sentences are presented to learners one by one with a maximum of six sentences, while in the tPM game a complete batch of 25 to 100 lines is provided, and users can sort these lines in various ways. Thus in the bundled-gap test, the incremental accuracy and decreased ambiguity in the filled gaps can manifest each word's role to function as an alternative. On the other hand, the tPM game is intended to provide learners with starting points of learning differences among synonyms, prepositional and signposting phrases, and antonyms while practicing analytical skills in language learning. In traditional vocabulary materials, the separation of lexis and grammar may not be able to make the priming of the language features as statistically or visually clear as is possible with concordancers.

The selection of items to be learned and played in tPM game draw on several aspects of words involving synonyms, antonyms, prepositions, and signposting phrases. tPM employs its own retrieving system of synonyms to generate a list of synonyms in a corpus, thus allowing for the future generation of synonymous items in different corpora. For the items in this first version of the game, words from the Academic Word List (AWL) developed by Coxhead (2000) were selected, according to their raw frequency (to ensure sufficient numbers of concordance lines would be available for both learning and testing) and the frequencies of other words automatically identified as having a similar meaning. The relationships of words to other words were based on the same system used on the main search tab of tPM. To give suggestions for user queries, tPM is designed to include synonyms, spelling support, collocation suggestions and other word forms on the query page (Jeaco, 2017b). Thus, the synonymous items comprise the game type of "Academic synonyms". There are also games based on "Academic prepositions", where a single item from the AWL is selected based on it collocating strongly with more than one preposition. Other groups of games are also available, including general signposting phrases, which were generated from a short list, and general antonyms such as *big/small* and *hot/cold* which were chosen for preparing players to familiarize themselves with the game procedures as it was hypothesized that these would have a low degree of difficulty. Since the items for all the games received little scrutiny during the design of the software, the question of their potential for providing learning opportunities is to be answered here.

Table 2 draws on the aspects of gamification which were outlined in Table 1, and shows that the tPM game attempts to address most levels of game design. Players will gain or lose points in the scoring system that quantifies the success of interaction. There are limitations on the minimum time that players should spend on familiarizing themselves with language patterns and the number of gaming lines they can view. The goals in the game design principles are providing learners with opportunities to observe patterns and then identify the missing word through matching new instances

with those patterns. The game model is the conceptual model that contains a challenge for learners to pay much attention to language patterns. Finally, the game design-specific practice belongs to the exercise of spotting the missing words. As a final product that promotes vocabulary learning, tPM game falls into Ulrich and Helms' (2017) category of a serious game that employs game in non-game contexts not aiming for entertainment.

Table 2

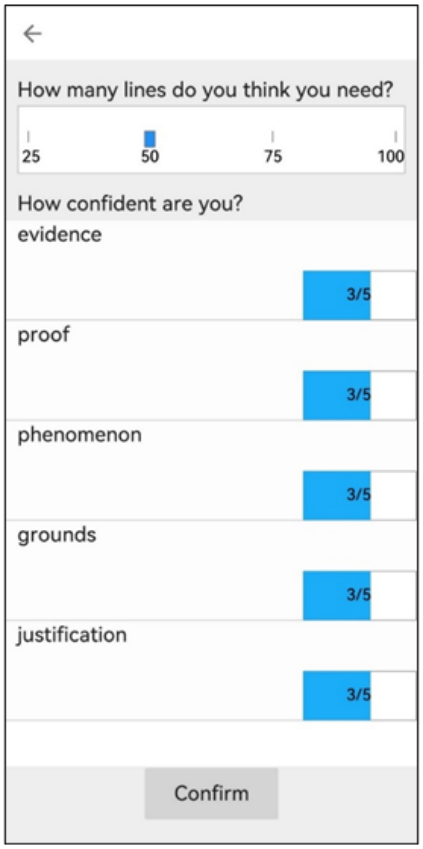
Levels of Game Design Elements (based on Deterding et al., 2011, p. 12)

Level	tPM Game Features
Game interface design patterns	Points, starring system
Game design patterns and mechanics	Minimum 15 seconds looking at learning lines, choices of the number of gaming lines (25, 50, 75, 100), limited gaming lines.
Game design principles and heuristics	Observe patterns in learning lines to spot the missing word in gaming lines.
Game models	Challenge of observing and noticing patterns.
Game design methods	"One Word, Many Contexts" "Spot the missing word".

