

*Improving reading fluency and comprehension
in adult ESL learners using bottom-up
and top-down vocabulary training*

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Abstract

The current research examines the effect of two methods of vocabulary training on reading fluency and comprehension of adult English as second language (ESL) tertiary-bound students. The methods used were isolated vocabulary training (bottom-up reading) and vocabulary training in context (top-down reading). The current exploratory and quasi-experimental study examines the effectiveness of these methods in two intact classes using pre- and posttest measures of students' reading fluency and comprehension. The results show that bottom-up training had a negative impact on fluency and comprehension. In contrast, top-down training positively affected fluency but had no impact on comprehension. Further, the results do suggest that fast-paced reading may potentially lead to improved comprehension. These findings have implications for the type of language instruction used in classrooms and, therefore, for teachers of adult ESL learners.

Keywords: reading fluency; comprehension; isolated word training; bottom-up strategy; context word training; top-down strategy

1. Background

For tertiary-bound students who are learners of English as a second language (ESL), developing an appropriate level of reading skills, particularly comprehension, is essential for academic success (Akinwumiju, 2010; August, 2011; Iwai, 2009; Lukhele, 2013; Pretlow, 2009). As reading is an active process requiring word recognition and language comprehension (Foss, 2009; Gough, 1996; Jiang, Sawaki & Sabatini, 2012), developing a sufficient level of learner vocabulary seems to be key to achieving this. Despite studying English for a number of years, many ESL students continue to have limited word knowledge and this impacts both on their reading and on their education in general. For example, when Mokhtar et al. (2010) conducted a study with Malaysian tertiary students to assess their knowledge of high frequency words, they found that most had a less than an adequate vocabulary for academic success.

Pointing to the close relationship between vocabulary and the development of reading, Mokhtar et al., (2010) suggest that “in terms of vocabulary development . . . poor readers read less, become poorer readers, and learn few words” (p. 78). The converse is that as competent readers read more, they learn more words and have better comprehension (Brantmeier, 2005; Foss, 2009). In addition, reading is a highly self-motivational activity and the inability to read well may lead to a loss of motivation and increased levels of frustration which, in turn, may also result in students reading less (Ahmad, 2011; Mokhtar et al., 2010; Rochecouste, Oliver, & Mulligan, 2012). Thus the effects of poor reading skills appear to be cumulative. This claim is supported by longitudinal research undertaken in the first language (L1) context where readers who demonstrate difficulties with vocabulary recognition and understanding have been found to be troubled by this in an ongoing and academic way (Baumann, Kame’enui, & Ash, 2003; Hart & Risley, 2003). There is an additional flow-on effect of poor reading skills for university-bound students, namely a reduced quality in their writing skills, which are also essential for university success (Mokhtar et al., 2010).

It does appear that there is a need for more research into the ways that reading can be developed, especially for adult second language (L2) learners (Nation, 2002; Tze-Ming Chou, 2012; Zimmerman, 1997). In particular, and relevant to the current study, there are calls for research into different methods of instruction that may improve reading fluency and comprehension (Mokhtar et al., 2010). Although Martin-Chang and Levy (2005) sound a cautionary note about how such research might translate into common teaching practice, there is no doubt that further investigations are needed about how best to improve reading skills, particularly of L2 adult learners seeking to study at university.

Given the integral role they play in the reading process, it is not surprising that methods used to improve reading have included vocabulary instruction, specifically word recognition practices, and training to develop both fluency and reading comprehension (August, 2011; Lipka & Siegel, 2012; National Reading Panel, 2000; Nisbet, 2010; Yu-han & Wen-ying, 2015). Other researchers provide support for using reading methods that bring together these skills to assist ESL learners with their reading (e.g., Lipka & Siegel, 2012). One early quasi-experimental instruction study was conducted by Zimmerman (1997). She compared the effectiveness of more traditional word skill development practices to interactive vocabulary instruction with 35 L2 adult high intermediate level learners from preparatory English courses held at two U.S. university campuses over a 10 week period. The training was based on high-frequency general academic vocabulary selected from the University Word List (UWL; Xue & Nation, 1984) with 10% being nonwords. These same words were used in randomised lists for pre- and posttesting. Zimmerman (1997) found that meaningful repetitious use of words in interactive learning did have a positive impact on vocabulary acquisition and on reading development more generally. She does caution about interpretation of the results because of the small size of the study, and it must be noted that there were a number of uncontrolled factors in the research design. However, the results do seem to suggest that vocabulary instruction may have a role to play in reading instruction in the classroom.

