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The effects of context and word exposure frequency on incidental vocabulary acquisition and retention through reading

Feng Teng

Educational Studies, Hong Kong Baptist University, Kowloon, Hong Kong

ABSTRACT
The research on incidental vocabulary acquisition through reading has claimed that repeated encounters of unfamiliar words and the context in which these words occur facilitate word learning. However, so far both variables have been investigated in isolation. This study was conducted to explore the impact of context types, word occurrence frequencies and the combination of these variables on learning and retention of unknown words. The context types included both more and less informative contexts. The word occurrence rates were 1, 5 and 10 times. A total of 180 Chinese university students participated in the study, with 30 in each of the 6 conditions. Learners in each condition were exposed to the same 15 target words. The more informative context was found to have significant effects on productive and receptive knowledge of meaning while an increase in word occurrences was found to produce significant effects on productive and receptive knowledge of word form. With regard to acquisition of word meaning, the cumulative effect of repeated encounters with new words was found only in the more informative context. Providing learners with 10 encounters of new words in an informative context is realistic for triggering the incidental vocabulary acquisition.

KEYWORDS
Incidental learning; context type; word occurrences; vocabulary acquisition

Introduction
Vocabulary acquisition is a challenge for most English as a foreign language (EFL) learners. Most studies have analysed the difference in acquisition of vocabulary through intentional versus incidental learning (Laufer 2009; Lessard-Clouston 2013). Incidental vocabulary acquisition is defined as a ‘by-product’ that occurs when learning activities do not include a specific focus on lexical acquisition (Laufer 2003; Richards and Schmidt 2002), and there is evidence that incidental vocabulary acquisition is less efficient than intentional vocabulary acquisition based on explicit teaching of decontextualised lexical word items (de la Fuente 2006; Laufer 2005; Nation 2013; Sonbul and Schmitt 2010, 2013; Teng 2015). However, due to the restricted classroom time available for explicit word teaching (Schmitt 2008), researchers have begun to agree that incidental vocabulary acquisition is essential and should be incorporated into teaching and learning (Pellicer-Sánchez and Schmitt 2010; Teng 2014).

Successful incidental vocabulary acquisition depends on the frequency with which words are encountered by the learners (Webb and Chang 2015). Numerous studies have shown the positive effects of word exposure frequency on incidental word acquisition (e.g. Horst, Cobb and...
Meara 1998; Pigada and Schmitt 2006; Rott 2007). The reason for this positive effect is that repeated encounters with target words facilitate acquisition by introducing new words in small increments (Schmitt 2008). There is, however, no agreement on the optimal number of repetitions needed for successful acquiring of new incidental vocabulary. As stated in van Zealand and Schmitt (2013: 622), when ‘the context was not controlled… the meaning of some target items was easier to infer than others, leading to variation in the acquisition rate of individual items’. Thus, exploring the context in which the target items occur is highly significant.

The present study aims to explore the incidental learning of unknown words as a function of two variables – the frequency of word exposure in the teaching material, and the quality of context in which the words occur. Previous research on vocabulary acquisition has examined the contribution of each of the two variables separately (for studies on the effect of multiple encounters, see Pigada and Schmitt 2006; Teng 2014, 2016a; Waring and Takaki 2003, and for examples of the effect of context, see Baleghizadeh and Shahry 2011; Laufer and Shmueli 1997). However, these two variables have seldom been addressed in conjunction, with one or two notable exceptions (Webb 2008; Zahar, Cobb and Spada 2001). Given their assumed role as main factors in explaining vocabulary acquisition from textual input, the lack of substantial information on the interaction of these two variables is considered as an important research gap. The present study aims to bridge this gap, exploring the interaction between these two major factors and the effect of this interaction on initial word learning and subsequent word retention in the students learning EFL.

Background

Word exposure frequency and incidental vocabulary acquisition

Although learners can acquire word knowledge incidentally, available research on the incidental vocabulary acquisition has shown that the number of encounters needed to acquire an unknown word is unclear (Waring and Takaki 2003), and the word knowledge that learners can acquire in this way may be partial (Laufer 2009; Schmitt 2010).