The reward and penalty system is reflected in the addition or reduction of points. As shown in Figure 1, Learners are invited to reflect on their own confidence about their ability to guess the words to be tested by using a slider. The selection acts as a multiplier for both points awarded for correct answers and penalties deducted for incorrect answers, thus encouraging more cautious and conscious attention to their knowledge of the priming of language patterns.

Figure 1

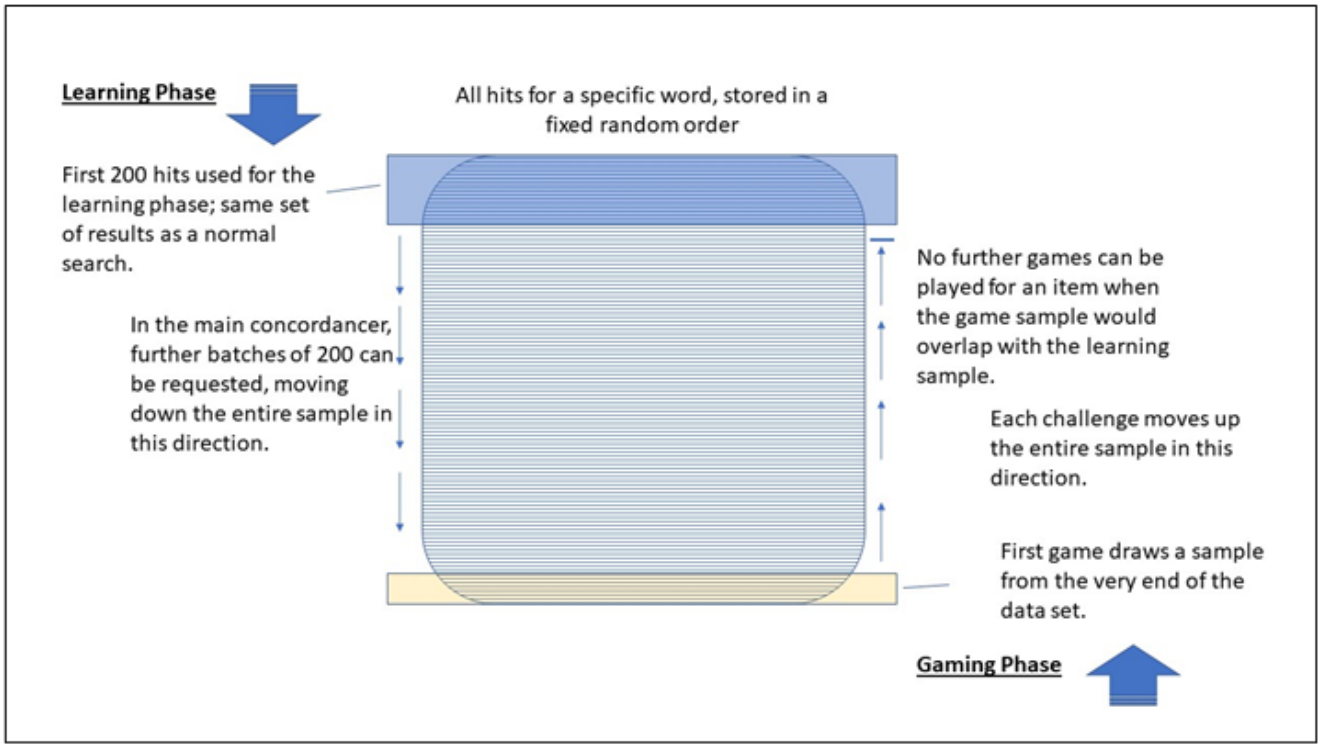
The Pre-challenge Screen of the tPM Game