2. Word recognition, reading fluency and comprehension

For L2 learners word recognition is “the knowledge of words and word meanings” (Diamond & Gutlohn, 2006, para. 1), but it also extends beyond this, involving “the ability to recall meaning, infer meaning, comprehend a text and communicate orally” (Zimmerman, 1997, p. 123). Further, it is an integral part of learners’ L2 vocabulary development. In the context of reading, word recognition involves linguistic, psycholinguistic and sociolinguistic components (Zimmerman, 1997). In order to process written words, phonological and orthographical decoding is a prerequisite (Breznitz & Berman, 2003) or, as Drucker (2003) expresses it, “reading is the phonological decoding of written text” (p. 23) and for ESL learners these skills need to be developed in their L2.

Related to word recognition is reading fluency. This is precise and fast reading, including word recognition, accompanied by comprehension (Levy, Abello, & Lysynchuk, 1997; Martin-Chang & Levy, 2006). From this it can be seen that vocabulary knowledge contributes to the development of reading fluency and comprehension in L2 learners. This is reflected in the research methodology of a number of studies in which fluency has been measured as fast and accurate vocabulary recognition.

According to Breznitz and Berman (2003), fluency can be evaluated in two ways. The first way is by determining efficient word recognition and comprehension (Carver 1990; Gough & Tunmer, 1986). For example, Breznitz (1997) in a study of accelerated and controlled paced reading with dyslexic readers found fewer reading errors and higher comprehension at accelerated reading rates, and fewer errors, but a considerable decrease in comprehension at the slowest paced reading rates. The second way of measuring fluency is by simply calculating word reading rate, and this has been done in research which has tested word reading fluency of school-aged children (e.g., Swanson & O'Connor, 2009; Zumeta, Compton, & Fuchs, 2012). Using this method, a high reading rate or fast-paced reading, equates to fluency.

Pointing to the relationship between fluency and comprehension, a study by Breznitz and Share (1992) found that both self-paced and fast-paced reading conditions resulted in high levels of comprehension in young children. Later studies confirmed these findings (Breznitz, 1997a; Breznitz & Berman, 2003). However, when pressed to accelerate their reading rate, young readers read 20% faster than at self-paced rate, fourth graders 15% faster and college students 10% with all producing fewer decoding errors and improved comprehension with variances for age and reading efficiency noted. Despite the ever increasing numbers of L2 learners engaging in adult education, there are relatively few such studies of reading rates, fluency, comprehension and the efficacy of different reading methods for this cohort.

3. Reading methods

Studies aimed at improving reading rate and comprehension especially in the L1 context have included the use of two related training methods. The first is based on the isolated word or "bottom-up model" and the second is the "in-context" or top-down method.

3.1. Bottom-up

The bottom-up model involves readers employing decoding strategies. Zhang (2008) describes it in the following way: "learners should be made aware that the use of reading strategies is essential to successful reading and some so-called bottom-up strategies such as 're-reading' and 'checking the exact meaning of words' are important" (p. 112). Specifically, this bottom-up and linguistically oriented approach involves recognition and recall (Breznitz & Share, 1992) with readers breaking words into syllables, using sentence syntax, matching synonyms or phrases, paraphrasing, and using a dictionary while reading (Abbott,

2005). Thus, this approach is based on the cognitive processes of perception, short term memory, judgment, and reasoning, which results in improved comprehension (Jiang et al., 2012).

Various alternative forms of isolated word training have been described in the literature and, as a consequence, have been the focus of other studies. As described earlier, Zimmerman (1997) combined various forms of vocabulary training with reading instruction.

Based on the premise that most classroom vocabulary knowledge is gained through the receptive methods (i.e., reading and listening), Webb (2005) undertook two experiments to test whether receptive or productive learning can facilitate vocabulary knowledge development. The first was conducted with two groups of first year university ESL Japanese speakers ($n = 66$) and the second with 49 Japanese students at Kyushu University, Japan. In the second study, which followed the same procedure, twice as many words (20) were chosen as target words. These words were unknown to the participants and some were nonwords created to represent English words both phonetically and orthographically. They were presented differently to the receptive group and productive group. For the receptive group the target English words were presented with their meaning in Japanese and then glossed in three English sentences with the only instruction being to learn the meaning of the target words (vocabulary in context). The second, productive group received the same word pairs, English with Japanese explanation (vocabulary in isolation), and was told to write a sentence using each target word and also to learn the meaning. Each group was given 12 minutes to complete the test in the first experiment and the second experiment was untimed. This was followed by a 10-part test with five parts measuring receptive and five parts productive word knowledge. Contrasting results were revealed with the receptive group producing higher retention of vocabulary knowledge than the productive group in the first experiment. However, this was not the case in the second experiment when more words were used. Although the study would have been enhanced with a delayed posttest, the results do suggest that gains in vocabulary knowledge are possible using both receptive and productive strategies.