A case study, by Pigada and Schmitt (2006), conducted on a French learner explored the incidental learning outcome of three word knowledge aspects (form, grammar and meaning) in a one-month extensive reading experiment. They selected 133 target words with different frequency bands (1, 2–3, 4–5, 6–10, 10+, and 20+ times) from four graded readers. The results showed that the acquisition of the three different aspects of word knowledge was not uniform. The greatest enhancement was shown in spelling (52.3%), followed by grammar (27.6%) and meaning (20.2%). This shows the strong impact of word exposure frequency on form and grammar acquisition, but the acquisition of meaning seems to be unaffected. For example, although this learner showed a noticeable uptake of verb meaning at 2–3 exposures, 4–5 exposures were needed to show a discernible uptake for nouns. In some cases, the participant failed to comprehend meaning, despite encountering the words more than 20 times.

However, other studies have suggested that word exposure frequency does have an effect on acquiring different aspects of word knowledge, including word meaning. For example, Pelllicer-Sánchez and Schmitt’s (2010) study showed that words with an exposure frequency of 10 or more yielded better results than words with fewer encounters. The higher word exposure frequency is consistently advantageous for acquiring various aspects of word knowledge (spelling, word class and meaning). Similarly, in Waring and Takaki’s (2003) study, the participants showed a steady increase in scores for words that appeared from one time to a maximum of 15–18 times in three tests (form recognition, prompted meaning test and unprompted meaning test). Similar results were also found in Teng’s (2014) study, which showed that incidental
vocabulary acquisition in all the three aspects of word knowledge – form, meaning and usage – were significantly affected by the frequency of word occurrence.

The aforementioned studies reveal that reading facilitates the incidental acquisition of word form and meaning, and vocabulary acquisition occurs in a gradual and incremental manner. In other words, there is a transition from more to less partial development of word knowledge in the vocabulary acquisition process. However, the optimum number of word encounters that are needed to ensure incidental vocabulary acquisition is unclear. In addition, there is a disagreement about the effects of word exposure frequency on acquiring word meaning. It could be, as Grabe and Stoller (1997) argued, that some words simply seem harder to acquire. Learners find it difficult to guess the meaning of such words despite several encounters. The difficulty in comprehending meaning could be attributed to the context in which the words occur. Thus, context may be one of the reasons behind the variations in the number of repetitions needed to learn individual words (Webb 2008). For example, in some sentences, the meaning of an unknown word might be apparent, but in others, it may be obscure. It is therefore essential to take into consideration the context type in order to assess accurately the relationship between incidental vocabulary acquisition and word exposure frequency.

**Context and incidental vocabulary acquisition**

The context in which learners encounter words plays a significant role in their word learning. The words that are encountered in a rich and clear context with relevant cues to the word meanings are more likely to be learned. The surroundings of a word carry a great deal of pertinent information, and should enable learners to gain in-depth vocabulary knowledge. Opaque, deceptive and unclear contexts, on the other hand, might cause learners to ignore words or infer an incorrect meaning. Therefore, unless context is taken into account, it may be difficult to assess incidental vocabulary learning accurately. It is surprising that relatively, only a few studies have investigated the role of context in learning vocabulary (Nation 2013). This may be particularly true in an EFL learning setting, wherein the number and frequency of encounters with unknown words are likely to be less than in the first language acquisition scenario.

Existing research sheds light on the role of context in vocabulary acquisition. For example, Webb (2008) exposed EFL learners to 3 sets of 10 short contexts to assess form recognition, form recall, meaning recognition and meaning recall for 10 target words. The contexts were rated on the basis of information available to infer the word’s meaning. Two context types were distinguished: more informative contexts and less informative contexts. More informative contexts provide rich contextual clues enabling learners to infer meaning of the target words while less informative contexts provide fewer contextual clues. Results showed that mean scores were significantly higher for all four measures (form recognition, form recall, meaning recognition and meaning recall) when the target words were encountered in the more informative contexts, confirming earlier studies suggesting that context affects the acquisition of meaning (Jenkins, Matlock and Slocomb 1989; Laufer and Shmueli 1997).

Previous research findings have also determined that simply being exposed to words in context is insufficient for inferring exact meaning and thus enabling full acquisition of target words (Hulstijn, Hollander and Greidanus 1996; Stein 1993; Zaid 2009). Kaivanpanah and Alavi (2008) concluded that learners often lack guessing accuracy, and thus having learners guess the meaning of words from context is considered an unreliable learning approach on its own. Beck, McKeown and McCaslin (1983) also suggested that many contexts might be deceptive, leading learners to infer a wrong meaning.

The differences in the types of contexts used in research may account for inconsistent results on the impact of context on vocabulary acquisition. For example, Herman et al. (1987) used four different types of context in a study of incidental vocabulary acquisition, which were a 1230-word passage and
3 edited versions with varying degrees of implicit and explicit clues about the target words. Other contexts have included short narrative and expository texts of about 1000 words (Teng and He 2015), a single-glossed sentence context (McKeown 1985), 3 consecutive context sentences (Baleghizadeh and Shahry 2011), a graded reader (Horst, Cobb and Meara 1998) and a novel (Saragi, Nation and Meister 1978).