Before analyzing linguistic patterns, it is necessary to recognize the relation of learning and gaming lines presented to players. As shown in Figure 2, both learning and gaming lines are derived from the same corpus. When used as a normal concordancer, with each search of a node word, tPM initially retrieves 200 concordance lines in one batch that is a fixed random sample (Jeaco, 2021). The default method of sorting concordance lines is to rank according to the number and strength of collocations that they contain. The learning lines initially presented to learners are the same as the first batch of results which would be retrieved in tPM if a normal search was performed. As for the gaming lines, batches ranging from 25, 50, 75 to 100 are selected from the same corpus, but to avoid overlapping with those from the preliminary learning phase, these are drawn from the opposite end of the corpus. Although in the normal concordancer, users could repeatedly request additional batches of results, the words used in the game all have a relatively high frequency, and so the fixed random order of all the hits for the node in the entire corpus essentially provides a means of having separate random samples – one readily retrievable for learning, and others which would be difficult to obtain outside the special procedures used in the game itself.

Figure 2

The Relation of the Sampling of Lines for Learning and Gaming



4 Reflection

The use of a concordancer as a language teaching and learning tool seems to be promising in the sense of employing technology and a large number of materials. Nevertheless, its effectiveness often remains a question that needs feedback in order to make improvements. According to Chapelle (2001), CALL programs should be evaluated from a set of qualities, thus paving the path towards "judgement analysis of appropriateness" and "empirical evaluation of CALL tasks" (p. 59, 68). In the first version of tPM, the qualities of language learning potential, learner fit, meaning focus, authenticity, impact and practicality were evaluated (Jeaco, 2017b). This project aims to evaluate the corpus-based game in terms

of vocabulary learning potential, appropriateness for learners, and relevant impacts on learning. The following two research questions guide this project to assess whether the gamified OIMC is capable of engaging learners with lexico-grammatical knowledge:

1. To what extent do the patterns observable in the gaming lines match the patterns presented in the learning phase?
2. What are the EMI learners' perceptions towards their gaming experience in terms of difficulty, usefulness and game design?

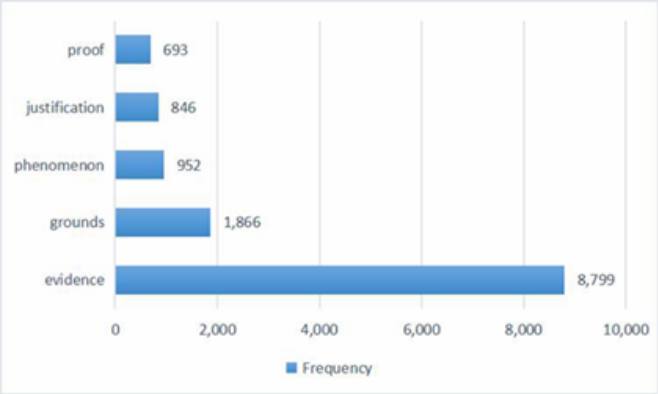
Following Dodigovic's (2005) definitions, this project could be recognized as "effect-oriented" (p. 49) since the focus transfers to the examination of the effects of the CALL project on learning outcomes. To answer the first question about the language learning opportunities provided for players, this research shall employ the corpus-based analytical method of Hoey (2005) in categorizing the primings of words according to their collocations, semantic associations, and colligations. Essentially, this method employs corpus data to analyze the kinds of linguistic patterns which are presented to players in the learning phase and the gaming phase, explicating the primings of lexico-grammatical patterns of collocation, semantic association, and colligation. Interview questions about players' gaming experience and their attitudes were also used to collect direct feedback, and information about their acceptance of and attitudes towards this game were collected to further improve the gaming experience.