3.2. Top-down

The top-down approach is based on the argument that reading comprehension requires more than simple linguistic knowledge, and that the use of schema theory is a key to unlocking comprehension, especially for L2 learners. The practical application of this involves drawing a connection between a readers' background knowledge and the text (Carrell & Eisterhold, 1983). This model uses

higher-level cues including such strategies as global background knowledge, skimming and locating main ideas, integration of information, recognition of inferences and prediction, and recognition of text structure (Abbott, 2005). Independent or self-reading, paired reading and listening while reading (Li & Nes, 2001; Drucker 2003) are also promoted because “people learn to read, and to read better, by reading” (Drucker, 2003, p.25). Studies of learners from various ethnic groups have provided support for the positive impact on reading comprehension of this approach (Drucker, 2003).

Despite this body of research, “while fluent reading is recognised as a primary goal of educational instruction, the methods that best promote the development of fluency remain unclear” (Martin-Chang & Levy, 2005, p. 343). It is yet to be determined whether bottom-up or top-down approaches are best or, indeed, if they should be used in concert. It is the purpose of the current study to explore this. As such the current investigation employs both bottom-up and top-down training methods (Marin-Chang & Levy, 2005, 2006) to determine if they can be used to improve fluency and comprehension in university aspiring students. Specifically, bottom-up training was performed using isolated word training and top-down training was achieved using “in-context” word training.

4. Isolated word training model

Isolated word training is when target words are read and coached in isolation of a text in preparation for reading (Martin-Chang, Levy, & O’Neil, 2007). Research began with Samuels in the 1960s and was replicated by other researchers in subsequent decades (e.g., Ehri & Wilce, 1980; Singer, Samuels, & Spiroff, 1974) but then fell from favour. It has re-emerged as the focus of reading investigations beginning with the work of Johnston (2000).

Underpinning this model is the belief that reading fluency requires sufficient word recognition. It is argued that intentional vocabulary training is useful for beginner readers with limited reading ability and vocabulary knowledge. The outcomes of studies using this method are generally positive (e.g., Zimmerman, 1997).

5. Context word training model

The second model is based on the context or top-down approach. Although the focus of this is meaning making, researchers have also suggested that vocabulary acquisition is a natural and incidental consequence as L2 learners listen and read with comprehension (Hulstijn, 2001; Hunt & Beglar, 2002; Knight, 1994; Nagy, Herman, & Anderson, 1985; Rieder, 2003; Schmitt, 2008; Zimmerman, 1997). As Johnson (2000) indicates, the development of word understanding is

assisted by continued exposure to words in meaningful context. According to Ahmad (2011), incidental vocabulary learning not only promotes vocabulary learning, but, as he also suggests, it motivates learners to read more extensively than the alternative of intentional vocabulary training activities.

Initially this whole language approach, including the learning of vocabulary in context, rather than by word lists, was supported by an influential L1 study undertaken by Goodman (1965), which was subsequently retested by Alexander (1998) and then supported by others (e.g., Archer & Bryant, 2001; Kim & Goetz, 1994; Nation & Snowling, 1998). The basis of such research is that reading is schemata or context driven (Alexander 1998; Goodman, 1965; Weaver, Gillmeister-Krause, & Vento-Zogby, 1996). More recent research supports this showing that children's reading was faster and more accurate when words of a text were first introduced in context (Martin-Chang & Levy, 2005). However, guessing meaning from context was only partially accepted as a means of learning vocabulary by Hunt and Beglar (2002), who suggested that proficient readers with a defined strategy for working out meaning become successful readers. Hence a combined approach to recalling and inferring meaning is suggested as necessary because of the many skills required to effectively acquire vocabulary (Alexander, 1998).

In a series of studies undertaken in the L1 context Martin-Chang and Levy (2005, 2006, 2007) compared the efficacy of isolated word training and context training. They had children read high frequency words aloud, trained the children using the two methods and then examined the results to see if the training transferred into their ability to read the same words in a new context. In their 2005 study they found isolated training was shown to improve reading rate and that poor readers (as determined by pretesting using achievement tests) learned more words in this condition whilst learning words through context training was found to result in faster reading and improved accuracy. In their next study, Martin-Chang and Levy (2006) found that both poor and good readers who studied training words in isolation demonstrated improvements both in fluency and accuracy, and greater retention. In 2007, they used individualised training material and this time found children "could read more words following context training than following isolated training" (p. 45). They also read with greater accuracy; however, there were no significant differences in word retention between the two training methods.