Gaps in research

More recently, word exposure frequency has come to the forefront in the field of vocabulary acquisition research (Schmitt 2010). For example, Webb and Chang (2015) found a cumulative effect for repetition of unknown words either in a sentence or a text. In other words, increased encounters of a vocabulary item seem to enhance the chances of guessing and remembering the word’s meaning. However, this may also be influenced by the effects of context. For this reason, the present study set out to explore incidental acquisition and retention of 15 unknown words in 2 different types of context (more informative vs. less informative) at 3 frequency levels, giving 6 conditions (2 context types × 3 number of encounters). Participants took four ‘surprise’ tests, measuring productive and receptive knowledge of form and meaning, respectively. The three research questions for the present study were:

(1) Will there be a significant difference in the learning and retention of the 15 target words between the more informative context and the less informative context, when exposure frequency is identical in the 2 conditions?
(2) Will there be a significant difference in the learning and retention of the target words in each type of context between the three frequency bands (1 time, 5 times and 10 times)?
(3) How will the different combinations of word exposure frequency and context type compare with each other in terms of the learning and retention of the target words?

Method

Participants

The participants were 180 first-year students (aged between 18 and 20 years, native language, Chinese) from 6 parallel classes, majoring in transportation studies at a university in China. They had started their English learning in junior middle school and had no previous experience of studying in a country where English is the official language. Thirty participants were randomly assigned to each of the 6 experimental conditions. In order to ensure similar vocabulary knowledge at the start of the study, participants were selected on the basis of their scores on the Vocabulary Levels Test (VLT) developed by Schmitt, Schmitt and Clapham (2001).

Target items

The following 15 items were selected from New Horizon College English (Wang 2006), one of the mainstream textbooks for teaching college English in China: intimidate, dilapidated, tumultuous, vulnerable, validation, alleviate, prevalent, retaliate, inevitable, cowardice, prosperity, complacent, animosity, observant and barricade. Adjectives, nouns and verbs were selected because they are the most common parts of speech found in natural texts (Kucera and Francis 1967). All the selected words were of 9–10 letters, based on the author’s teaching experience and piloting with similar students, and were unlikely to be known to the participants. The same set of 15 target words was included in each condition (Table 1).
The participants encountered each target word in separate written texts of one to two sentences long. The contexts were taken from the aforementioned textbook (Wang 2006). The surrounding words belonged to the 2000 frequently used words, based on the *Range* programme (Heatley, Nation and Coxhead 2002). Proper names that might not have been known to the participants, such as ‘Hammersmith’, were excluded. It could thus be reasonably assumed that, apart from the 15 target words, the participants knew all or very nearly all the words in the short texts. The texts together contained a total of 3500 words. The proportion of known to unknown words was thus likely to be well within the 95% required for successful inference of meaning, according to van Zealand and Schmitt (2013).

The specification of context was based on Webb’s (2008) scale of 1–4, illustrated below for the word *intimidate*:

1. It is very difficult to infer correctly the meaning of unknown words from this context.
   \[ \text{You have no right to intimidate this man}. \]
2. Readers are unlikely to infer the meaning from this context, and, even if they do, information in the context can only lead to partial knowledge of the unknown words’ meanings.
   \[ \text{Intimidating others is not a good behavior}. \]
3. It is possible to infer the meaning of unknown words from this context, although sometimes it may only lead to partial knowledge.
   \[ \text{Do not try to intimidate others to do what you want}. \]
4. It is easy to infer the meaning of unknown words based on the information in this context.
   \[ \text{The gang intimidated the bank manager with their offensive behavior in order to rob the bank}. \]

A group of college EFL learners at the same English proficiency levels as the participants were invited to rate the context sentences. Only sentences rated 1 (less informative) or 4 (more informative) were used in the current study (see Appendix 1).

**Measures of dependent variables**

Four tests, adapted from previous studies (Eckerth and Tavakoli 2012; Teng 2016b), were used to measure the participants’ knowledge of the target words. The tests measured, respectively, the participants’ receptive and productive knowledge of word form and word meaning. Although they have an implicational relationship, these four tests of word knowledge were treated as independent measures (Nation 2013). See Appendix 2 for examples of test items.