4.1 Findings of language learning potential

Under the category of academic synonyms, three sets of synonyms including *evidence*, *argue* and *significant* are available for learning and playing. In this paper, *evidence* and its synonyms are analyzed. The academic synonyms of *evidence* include *grounds*, *phenomenon*, *justification*, and *proof*, ranked in the order of frequency from the most used to the least. The total number of concordance lines available in *BNC: Academic* for each of these words is shown in Figure 3.

Figure 3

Frequency of Academic Synonyms of evidence in the corpus BNC: Academic



As nouns, the words that they grammatically collocate with are primarily adjectives, verbs, and determiners such as indefinite determinatives and quantifiers. The adjectives and determiners can be classified according to their semantic preferences and the verbs can be grouped in the degree of agency and reciprocal relations of actors or recipients. The collocations referring to a general subject or a professional discipline are recognized to be common for this group of academic synonyms (*archaeological evidence*, *scientific grounds*, *social phenomenon*, *philosophical justification*, *mathematical proof*). In addition, the relatively more general category of status might be considered common in describing the

fluid changes (*increasing evidence*, *regressive phenomenon*), temporal stage (*recent evidence*, *historical phenomenon*, *new justification*), similarity (*same proof*, *distinct grounds*, *similar phenomenon*), degree of prominence (*main grounds*, *major justification*, *priori proof*) or depth of information (*further evidence/ justification*, *complex/surface phenomenon*). Less commonly, the quantifying property of entities that confirm matters or issues is found to be shared by evidence, grounds, justification, and proof. This quantifying set of associations can be identified by the collocates with adjectives (*sufficient*, *several*, *ample*), indefinite determiners (*no*, *some*, *any*), or prepositions (*without*). Furthermore, there are features favoured in the confirming entities exhibited by adjectives with positive elements that modify *evidence*, *grounds*, *justification*, and *proof* (*reliable evidence*, *solid grounds*, *rational justification*, *convincing proof*). On the other hand, adjectives with negative connotations describe the features that may be disliked or rejected (*ambiguous evidence*, *retributivist grounds*). Although some of these specific semantic categories may be absent in gaming lines, the majority of semantic categories combine together to indicate the peculiarity of each synonym, making it distinctive from the others.

Considering the distinctive subtlety among synonyms, the semantically grouped collocates indicate a difference in meaning and use. In the case of *evidence*, relevant actions enacted by the agents have subtle differences in relation to the degree of agency and impact claimed on the entities. For instance, the actions of *give*, *scant*, *seek*, exclude might be perceived as active while *preserve*, *secure*, *show* may be static. The collocates of *grounds* can be regarded as an indication of logical relations (*reasonable*, *logical*) and the polysemous meaning (*regional*). As for *phenomenon*, a minority of collocates referring to the range of incidents (*European*, *Jamaican*, *global*) and attitudes (*curious*, *interesting*, *unexpected*) may be grouped together. While the actions enacted frequently with *proof* may be similar to the degree of agency in *evidence*, giving and receiving relations might be claimed to be more obvious. The agency exhibited by the verbs of giving and receiving might be similarly operative (*give*, *provide*, *require*), but the agents may meanwhile be recipients (*ask for*, *obtain*, *demand*). In particular, *proof* co-occurs with multi-word-units that might imply weight of responsibility (*burden of*, *onus of*) and qualification of effectiveness (*standard of*).