6. Adult L2 learners

Despite the desire of educators, many L2 adult students enter university ill-equipped for success in terms of academic achievement (RocheCouste, Oliver, &

Mulligan, 2012). It has been suggested that this is because even after many years of ESL tuition, they lack the academic vocabulary necessary to achieve their educational goals (e.g., Mokhtar et al., 2010). There has been increased interest in researching types of instruction that may help learners improve. This includes research on the impact of isolated word training, training of vocabulary in context and associated strategies for vocabulary development, the use of decoding strategies, and, how to improve reading fluency using self-paced and fast-paced reading rates.

As discussed, such research includes the vocabulary studies by Zimmerman (1997) and isolated word training and contextual word training by Webb (2005). Another study by Jiang et al. (2012) concerned the development of phonological decoding and word recognition skills and their contribution to reading fluency and accuracy in adult Chinese ESL students. They found that speed and accuracy of word recognition are indicators of reading fluency, perhaps because the learners come from a logographic writing system and as such are slower at sounding out words (phonemic decoding) and at sight recognition of whole words than those who come from an alphabetic background (e.g., English). Further, they found that L2 reading fluency positively impacts upon text comprehension.

It is the aim of the current study to examine the generalisability of such findings to other cohorts of learners, specifically adult ESL learners. It seeks to examine the effectiveness of (a) bottom-up, and (b) top-down methods of vocabulary training (specifically word recognition) on reading fluency and comprehension for adult ESL tertiary-bound students. Further, unlike previous laboratory-based research, the current study examines the effectiveness of these methods in authentic and intact classrooms. Hence, the primary research question is: Does type of vocabulary training (top-down vs. bottom-up) improve reading fluency and comprehension for adult learners in ESL classrooms?

7. Method

This exploratory and quasi-experimental study was undertaken as an intervention study exploring the impact of isolated vocabulary (bottom-up) instruction (Experiment 1) and context vocabulary (top-down) training (Experiment 2) on reading fluency and comprehension. Specifically, both experiments employ(ed) a mixed design where a set of words was taught in Phase 1, and the transfer of learning was measured during the reading of a subsequent passage in Phase 2. The critical difference between the experiments occurred during the training phase. However, unlike the work of Martin-Chang and Levy (2005), this experiment is neither yoked nor laboratory-based, but it was rather undertaken in authentic and intact mixed level classrooms.

7.1. Setting

Data collection took place in two classes at a metropolitan tertiary institution, in Western Australia, and specifically at the English Language Centre of that university. This setting is familiar to the researchers, and the management provided full support for the investigation.

7.2. Participants

Although 29 ESL tertiary students volunteered to participate in this study, due to absenteeism and missed training sessions, only 20 participants from two ESL classes completed the experiment. These adult students are from diverse cultural and language backgrounds. Eight males and 12 females ranging in age from 18 to 44 years completed the study. It is acknowledged that this is a large age range, but it reflects the intact nature of the classroom data and the cohort enrolled at the time of the data collection. Notably, the majority of these participants are graduates, many of whom have several years work experience, with about 20% being postgraduates and a minority, approximately 10%, having no degree. There is also an array of academic interests as indicated by their intended university studies which include three main areas of study: Almost two thirds of the participants have a focus in the sciences including health and engineering, 30% are planning to undertake business studies, and the remaining 20% plan to enter humanities courses. Prior formal English education shows 50% have studied English for a number of years, 20% for 1-3 years and almost one-third for a limited 6-month period.

The participants' overall IELTS scores (or equivalent) on entry in this study ranged from 5.0 to 6.5, with a variation in the IELTS *reading* band scores from 5 to 6.5. Again, this large range reflects the reality of the cohort and classroom situation. They were all enrolled in classes that prepared them for graduate study classes (e.g., Bachelor, Masters or Doctorate degrees). Table 1 includes the demographic information about the participants.