The four tests were administered separately and carefully sequenced to avoid the possibility of earlier tests providing hints for the later tests; productive tests were thus completed before receptive tests. In order to include retention in measuring word knowledge, the four tests were administered on two separate occasions: immediately after the experiment and after two weeks’ delay. For each administration, the order in which the items were presented was changed to rule out test–retest memory effect.

### Table 1. Target words in different experimental conditions.

<table>
<thead>
<tr>
<th>Word exposure frequency</th>
<th>More informative context</th>
<th>Less informative context</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 time</td>
<td>Condition 1 (15 target words)</td>
<td>Condition 2 (15 target words)</td>
</tr>
<tr>
<td>5 times</td>
<td>Condition 3 (15 target words)</td>
<td>Condition 4 (15 target words)</td>
</tr>
<tr>
<td>10 times</td>
<td>Condition 5 (15 target words)</td>
<td>Condition 6 (15 target words)</td>
</tr>
</tbody>
</table>
Scoring

Participants achieved one point for providing a correct answer and zero points for an incorrect answer in Tests 1, 2 and 4. On Test 3, providing a fully correct meaning was credited with one point, while a partly correct meaning was given half a point. The maximum possible score for each test was 15 points. The tests were rated by two experienced English teachers. No discrepancies between the raters were found for Tests 1, 2 and 4. Approximately 36 discrepancies out of 2700 responses were found for Test 3. Inter-rater reliability was thus about 99%, and the differences were resolved through discussion.

Procedure

The participants took the VLT during the first week. They then embarked on the experiment during the third week. The students in conditions 1 and 2 read 15 main sentences; those in conditions 3 and 4 read 75 main sentences and those in conditions 5 and 6 read 150 main sentences. The target words were included in the main sentences. In addition to this, the students in conditions 1 and 2 were required to read 185 distracter sentences; those in conditions 3 and 4 were required to read 125 distracter sentences and those in conditions 5 and 6 were required to read 50 distracter sentences. The target words were not included in any of the distracter sentences. The distracter sentences and main sentences were intermixed in the reading materials. The purpose of having distracter sentences is to have all participants read the same number of sentences, despite the differences in number of exposures to target words. These distracter sentences also serve as a means to deviate learners’ sole attention from the target words. The total time allotted for reading, determined by an extensive pilot reading, was 60 minutes in all 6 conditions. The experiment was administered by six experienced English teachers, who were familiarised with the research procedure and objectives in a joint session prior to the experiment. The retention ability of all the participants was measured in the fifth week. The test items were not taught during the two weeks. The participants were told to focus on reading for understanding the meaning of the words, irrespective of possible encounters with unknown words. Thus, the whole experiment can be defined as engaging incidental vocabulary acquisition during the course of reading (Hulstijn 2001).

Results

Descriptive statistics

Table 2 presents the descriptive statistics for the four dependent measures on immediate testing while Table 3 presents the descriptive scores for the four dependent measures on delayed testing.

<table>
<thead>
<tr>
<th>Contexts</th>
<th>Productive knowledge of word form</th>
<th>Receptive knowledge of word form</th>
<th>Productive knowledge of meaning</th>
<th>Receptive knowledge of meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>More informative context</td>
<td>1 time</td>
<td>1.86(1.37)</td>
<td>6.73(1.02)</td>
<td>2.96(1.96)</td>
</tr>
<tr>
<td></td>
<td>5 times</td>
<td>2.93(1.58)</td>
<td>9.73(1.21)</td>
<td>4.20(1.25)</td>
</tr>
<tr>
<td></td>
<td>10 times</td>
<td>4.26(1.35)</td>
<td>12.80(1.06)</td>
<td>7.33(1.21)</td>
</tr>
<tr>
<td></td>
<td>Overall</td>
<td>3.01(1.43)</td>
<td>9.75(1.09)</td>
<td>4.83(1.47)</td>
</tr>
<tr>
<td>Less informative context</td>
<td>1 time</td>
<td>1.66(1.30)</td>
<td>6.66(1.21)</td>
<td>2.70(1.78)</td>
</tr>
<tr>
<td></td>
<td>5 times</td>
<td>2.60(1.48)</td>
<td>9.66(1.25)</td>
<td>3.23(1.76)</td>
</tr>
<tr>
<td></td>
<td>10 times</td>
<td>3.33(1.34)</td>
<td>12.60(1.24)</td>
<td>5.01(1.46)</td>
</tr>
<tr>
<td></td>
<td>Overall</td>
<td>2.46(1.37)</td>
<td>9.64(1.23)</td>
<td>3.64(1.66)</td>
</tr>
</tbody>
</table>
Tables 2 and 3 show that the mean scores for the acquisition and retention of the target words based on the four dependent measures are higher for the more informative contexts. Furthermore, scores increase with additional encounters with the target words in each context type and for both initial acquisition and retention after two weeks.