Table 3

Semantic Associations of Academic Synonyms of Evidence in the Learning and Gaming Lines

Semantic associations	evidence		grounds		phenomenon		justification		proof	
	Learning	Gaming	Learning	Gaming	Learning	Gaming	Learning	Gaming	Learning	Gaming
adj/det/prep (quantity) +	14%	8%	8%	2%	—	—	18%	16%	8%	6%
adj (+ feature) +	12%	12%	4%	2%	—	—	5%	2%	3%	0%
adj (- feature) +	2%	6%	1%	0%	—	—	3%	2%	—	—
adj (subject/discipline) +	7%	2%	9%	2%	9%	8%	8%	12%	3%	0%
adj (status) +	3%	12%	3%	4%	21%	20%	10%	12%	6%	6%
adj (type) +	8%	4%	—	—	4%	2%	—	—	2%	2%
adj (logic)	—	—	6%	3%	—	—	—	—	—	—
adj + (space)	—	—	1%	2%	—	—	—	—	—	—
adj (commonality) +	—	—	—	—	5%	2%	—	—	—	—
adj (similarity) +	—	—	—	—	4%	2%	—	—	—	—
adj (range) +	—	—	—	—	2%	0%	—	—	—	—
adj (attitude) +	—	—	—	—	2%	0%	—	—	—	—
verb (active) +	4%	6%	—	—	—	—	—	—	—	—
verb (static) +	4%	0%	—	—	—	—	—	—	—	—
verb (giving) +	—	—	—	—	—	—	—	—	3%	4%
verb (recipient) +	—	—	—	—	—	—	—	—	4%	10%
MWU/verb (weight) +	—	—	—	—	—	—	—	—	15%	20%
MWU (qualification)	—	—	—	—	—	—	—	—	3%	0%

The grammatical structures may sometimes be entailed in the non-lexical collocations when the frequency of co-occurring syntactic patterns is high. The primed choices of sequential positions, their grammatical functions, and relevant patterns in the academic synonyms of *evidence* can be sketched by the statistics generated by tPM. With tPM's statistics of the learning lines, the synonyms of evidence could be depicted as preferring the sentence position of Rheme, avoiding modality, and functioning as

nouns that usually avoid articles and co-occur with prepositions. Nevertheless, *phenomenon*, *justification*, and *proof* seem to be primed more strongly to co-occur with indefinite articles than their synonymous counterparts. Examples of such priming are listed as follows:

1. *Scotland shows some evidence for a higher alcohol consumption than ...*
2. *The next month we received yet another set of referee's comments and a rejection of the paper on the grounds of its unsuitability for ...*
3. *The general point here is that 'class' as a cultural phenomenon in British society, as a form of ....*
4. *..., but he provides no rationale or justification for them.*
5. *The old Michigan law which preceded the 1974 reform placed an extremely heavy burden of proof upon the prosecution, ...*

Table 4

Colligational Priming Summary of Academic Synonyms of evidence in the Learning Lines

			Academic synonyms of "evidence"				
			evidence	proof	phenomenon	grounds	justification
Position	Theme/Rheme	Theme	18%	23%	22%	9%	16%
		Rheme	**80%**	**74%**	**78%**	**91%**	**83%**
Sentence type	Modality	no modals	**98%**	**94%**	**99%**	**99%**	**95%**
Grammar	PoS	Noun	**100%**	**98%**	**100%**	**100%**	**100%**
		Adjective	0%	2%	0%	0%	0%
	Definite/Indef	Definite	**28%**	**28%**	**34%**	**50%**	**31%**
		Possessive	3%	7%	2%	3%	7%
		Indefinite article	9%	**17%**	**44%**	5%	**29%**
		No articles	**61%**	**50%**	**21%**	**43%**	**35%**
	Prepositions	Near Prepositions	**71%**	**80%**	**60%**	**95%**	**84%**
		Not Near Prepositions	29%	21%	40%	5%	17%