Table 1 Background, gender and age of participants

Country of origin	Gender	Age	Level of education	Work/study prior to course	L1	Entry level IELTS reading score	English study prior to course	Intended study at Australian university
Class 1								
South Sudan	F	35-44	G	FT	Arabic/ Muro	5	5 yrs+	Geology
China	F	25-34	D	FT	Chinese	6	5 yrs+	Nursing
China	M	18-24	UG	S	Chinese	5.5	5 yrs+	Geospatial technology
Iran	F	25-34	G	FT	Persian	5	5 yrs+	International relations
India	F	25-34	G	FT	Hindi/ Punjabi	6.5	1-3 yrs	Business management
China	F	18-24	SC	S	Chinese	6	5 yrs+	Business management
China	F	18-24	G	FT	Chinese	6.5	5 yrs+	Geology
Thailand	F	25-34	G	FT	Thai	4.5*	6-12 mths	Nursing
China	M	25-34	G	FT	Chinese	5.5	5 yrs+	Engineering
Class 2								
Oman	M	35-44	D	FT	Arabic	3.5*	<6 mths	Health information management
Turkey	M	25-34	G	S	Turkish	**	6 mths-1yr	Design & art
India	M	25-34	G	FT	Punjabi	5.5	<6 mths	Health administration
Thailand	M	18-24	G	NG	Thai	5	5 yrs	Communication
Iraq	M	35-44	MA	FT	Arabic	5.5	1-3 yrs	Engineering
Iraq	M	35-44	MA	FT	Arabic	5	<6 mths	Engineering
Japan	F	35-44	G	FT	Japanese	5.5	1-3 yrs	Business management
Cambodia	F	18-24	PG	FT	Khmer	5	5 yrs+	Accounting
Indonesia	F	25-34	G	FT	Indonesian	5	5 yrs+	Science
Nepal	F	25-34	G	S	Nepali	5	<6mths	Nursing
China	F	18-24	UG	S	Chinese	5.5	3-5 yrs	Marketing

Note. F = female; M = male; S = student; GR = graduate; D = diploma; UG = undergraduate; SC = school; MA = Masters; PG = postgraduate; FT = full-time employment; PT = Part-time employment; * entry into the ESL course through a pathway course to improve English language level; ** already has direct entry through pathway entry into university.

7.3. Materials

Although this investigation was based on Martin-Chang and Levy's (2005) study, as that was conducted with children, the materials in this study were selected to be suitable for adult ESL classes covering topics with which the participants were known to have some familiarity (based on their backgrounds and the course syllabus). Some of these materials were chosen from suggested course texts; others were selected from related sources. Therefore, in contrast to Martin-Chang and Levy (2005), all texts used in both experiments were based on actual class texts which had been selected specifically for teaching purposes in this context.

The materials consisted of a word training list, a transfer text and a control text for Experiment 1, and, for Experiment 2, another transfer text and a control text, as well as a training text. In order to test for fluency, the texts were selected to be of comparable length, containing on average 570 words.

The word training list for Experiment 1 consisted of 40 frequently used academic words. To develop this list, a course text was selected and the academic words within the text were chosen using the Academic Word List (AWL) Highlighter website (<http://www.nottingham.ac.uk/alzsh3/acvocab/awlhighlighter.htm>). The selected words were used in the training and transfer assessment of all the participants. The transfer text "Car Glut Threatens Sustainability of Cities" for Experiment 1 was a novel course text and included all the 40 words taught.

For Experiment 2 a text was selected and modified to be used as the training text. It included the 32 target words that were thematically aligned with the course syllabus, again based on the AWL list as indicated above and, therefore, providing some comparability. The selection of an authentic text with such words resulted in a set less numerous than the targeted 40 words. It is acknowledged that this is a limitation of the current design, but it was done because the text choice was seen to be a vital part of this study. The transfer text, also a novel text "Australia's Climate Change, Wind Farming, Coal Industry and the 'Big Carbon Plan': Mine Coal, Sell Coal, Repeat Until Rich" contained the same 32 contextually taught words.

The control texts were also novel texts: "Driven to despair in Australia's outer suburbs" for Experiment 1 and "Illicit Drug Use in Regional Australia, 1988-1998" for Experiment 2. They did not contain any of the target words.

7.4. Procedure

Once recruitment of the consenting participants was complete, as a first step in the study an individually structured survey was conducted to collect background information about the participants. Then the two experiments were conducted sequentially and in two phases: Phase 1 was the training phase and Phase 2 the posttest assessment phase (see Figure 1). As in Martin-Chang and Levy (2005), for both investigations the training was quite different for each experiment.

7.4.1. Experiment 1

Phase 1 commenced with a pretest of the participants' recognition of 40 training words. These individual assessments took no more than a few minutes of each student's time between classes. During this assessment any errors that occurred while individual participants read the chosen lexical items to the investigator

were noted. Later that week after all participants for each class had been assessed, isolated vocabulary training for Experiment 1 began. The participants received training in their respective classes with all members of the class participating regardless of their involvement in the study. To minimise disruption, this training occurred twice per lesson sometimes at the beginning of the lesson, towards the end or at an appropriate “focal change” interval during the lesson.