**Inferential statistics**

Research question 1 aimed to determine whether there was a significant difference in acquiring and retaining the target words between the type of context (more informative vs. less informative) at incidental frequencies of exposure. The non-parametric Kruskal–Wallis test was used here, rather than a one-way analysis of variance, as the median of some outcome variables was different between groups (the assumption of normality was not met). Tables 4–7 present the results.

Table 4 shows that in relation to productive knowledge of word form, the more informative context only yielded significantly higher results when the target words were encountered 10 times and only on immediate testing. No other statistically significant results were found.

As shown in Table 5, there were no statistically significant differences for the receptive knowledge of word form between context types and between the different frequencies of exposure.

Table 6 shows that in relation to the productive knowledge of word meaning, the more informative context yielded significantly better results where words were encountered 10 times, both on immediate and on delayed testing. At five exposures, however, the more informative context only showed a significant advantage on immediate testing; the advantage was not maintained on delayed testing after two weeks. There were no significant differences between context types when the participants were exposed only to one occurrence of the target word.

Table 7 shows that in relation to the receptive knowledge of word meaning, there was a fairly clear advantage for the more informative context with significant results on immediate testing for all frequency conditions, and for 5 times and 10 times on delayed testing. The advantage for one exposure in the more informative context was lost on delayed testing.

**Table 4.** Context effect for each word exposure frequency condition: productive knowledge of word form.

<table>
<thead>
<tr>
<th>More informative context</th>
<th>Less informative context</th>
<th>Asymp. Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Imm.</td>
<td>Del.</td>
</tr>
<tr>
<td>1 time</td>
<td>1.86</td>
<td>.81</td>
</tr>
<tr>
<td>5 times</td>
<td>2.93</td>
<td>1.92</td>
</tr>
<tr>
<td>10 times</td>
<td>4.26</td>
<td>3.21</td>
</tr>
</tbody>
</table>

Note: Imm. = Immediate test; Del. = Delayed test.

*Significant at $p < .05$. 

**Table 3.** Vocabulary retention score after two weeks: Four dependent measures (mean values; SDs are given in parentheses).

<table>
<thead>
<tr>
<th>Contexts</th>
<th>Productive knowledge of word form</th>
<th>Receptive knowledge of word form</th>
<th>Productive knowledge of meaning</th>
<th>Receptive knowledge of meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>More informative context</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 time</td>
<td>0.81(1.20)</td>
<td>5.68(1.12)</td>
<td>1.91(1.75)</td>
<td>2.71(1.11)</td>
</tr>
<tr>
<td>5 times</td>
<td>1.92(1.28)</td>
<td>8.71(1.15)</td>
<td>3.18(1.21)</td>
<td>5.79(1.36)</td>
</tr>
<tr>
<td>10 times</td>
<td>3.21(1.14)</td>
<td>11.78(1.05)</td>
<td>6.31(1.15)</td>
<td>8.62(1.35)</td>
</tr>
<tr>
<td>Overall</td>
<td>1.98(1.20)</td>
<td>8.72(1.10)</td>
<td>3.80(1.95)</td>
<td>5.70(1.27)</td>
</tr>
<tr>
<td>Less informative context</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 time</td>
<td>0.61(1.15)</td>
<td>5.12(1.15)</td>
<td>1.72(1.56)</td>
<td>2.16(1.15)</td>
</tr>
<tr>
<td>5 times</td>
<td>1.54(1.24)</td>
<td>8.06(1.20)</td>
<td>2.21(1.45)</td>
<td>2.96(1.25)</td>
</tr>
<tr>
<td>10 times</td>
<td>2.51(1.13)</td>
<td>11.17(1.12)</td>
<td>4.15(1.38)</td>
<td>6.15(1.20)</td>
</tr>
<tr>
<td>Overall</td>
<td>1.55(1.17)</td>
<td>8.11(1.15)</td>
<td>2.69(1.46)</td>
<td>3.75(1.20)</td>
</tr>
</tbody>
</table>
Research question 2 focused on whether there was a significant difference in acquiring and retaining the target words between the three exposure frequency bands (1, 5 and 10 times) within each type of context. The results on the Kruskal–Wallis test showed that, with the more informative contexts, an increase of word encounters yielded a significant increase on all tests both immediate and delayed (\(p < .001\)). This was also the case for the less informative contexts in relation to productive and receptive knowledge of word form; however, in relation to word meaning, there was no such significant effect. With less informative contexts, the word need to be encountered 10 times before there was any significant improvement in word meaning (\(p < .05\)).