Figure 4

Proof in the Gaming Lines from the Corpus BNC: Academic

	Text to the left of node	Node	Text to the right of node
1	r Pt I of the CPA 1987. (e) Defences The burden of	---	of causation under the CPA 1987 is upon the victim
2	jure its reputation in the way of its business without	---	of special damage. Morland J. held that there is no
3	13 June 1961, p. 18). Whilst there is no conclusive	---	, it seems highly likely that this piece of information v
4	ıjury occurred within that area of risk, the burden of	---	was reversed and the defendant had to prove that h
5	sought, such as the Schroeder case, the burden of	---	appears to be on the party arguing that the restraint
6	ıential differences are (1) the shift in the burden of	---	: in defamation the defendant has to prove that the c
7	ıualified covenant; and the placing of the burden of	---	for proving"reasonableness" where consent has be
8	ıe summing-up to omit a direction on the burden of	---	: but the omission was not necessarily fatal to the cc
9	ıtion any less when the defence bear the burden of	---	? Do the defence have the resources to make the ne
10	a reasonableness test, where there is no burden of	---	placed on either party. The reasonableness test is f
11	ıere. Whichever defence is relied upon, the onus of	---	is firmly upon the defendant to prove both ingredien
12	1967 Act, not least because it reverses the onus of	---	by placing it upon the seller (see Howard Marine an
13	ous with violence; violent behaviour being taken as	---	of the existence of an inner state called aggression.
14	re his Lordship dismissed a petition to expunge the	---	of a surety against the estate of a co-surety. But the
15	ıly that a local authority could only sue for libel upon	---	of special damage; and that the council would be re
16	met./ While one can accept that a high standard of	---	is apposite in cases affecting liberty it is very doubtf
17	ıtion officer would have to satisfy a civil standard of	---	to a high degree of probability that the entrant had p
18	ın offer do I choose and why? Are any of these fool-	---	, and if not might I be wrong after all and religious ex
19	ı of the egalitarian and communally-based gens: a	---	of the Marxist view of the State as fundamentally a
20	e devastation at the end of King Lear is a sufficient	---	of the destructiveness of hypocrisy, once it is believ
21	ıtructured. it should not be too difficult to produce a	---	of evidence that can be used directly as a formal wi

As can be seen in Figure 4, where coloured lines and highlighting have been added for the purposes of this analysis, one example set of gaming lines has reoccurring collocations that can be matched with those from the learning lines. Particularly, a number of lines indicate the missing word would collocate more with multiple-word-units that imply weight of responsibility (*burden of*, *onus of*) and some with qualification (*standard of*). The missing word also seems able to be quantified, which is revealed by the collocation with words that indicate existence or quantity (*no*, *without*, *sufficient*). Based on such observation, it could be hypothesized that the answer for the example in Figure 4 should be *proof*. With this judgement in mind, some collocations that indicate the status of proof (*conclusive*) and active action related proof (*produce*) offer further support.

Similar analysis was carried out for the other game types, and as with "academic synonyms", it was found that many of the primings of the different vocabulary and signposting items were visible in the sets of 50 lines used in the challenges. For example, it was found that few highly overlapping meanings or usages occur for the academic prepositional phrases *account of* and *account for*. In the gaming lines, these distinctive differences in the semantic grouping of collocations could constitute the chances for learning outcomes and gaming achievements. As antonymous adjectives, *big* and *small* are found in the learning and gaming lines to be common in some objects that they modify and distinctive in collocational groups with which they co-occur. As mentioned earlier, the idea of using antonyms in the game was primarily to help users become familiar with how to read concordance lines and the kinds of clues which can be used. The features of the target objects that are modified by this pair of antonyms might be recognized as tangible (*a big/small city/lake/park*), abstract (*in a big/small way*, *big/small decisions*), and related to people (*a big/small boy*, *big fans*, *small farmers*). There are common functions of measuring or evaluating the shape, scale, or capacity of the modified objectives that can be observed from these instances. However, the concordance results also suggest that they have different collocational behaviours in semantic groupings. As for *big*, it can be observed that organizations (*big firms/banks/school*), trading activities (*a big deal*, *big-selling*, *... as big a deficit reduction*), positive features (*a big help/advantage/advance*, *big and strong, glamorous*) and negative matters (*a big problem/blow/loss/embarrassment*) appear in the lines provided by this game. Some of the semantic associations of *small* differentiate it from its antonymous counterparts. Its collocations may be perceived as emphasizing the numeric nature of quantity (*a small amount/number/percentage/portion*), the size of social or economic units (*small groups/parties/communities/businesses*), and the amount of money (*small cost/fee/fortune*, *revenues ... small*). Similarly, while both the signposting phrases *in contrast* and *on the contrary* tend to occur as Theme and stand as prepositional phrases, the forms and uses of *in contrast* differentiate itself from its counterpart since it often collocates with prepositions *to* and *with*. Therefore, the evaluation of the concordance lines for learning and gaming lines for playing revealed that the primings of language features were more than amply provided to players.