The training involved each of the target words being presented in isolation. A Microsoft Office PowerPoint had been produced for the training with one of the 40 target words appearing on each slide. These were projected onto a screen at the front of the class for the training. A training session involved the appearance of the target words for a maximum of 2-4 seconds. The words were read aloud by the investigator and then by the participants together as a class. This procedure was repeated a second time in the same lesson, again using a PowerPoint with the target words in a different order each time. This was done for three days, resulting in a sum of six repetitions for each word. The 40 target words were randomized for each PowerPoint and the duration of word appearance varied from 2-4 seconds per list.

In Phase 2, which occurred in Week 2 of the investigation and after the training was complete, the participants were posttested individually in a quiet room using the transfer text and the control text. As with Martin-Chang and Levy’s (2005) study, participants were informed that their reading rates would be recorded as they read aloud. They were also instructed to read for understanding as comprehension questions would follow the reading of each text. Each student was allowed 20 minutes to read both the transfer text and control text. Participants were then asked four comprehension questions to assess their understanding of each text, the results of which were recorded by the investigator. Although using only four comprehension questions may be a limitation, pilot testing determined that, on balance, this was the most feasible number given the constraints of time, the individual nature of the testing procedure and the limited scope of the text. Any errors or omissions were noted on a modified copy of the texts by the investigator. There was a break of one week between Experiment 1 and Experiment 2 and, therefore, no training occurred in Week 3.

7.4.2. Experiment 2

In Phase 1 the training involved the presentation, in context, of 32 target words (see the note above in 7.3 about the number of words). The whole class training for Experiment 2 began in Week 4 and continued through to Week 5. The training text was prepared in large type (size 24) as a Microsoft Office Word document. The target words were highlighted and each appeared at least twice in

the text in red print. This Word document was projected onto a screen at the front of the classroom. For the training sessions the trainer read the text to the class while they followed and read the highlighted words aloud. If students had difficulty reading the target words or made mistakes, they were corrected. This training was completed twice per teaching session for three days, thus each target word was read six times by participants.

Phase 2 was conducted in the same way as in Experiment 1, using the same 32 training words for the transfer text and none appearing in the control text. As with Experiment 1, Experiment 2 was conducted with the investigator meeting individual students on campus in the students own time between or after classes to listen to them read a transfer text and control text while timing them and then asking four comprehension questions.

Week	Experiment 1	Experiment 2	Mode
1	Pre-interview participants		Individual
	Pretest assessment: isolated word recognition + comprehension		Whole class
	Training begun (Class 1) Training completed (Class 2)		
2	Training completed (Class 1)		Whole class
	Posttest assessment: reading transfer text & control text (Classes 1 & 2)		Individual
3			
4		Training begun (Class 2)	Whole class
5		Training begun (Class 1) Training completed (Class 2)	Whole class
		Training completed (Class 1)	Whole class
6		Posttest assessment begun: reading transfer text & control text (Classes 1 & 2)	Individual
		Posttest assessment completed: reading transfer text & control text (Classes 1 & 2)	Individual

Figure 1 Research design and timetable

Because of the intensive syllabus of the course in which the participants were enrolled, which was of seven weeks' duration and included only two hours per day of face-to-face classes, and because of several public holidays, there was reduced contact time for training. Also, the final week (Week 7) of the course was fully focused on course assessments. Even so, training was conducted over the majority of the course, namely five of the seven weeks. The posttraining individual assessments were conducted outside of class time. Once again, this is an acknowledged limitation of the current study; however, it also reflects the constraints that occur when undertaking research in classrooms rather than laboratory settings.

7.5. Data analysis techniques

As a first step, each of the student's fluency and comprehension scores were calculated. The scores for Experiment 1 and Experiment 2 were then compared using a *t* test. Thus, a causal-comparative technique was implemented to determine any differences that occurred. Although such a technique provides inconclusive data, "causal-comparative studies are of value in identifying *possible* causes of observed variations in the behaviour patterns of students" (Fraenkel, Wallen, & Hyun, 2012, p. 12).

8. Results

8.1. Experiment 1

The outcome of the pretest, presented in Table 2, in which all participants individually read aloud 40 selected words, showed a range of errors from one student making only two mistakes to another reading more than half of the words incorrectly (i.e., 19 out of a possible 40). However, a comparison of the results indicates that there was no significant difference between the two classes with the mean for correctly read words in Classes 1 and 2 being 29.25 and 29.82 respectively, with $t = 0.20$ and $p = .841$. Nevertheless, these results also indicate that a significant number of words were unknown and, therefore, undertaking vocabulary training as part of learner instruction was deemed beneficial.