Wilcoxon signed-rank tests were performed to check key differences. A scale effect for frequency of exposure was confirmed for productive knowledge of the word form where words were encountered in more informative contexts (\(Z = -3.397, p < .05\)). This was the case for both immediate and delayed tests. The results were also similar for the less informative context.

Similarly, the receptive knowledge of word form was significantly higher for items encountered 10 times compared with 5 times (\(Z = -3.358, p < .05\)) and 5 times compared with once (\(Z = -3.368, p < .05\)) in both the types of context and on delayed as well as immediate testing.

However, the results were slightly less clear-cut for the tests of word meaning. There was a consistent scale effect for scores for productive knowledge of word meaning in the more informative context with significantly higher scores for items encountered 10 times rather than 5 times (\(Z = -3.494, p < .05\)), and 5 times compared with once (\(Z = -2.810, p < .05\)) in both immediate and delayed testing. However, for words encountered in the less informative context, a significant difference was only found between 10 and 5 exposures (\(Z = -3.414, p < .05\)), but not between 5 and one exposure(s) (\(Z = -1.667, p > .05\)). This was the case in both the immediate and the delayed tests. The same results were also found for the test of receptive knowledge of word meaning.

Research question 3 focused on how all six conditions compared to each other in terms of acquisition and retention. Wilcoxon signed-rank tests on the mean scores of productive and receptive knowledge of word form (see Tables 2 and 3) showed that the combination of 10 encounters in the more informative context yielded significantly better results than the other 5 combinations (\(p < .05\)). This was the case for both the immediate and the delayed tests.

The profile was somewhat different for word meaning. The best results again emerged from the combination of 10 encounters and more informative context, but patterns in the data were less clear-cut. For example, the productive knowledge of word meaning was no better after one or five exposures with the less informative context than it was after one exposure with the more informative context.

### Table 5. Context effect for each word exposure frequency condition: receptive knowledge of word form.

<table>
<thead>
<tr>
<th></th>
<th>More informative context</th>
<th>Less informative context</th>
<th>Asymp. Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Imm.</td>
<td>Del.</td>
<td>Imm.</td>
</tr>
<tr>
<td>1 time</td>
<td>6.73</td>
<td>5.68</td>
<td>6.66</td>
</tr>
<tr>
<td>5 times</td>
<td>9.73</td>
<td>8.71</td>
<td>9.66</td>
</tr>
<tr>
<td>10 times</td>
<td>12.80</td>
<td>11.78</td>
<td>12.60</td>
</tr>
</tbody>
</table>

Note: Imm. = Immediate test; Del. = Delayed test.

### Table 6. Context effect for each word exposure frequency condition: productive knowledge of meaning.

<table>
<thead>
<tr>
<th></th>
<th>More informative</th>
<th>Less informative</th>
<th>Asymp. Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Imm.</td>
<td>Del.</td>
<td>Imm.</td>
</tr>
<tr>
<td>1 time</td>
<td>2.96</td>
<td>1.91</td>
<td>2.70</td>
</tr>
<tr>
<td>5 times</td>
<td>4.20</td>
<td>3.18</td>
<td>3.23</td>
</tr>
<tr>
<td>10 times</td>
<td>7.33</td>
<td>6.31</td>
<td>5.01</td>
</tr>
</tbody>
</table>

Note: Imm. = Immediate test; Del. = Delayed test.

*Significant at \(p < .05\).
**Significant at \(p < .001\).
context \((p > .05)\) while 10 exposures in less informative contexts were no more effective than 5 exposures in a more informative context \((p > .05)\). The receptive knowledge of word meaning was no better after 10 exposures in a less informative context than it was after 5 exposures in a more informative context \((p > .05)\); however, the results did suggest that a combination of 5 exposures in a less informative context was more effective in relation to receptive knowledge of word meaning than a single exposure in a more informative context \((p < .05)\). With regard to the delayed test scores on the receptive knowledge of word, the combination of a more informative context and 5 exposures was more effective than up to 10 exposures in a less informative context. In addition, the combination of a less informative context and five exposures did not yield better results than a single exposure in a more informative context.