4.2 Findings of Chinese university students' perceptions

A total of five students who had played the game participated in the individual face-to-face interviews. All five participants were Chinese and female and were studying majors containing modules of applied linguistics. Aged from 19 to 21, three students were from Year 2 and two students were from Year 4. The interview questions related to whether players noticed the linguistic features in the concordance examples, whether the level of difficulty was suitable and whether the game itself was compatible with their learning needs. In interviews, none of the respondents denied the importance of the contexts to the left and right of the node word for learning the linguistic patterns and matching with those within the gaming lines. Direct and indirect references to the lexico-grammatical patterns were made by all in their descriptions of the process of guessing. For example, the following answer indicated the awareness of the priming of grammatical choices and semantic groupings:

> "I firstly look through the words before and after the node. I will classify them with their nouns, adjectives, adverbs. And in among nouns, I will classify their abstract meanings to describe people and the animate or inanimate."

Later in the interview, there were prompts that explained the priming patterns of collocation, semantic association, and colligation to all participants. After listening to these explanations, they were capable of linking the noticed patterns with these terms. Such understanding was made based on their gaming experience of observing, obtaining, and matching these linguistic patterns. For instance:

> "Yeah, like the semantic associations. There is the gap should fill the evidence in it and the context will have some positive words occur in the context like "right" or "powerful" and something else."

Another set of questions focused on the level of difficulty and the impacts. While all the Year 2 participants commented that the game was difficult, both Year 4 interviewees thought it was easy. One Year 4 student acknowledged that the pair of general signposting phrases were easy to compare and guess. The other interviewee commented that it would be easy as long as close attention was paid to the concordance lines and the number of lines should be given in between 10 to 20. In contrast, Year 2 students measured the difficulty of this game in terms of the number of lines they chose; the fewer lines they chose, the more difficult they thought the game would be. Among the four choices ranging from 25 to 100, the least number of lines was thought to be the most challenging, while 50 and more lines were regarded as "enough" or suitable for them "to confirm hypotheses or assumptions". Nevertheless, one commented that the game was difficult for not giving an explanation after an incorrect answer was chosen. Though two respondents pointed out how they perceived the drawbacks of this game from the perspective of their own vocabulary learning, they all admitted its potential for providing opportunities for learning vocabulary. One mentioned a preference for learning vocabulary through reading small articles of interest. A comment on the inefficiency of this game that took 10 to 15 minutes to learn a set of words was also made. However, other participants recognized that the concordance lines could provide "an opportunity to learn more" about the differences among synonymous words, better than the direct translations of vocabulary in Chinese.

Additionally, the impacts on players' mood were also taken into consideration when determining how the game played a role in enhancing motivation and engagement. One student showed a high degree of engagement with the calculating system of stars and points, and admitted how the punishment on points could discourage confidence and affect mood negatively. As for others, there was a divergence in attitudes. One respondent acknowledged the game was different from traditional methods of learning vocabulary. It presented the materials as "learning English not just for the grades but also as an instrument". Nonetheless, others treated it more as "an examination" or preferred other awarding systems and aesthetics of design found in other games. For example, one interviewee commented:

> "Because when I use some apps, they will give me some award like the score, star, and I can get in the next level. I can upgrade my level like level 1 to level 5 and I will get the sign or medal."