Table 2 Comparisons of classes: correct words (max. 40)

	Class 1	Class 2
<i>M</i>	29.25	29.82
<i>SD</i>	7.05	5.12
<i>Comparison of classes: $t = 0.20$ $p = .841$</i>		

Upon completion of the training the participants undertook a posttest by reading the transfer text (which contained the words taught) and the control text (which did not). Reading times were then measured, both in seconds and words per minute, as the participants read the texts orally while being timed by the investigator. Comprehension was measured as a score out of 4.

An analysis of the results, shown in Table 3, shows a significant difference between reading fluency of the transfer text and the control text for Experiment 1. As can be seen, after training, the participants were significantly slower in terms of time taken in reading the transfer text ($M = 391.40$ seconds) than the control text ($M = 365.55$ seconds; $p = .002$) and according to the mean number

of words read per minute (wpm) in the transfer text ($M = 95.84$ wpm, $SD = 17.29$) and the control text ($M = 112.09$ wpm, $SD = 15.84$, $p < .0001$). With respect to the participants' comprehension, the mean score of the responses for the control text ($M = 1.75$, $SD = 1.29$) was also significantly higher ($p > .05$) than for the transfer text ($M = 1.10$, $SD = 0.55$). This suggests that bottom-up training had a negative impact on fluency and comprehension as the participants did significantly better on the control task than the transfer task.

Table 3 Overall comparisons: Experiment 1

	<i>M</i>		<i>SD</i>		<i>t</i>	<i>p</i>
	Transfer text	Control text	Transfer text	Control text		
Reading times (seconds)	391.40	365.55	54.58	53.07	3.62	.002
Words per minute	95.84	112.09	17.29	15.84	8.70	.000
Comprehension (max. 4)	1.10	1.75	0.55	1.29	2.16	.044

8.2. Experiment 2

Similar to Experiment 1, after training the participants completed a posttest, the results of which are offered in Table 4. Once more the analysis was based on a comparison of the results for reading fluency and comprehension. The results show that the reading time for the transfer text was significantly faster ($M = 324.24$ seconds) than for the control text ($M = 359.80$ seconds; $p < .0001$), and the number of words read per minute was significantly higher for the transfer text ($M = 99.38$) than the control text ($M = 91.61$; $p < .0001$). However, the participants' comprehension scores for the transfer ($M = 1.00$, $SD = 0.92$) and control texts ($M = 1.60$, $SD = 1.10$) were not significantly different.

Table 4 Overall comparisons: Experiment 2

	<i>M</i>		<i>SD</i>		<i>t</i>	<i>p</i>
	Transfer text	Control text	Transfer text	Control text		
Reading times (seconds)	324.25	359.80	47.26	60.41	6.23	.000
Words per minute	99.38	91.62	14.64	15.38	7.21	.000
Comprehension (max. 4)	1.00	1.60	0.92	1.10	1.93	.069

It appears from these results that contextual training is linked to improved reading speed; however, it had no impact on understanding. It is possible that the increased saliency, by way of textual enhancement (i.e., large font and highlighting), may have contributed to the result, but only advantaging the learners' fluency and not their comprehension. It is a methodological issue that needs to be considered in future research.

It is also interesting to note that in Experiment 2 there were significant differences in reading speed of the two classes with Class 2 reading much faster ($M = 305.36$ seconds) than Class 1 ($M = 347.33$ seconds; $p = .045$; see Table 5).

Table 5 Transfer text reading time (seconds)

	Class 1	Class 2
<i>M</i>	347.33	305.36
<i>SD</i>	36.49	48.02
<i>Comparison of classes: $t = 2.158$ $p = .045$</i>		

Why such differences occurred is difficult to explain, particularly as this was not the case in Experiment 1. There was a higher proportion of Chinese participants coming from a logographic first language background in Class 1. These students may have had more difficulty with word recognition and thus read less fluently than others from nonlogographic or alphabetic language backgrounds, as proposed by Jiang et al., (2012), but why this would only affect the results in Experiment 2 and not 1 is not clear.

9. Discussion

With respect to bottom up training, presenting training words first in a list did not transfer into the ability of the participants to read these words fluently and with comprehension when reading them next embedded in a text. Therefore, the current findings are contrary to those of previous studies where isolated vocabulary training has been found to produce increased fluency and comprehension (e.g., Breznitz & Share, 1992; Levy, Abello, & Lysynchuk, 1997; Martin-Chang & Levy, 2006). It is possible that this result may reflect the participants' limited English proficiency and also their minimal exposure in general to written English texts.