Overall, these different result patterns suggest that the acquisition of productive and receptive knowledge of word form may be more affected by increased exposure to target words than the word meaning, while acquisition of word meaning may be more affected by the informativeness of the context. However, in both cases, the most effective condition for acquisition and retention is the combination of 10 exposures in more informative contexts.

### Discussion and conclusion

In line with Webb’s (2008) study, findings from this study confirm that in general, the more informative context triggered greater incidental acquisition of word meaning than the less informative context; unknown word encounters in a more informative context are more likely to lead to acquisition of word meaning than word encounters in a less informative context. This is consistent with previous findings that the availability of fewer clues for inferring a word’s meaning might lead learners to ignore unknown words in a context (Hulstijn, Hollander, and Greidanus 1996).

This study also found that the effectiveness of the more informative context in triggering the acquisition of both word form and meaning varied at different frequencies of word exposure. For example, the difference between one and five exposures in either type of context did not produce significantly different results in productive knowledge of word form. However, 10 exposures in a more informative context did have a significant effect on productive knowledge of word form. Thus, encountering a word 10 times in more informative contexts seems to encourage participants to be more attentive towards the form of unknown words. There was evidence that where an unknown word is encountered only once, acquisition of word meaning is not significantly affected by context type. With more informative contexts, productive knowledge of word meaning was enhanced after 5 and 10 exposures, compared with less informative contexts. The effect of context on incidental acquisition of word form and meaning is complicated, and more frequent encounters with the unknown word seem to be significant in making context work.

With regard to the effect of word frequency, overall, in both contexts, the participants demonstrated significant gains in acquiring the productive knowledge of word form with every increase in the number of target word encounters. This is in line with previous studies (González Fernández and Schmitt 2015; Laufer and Roitblat-Rozovski 2011). For example, as shown in Heidari-Shahreza and Tavakoli (2016), increasing the number of exposures for target words has a positive effect on
incidental vocabulary acquisition. One finding that is not reported in previous studies is that the results for the acquisition of meaning vary according to the context type. For example, the present study shows that increases in encounters in a more informative context lead to a significant improvement in word meaning acquisition. However, where words are encountered in a less informative context, the smaller increases in exposure are less effective for triggering acquisition of word meaning. In other words, the repetition of new words in more informative contexts seems to have a greater effect on the acquisition of word meaning than the repetition of words in less informative contexts. This highlights the importance of more informative contexts in the acquisition of word meaning, and may partly explain previous findings on difficulties faced by learners in comprehending the meaning of words despite multiple encounters (Pigada and Schmitt 2006; Teng 2014; Waring and Takaki 2003). The contextualisation of the target words may have been insufficient.

Overall, the findings of current study have underlined that, although repetition is crucial, it is difficult to determine the number of encounters that are necessary for successful incidental vocabulary acquisition. This is because many variables interact with repetition. In the present study, the context type had a strong impact on the number of repetitions needed to gain the knowledge of a word, particularly meaning. To trigger satisfactory incidental vocabulary acquisition, our study suggests that learners need to encounter new words at least 10 times in richly informative contexts. Our results show an average score of 4.26 out of 15 (28%) for productive knowledge of word form, 12.80 (85%) for receptive knowledge of word form, 7.33 (48%) for recall of word meanings and 9.66 (64%) for recognition of word meanings. This suggests that all participants in this study acquired significant partial word knowledge. In Pellicer-Sánchez and Schmitt’s (2010) study, learners only demonstrated receptive knowledge of word form for 70% of target items even after encountering the words 28 times. Similar results were also found by Teng (2015). The improvement in word gain in the present study might be due to the effect of an optimum context, that is, 10 encounters with the target words in more informative contexts. However, it should be recognised that acquiring full word knowledge through incidental encounters is something of a challenge for learners. Future experiments on the combination of more informative context and more word exposures (e.g. 15+ times) are needed to help identify more precisely optimum conditions for incidental acquisition of full word knowledge.

This study inevitably has a number of limitations, which need to be considered in future research. Only 15 target items were used, with only two distinctions of ‘context’ and, as noted above, only three different frequency conditions. Future research could explore further distinctions of ‘context’ and a larger number of target items. Furthermore, the participants encountered the target words in short unrelated sentences and this may have triggered a heightened awareness of the target words. It would thus be useful to explore the influence of repetition on incidental acquisition of new words under a range of reading conditions such as reading of longer texts. Finally, as Stæhr (2008) has shown, EFL learners’ vocabulary size could explain a significant and substantial portion of the variance in the scores of listening, reading and writing, having participants with a larger vocabulary size may yield different results.