The last set of questions asked about the perceptions of using the game for future learning of EAP, the preferred platform, and its usefulness in understanding corpus data. Overall, respondents were willing to play this game to assist the learning of EAP in the future. One only gave a short affirmative response, while others explained that academic words in this game stood as its advantage and the game could help them reflect on their language use in essay writing or presentations. One of them recognized the novel experience of understanding words through learning the collocations. As for the preferred platform to play this game, mobile phone and iPad were ranked the first because of their portability. Similarly, four participants explained their perceptions about the usefulness of this game to comprehend the study of corpus linguistics and corpus data. Those who explained further about its usefulness addressed different aspects of the concordance lines they found helpful. These aspects included semantic meanings,

frequency of use, texts' connection to genres such as "academic, non-academic, publications, or spoken fiction texts" and differences of synonyms in actual use.

In conclusion, through the analysis of concordance lines, the game was considered capable of providing lexico-grammatical knowledge of vocabularies and phrases to learners for comparison, and generally the interviewees had positive views. In each type of game, collocation, semantic association and colligation of a group of words or phrases were examined through close observation and categorization and opportunities to observe and notice collocation, semantic association, and colligation were recognized. According to the gaming experience of EFL learners, the processes of observing and categorizing lexico-grammatical patterns surrounding the target words or phrases were recalled. Thus, the impacts of this game on directing attention to language features in the automatically selected materials could be proved positive.

Several implications may be drawn from the current research. Refinement could be made to the interface of the game mode in tPM, assisting learners to focus on observing and categorizing the language features of relevance for learning and gaming achievement. For instance, an instruction video could be inserted within a help button that advises players to recognize the concepts of collocation, semantic association, and colligation. Apart from the instruction on linguistic features, the help button could also potentially have web links that provide learners more English learning tools such as dictionaries or grammar forums. These traditional language learning materials might provide learners guidance in the manners that they have been familiar in the course of language learning. In this way, the vocabulary learning demands for lexico-grammatical features may be better addressed and negative emotions after failures in gaming might be relieved. Furthermore, improvements on the rewarding system could be made with consideration of other forms such as virtual badges or medals that indicate the success in different levels marked by the number of lines chosen by players. Since this investigation was conducted, the game has been updated to give points and a flashing star when users complete each of the words in the learning phrase. However, more could be done to develop levelling and badges. It would also be beneficial to compare the degree of difficulty among the different number of gaming lines given to learners, which might further benefit the calculation of the award system.

Overall, this research noted several plausible improvements could be made regarding the selection of items to be learned and quizzed, the design of the instruction, motivational design element, and comparison of different difficulty levels. Regarding the background of the participants who commented based on their gaming experiences, it should be noted that the degree of familiarity with concordancing tools and corpus data may be a variable to the learning outcomes. In addition, the significance of language proficiency to the effects on noticing and learning language features still need further research. More studies may need to be conducted to yield stronger evidence of the impacts of this game on a general group of EFL learners. Nonetheless, this study could further prove the advantages of employing corpus-based materials and could also be replicated on mobile devices such as smart phones and iPads. It is hoped that more teachers and students will take advantage of the DDL exercises inside the free app – The Prime Machine – and that it will be helpful for their English vocabulary teaching and development.

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Ting Yang completed her undergraduate degree in Applied English at XJTLU where she conducted the research presented in this paper. She went on to complete her Masters in TESOL at the University of Edinburgh.

Stephen Jeaco, PhD, is Senior Associate Professor at Xi'an Jiaotong-Liverpool University. He has worked in China since 1999 in EAP, linguistics and TESOL. His PhD was supervised by Professor Michael Hoey and focused on developing a user-friendly corpus tool - The Prime Machine - based on Lexical Priming theory.