According to Jiang et al. (2012), a diversity of cognitive processes is required for a successful bottom-up learning process to successfully produce fluency of word recognition, and it is possible that limited proficiency of the participants in this study impacted on their ability to access such processes. It did seem that words taught in isolation were less readily retained in both short term and long term memory, and this may explain why it was more difficult for the participants to remember the same words when encountered in a new and embedded context. It is possible that more training and extended exposure to the target vocabulary may have led to improved results. Modifying the methodology in this way needs to be considered in future investigations.

At the same time, if these results do have any veracity at all, they do call into question some of the practices that are often used in adult classrooms. Specifically,

introducing lexis items in isolation (albeit accompanied by meaning explanation) before reading the same items in context is a quite common practice, particularly in ESL classrooms in Australia, yet on the basis of these results doing so may enhance neither students' ability to read (aloud) these words any quicker when they are in context nor their comprehension. In fact, in this study it was found that the participants were able to read aloud the text with untrained words significantly faster (as measured by wpm) and with greater comprehension than the text containing the trained words.

Although these results do not provide support with regard to isolated word training used in this research, they do provide tentative support for previous research showing fast-paced reading results can increase reading comprehension (Breznitz & Share, 1992; Martin-Chang & Levy, 2005). Further research in this regard may provide some guidance for L2 instruction. For example, working with learners in class reading texts together at a slow pace may reduce rather than assist reading comprehension, and instead there seems to be a case for including fast-paced reading in classrooms.

In contrast to the bottom-up findings, a slight increase in reading fluency was found after the top-down contextualized training. It must be acknowledged that the testing protocol of reading aloud (potentially a bottom-up strategy) may conflate the issues under investigation and therefore affect the results. However, the findings are similar to previous research where it has been found that poor readers read more fluently when trained this way (Martin-Chang & Levy, 2006). It is proposed that the efficacy of this type of training lies with the semantic prompts or deep processing that becomes possible through context. Thus the current results align with the context superiority hypothesis first proposed by Craik and Lockhart (1972) and later supported by others (e.g., Archer & Bryant, 2001) whereby vocabulary recognition is long term and thus easily recalled when semantic prompts are used, whereas fast memory loss occurs when the use of orthography or phonemes are employed to recall vocabulary. However, in the current study there was no significant difference in comprehension, which is somewhat surprising. It might be that, as Nation (2002) suggests, while prior schemata knowledge may help readers to manage unknown vocabulary in context, the gain is in the short term only.

Even so, in terms of instruction it does seem that contextualized training may be more beneficial in the classroom than isolated training (i.e., having learners memorize lists of words), at least in terms of fluency. It also seems that this needs to be coupled with increased exposure to the target language as it appears that the retention of vocabulary items may only occur after numerous encounters. Webb (2008), for example, suggests anywhere between six to 20 encounters of a word are required before meaning is acquired. However, it may

also be the way the vocabulary is presented and subsequently processed by the learners, rather than the number of times they encounter the lexical items, that impacts on learning.

Although all the vocabulary taught was thematically compatible with the syllabus, the text containing none of the words taught in Experiment 1 was possibly more familiar (i.e., it focused on transport), which might explain the fact that this text was read more fluently than the one containing the taught vocabulary. In contrast, in Experiment 2 only the taught words and the text containing them may have been more closely aligned with the participant's knowledge and understanding of the topic. This may be a weakness of the current investigation and is something that needs careful consideration in future studies.

10. Conclusion

The current study investigated vocabulary training in isolation (bottom-up) and in context (top-down) to see whether these approaches improve fluency. The cautious answer is that with adult ESL learners the impact of using these reading strategies is small and supported only minimally in the latter case. Of course, it is possible that the participants in the current study, who had limited English language proficiency, simply require more time to learn. It is also possible that it is necessary to use more than one type of learning strategy. The combination of exposure and time may explain why success in relation to the training (at least in terms of fluency), which was done sequentially, occurred in Experiment 2.

When taken together the results do highlight the difficulties faced by adult learners as they try to understand texts when prompted to read faster (Breznitz & Berman, 2003). They also show the complex interaction of a number of factors (e.g., level of proficiency, language background and orthographic representation of L1, text type, etc.) and reading processes, and how together these impact on fluency and comprehension. Given the importance of these facets for university study, it is an area that requires much further investigation.

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