Despite its limitations, our study has clear implications for the design of teaching materials. It is difficult for teachers and material designers to control the richness of context in authentic reading materials, but raising awareness among teachers about the importance of rich context is important in developing their understanding of the potential for incidental vocabulary acquisition. Teachers, particularly for low frequency words, may need to take steps to ensure that students encounter new words in more informative contexts, supplementing wherever necessary the existing reading texts with specially designed material providing rich contextual clues. In addition, textbook writers need to take the rate and regularity of repetition of new words into consideration. Learning gains measured at immediate post-test were considerably higher than at the delayed test two weeks later, pointing to the necessity for learners to rehearse newly acquired words regularly in order to reinforce the initial form–meaning connection. Further, while the knowledge of word form is likely to be acquired incidentally through repeated encounters in context, knowledge of meaning is
probably more challenging and likely to be a longer process. Therefore, large amounts of meaning-focused input are necessary. Learning extensively through reading should be included in learning programmes even though it is recognised that learners may only acquire partial word knowledge incidentally. This implies that teachers need to support their learners’ vocabulary learning with a range of more explicit approaches, such as lessons on word structure, decontextualised practice of the target words and practice in sentence context (Laufer and Roitblat-Rozovski 2011). Typographic salience (target words underlined and printed in bold typeface), as shown in Peters (2012), could also be an appropriate and effective way to establish initial form–meaning connections of lexical items in a classroom-based course.

**Note**

1. Information on the validation of this test is described in Nation and Gu (2007), and it was successfully applied by Peters (2014). The average score of the selected students was 26.74 out of 30 on the 2000-word level test and the average scores for the 6 different experimental groups did not differ significantly (Condition 1: 26.65 out of 30; Condition 2: 26.84 out of 30; Condition 3: 26.68 out of 30; Condition 4: 26.65 out of 30; Condition 5: 26.75 out of 30; Condition 6: 26.87 out of 30, \( p = .65 \)).

**Disclosure statement**

No potential conflict of interest was reported by the author.

**References**


Appendix 1 Examples of two types of context (1 item out of 15).

More informative context

Occurred one time (Condition 1)
To intimidate

- The gang intimidated the bank manager with their offensive behavior in order to rob the bank.

Occurred five times (Condition 3)
To intimidate

- The gang intimidated the bank manager with their offensive behavior in order to rob the bank.
- You have no right to intimidate this man to vote for you.
- It is not a good idea to intimidate people for doing what you want.
- Do you really think that you can intimidate people for being loyal to you?
- I have no way but to find someone to intimidate the staff for fixing the electricity problem.

Occurred ten times (Condition 5)
To intimidate

- The gang intimidated the bank manager with their offensive behavior in order to rob the bank.
- You have no right to intimidate this man to vote for you.
- It is not a good idea to intimidate people for doing what you want.
- Do you really think that you can intimidate people for being loyal to you?
- I have no way but to find someone to intimidate the staff for fixing the electricity problem.
- He is trying to intimidate you for not telling the truth.
- Their large size alone is enough to intimidate any animals that may attack them.
- The salesman intimidated the old woman while signing the document by telling her that he would take away her goods.
- The thief intimidated the boy to not inform the police.
- The little boy was intimidated to give the money to the man.

Less informative context

Occurred once (Condition 2)
To intimidate

- You have no right to intimidate this man.

Occurred five times (Condition 4)
To intimidate

- You have no right to intimidate this man.
- Don't try to intimidate people.
- I believe you will not be intimidated by this.
- Don't let anybody intimidate you.
- This can never intimidate us.

Occurred ten times (Condition 6)
To intimidate

- You have no right to intimidate this man.
- Don't try to intimidate people.
- I believe you will not be intimidated by this.
- Don't let anybody intimidate you.
- This can never intimidate us.
- He came close to me, trying to intimidate me.
- Are they just trying to intimidate you?
The little boy was often intimidated.
This guy often intimidates the people in this area.
We will not allow anybody to intimidate us.

**Appendix 2. Sample test items (one item out of 15)**

**Test 1: Productive knowledge of word form**
To make somebody frightened is to ______.

**Test 2: Receptive knowledge of word form**
To frighten somebody is to ______.
- a. nominate
- b. stimulate
- c. intimidate
- d. distribute
- e. I don’t know

**Test 3: Productive knowledge of word meaning**
If you are intimidating somebody, you are making him ______.

**Test 4: Receptive knowledge of word meaning**
Intimidate
- a. make something worse
- b. make somebody happy
- c. make somebody scared
- d. make something better
- e. I don’t know