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Evaluation of CALL: Initial vocabulary learning

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Abstract

Vocabulary learning theory suggests that productive recall should strengthen learning of new vocabulary items (Nation, 2001). CALL can provide both the opportunities for productive recall and the feedback to motivate repeated efforts to reproduce new items. The latter capability appears to give CALL some advantages over paper-based exercises, in particular when such learning is done out of class time without immediate teacher feedback. Three experiments are reported. In the first two, a comparison is made of CALL exercises that encourage productive recall with those that encourage passive recall. Initially productive recall appears to give greater learning gains, supporting theory. Over time, the results are comparable. Both groups make substantial gains. Observation suggests that students apply their own strategies to enhance recall, to some extent independently of the exercise type. The advantages and disadvantages of incorporating productive recall into the design of CALL exercises need to be considered together with those of students applying their own strategies to enhance recall. Based on the outcome of this assessment, a sequence of exercises to introduce new vocabulary is designed that encourages passive and active recall as well as other strategies thought to help initial vocabulary learning. In the third experiment, these exercises are delivered over the Web for a whole semester as preparatory materials for in-class work. Outcomes are reported in terms of learning gains but particular attention is paid to evaluating maintenance of student motivation. It is suggested that CALL is an effective way to introduce new vocabulary, that such effectiveness is enhanced by designing exercises based on theory, and that it works well for sustained periods, even in circumstances where student motivation is not necessarily high, when there is close integration with classroom work.

1 Introduction

Vocabulary learning theory suggests that production opportunities should enhance the learning of new words (Nation, 2001). One distinguishing aspect of CALL compared to print exercises is that CALL can include varied and repeated production opportunities with immediate feedback. This makes it a potentially attractive option for vocabulary teaching. While production opportunities can be built into print exercises, it requires a fairly disciplined student to check the answer, check relevant feedback, make

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corrections and try again through a whole series of exercises. Further, within a print environment, it is difficult to encourage students to try to recall again when they fail, or offer hints to strengthen recall in such cases, without actually showing the answer in order that they know if they are right or wrong. In brief, the interactive nature of CALL, its ability to assess the input text without revealing the answer, and to give immediate and appropriate feedback may well provide the motivation and means to encourage students to make greater and repeated efforts to recall and produce newly learnt words, thus potentially strengthening memory for them.

Vocabulary is often pre-taught at the beginning of a unit. However, it can consume a relatively large portion of limited and expensive class time. Given CALL's potential as a medium for teaching vocabulary, it would seem that the pre-teaching of vocabulary is an aspect of language learning that is an excellent candidate for delivery by CALL. This would make expensive and limited class time available for freer production opportunities or activities that CALL cannot easily handle. That such freer use needs to be encouraged is evidenced by Laufer (1998) who shows that 'free active vocabulary' does not increase in parallel with increases in passive or 'controlled active vocabulary'. Her suggestion is that, following Swain and Lapkin (1995), we need to provide opportunities for 'pushed output'. The classroom would seem to be the place for this activity. While such use of CALL needs to take into consideration available student time outside the classroom, when properly timetabled and coordinated with class work, it provides better value for money per hour of teacher's time. There have been many studies that show CALL is as effective as a teacher in effectively delivering a wide variety of language learning tasks, including vocabulary learning (e.g. Allum, 2002). The final study reported here investigates whether this effectiveness can be consistently maintained when the work is done outside the classroom over a longer period.

Three studies are reported. Two main questions are addressed. In the first two studies, the question is asked whether use of the opportunities and motivation for repeated *productive* retrieval of new vocabulary items provided in CALL provides superior learning to use of *receptive* retrieval tasks in the same medium. In the third study, the question is whether CALL remains effective as a means of pre-teaching vocabulary when used longer term, over a whole semester, and only outside the classroom. Particular attention is paid to incorporating the results of the first two studies into the design and to the effectiveness of CALL as a means of maintaining motivation.

2 Vocabulary learning

In a broad survey of research on vocabulary learning, Nation (2001: 63–71) suggests that three stages are necessary for thorough acquisition of new vocabulary: noticing, retrieval and generative use. The first is more or less self-explanatory. Noticing involves decontextualisation. This is desirable – 'even if decontextualisation is not an essential element of language learning, there is certainly evidence that it can help learning.' Effective ways to encourage noticing include giving a definition or an L1 translation. Of the latter Nation says 'for many learners learning is faster if the meaning of the word is conveyed by a first language translation. First language translations are probably the simplest kind of definition…' Retrieval strengthens the memorizing of a word. Receptive retrieval involves perceiving the form and retrieving the meaning while

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productive retrieval means having the meaning and retrieving the form. For example, if the newly noticed words had been 'left' and 'right', we could present a diagrammatic street plan with buildings represented by either unlabeled squares or clearly labeled squares, e.g. one box is labeled as a hotel, one as a post office, etc. Receptive or productive retrieval tasks for the word 'left' would be as follows.

Receptive (squares not labeled):
The hotel is on the left. Mark the hotel with an 'H'.
Productive (squares labeled)
The hotel is on the ( ). Fill in the blank.

While the relative importance of these two types of retrieval may depend on the purpose of learning the vocabulary, a summary of the evidence (Nation, 2001: 30–33) suggests that for productive use, productive learning is clearly better, and that, even though it may consume more time and effort than receptive learning, it possibly produces better results even for receptive learning than simple receptive learning does (Ellis & Beaton, 1993). Generative use involves not just simple retrieval but production or perception of the word in a different grammatical form, in a new context, or with new meaning.

Nation gives as an example the case of a learner who has learned the word 'cement' in the meaning of 'We cemented the path', and then meets the same word in the sentence 'We cemented our relationship with a drink'. Another example he gives is learning the word 'chronic' in the phrase 'chronic pain' and then recognizing it in the phrase 'chronic backache'. Another example would be for a learner to learn the word 'talk' as a verb in the present tense and then produce it with a different inflection 'talking' or as a different part of speech 'a talk'.

A related factor described by Laufer and Hulstijn (2001) is 'task involvement'. This is constituted of three elements: need, search and evaluation. The strength of each of these contributes to the overall strength of task involvement. Need for a vocabulary item is moderate if the task demands it but strong if the learner feels the need for it. Search 'does not exist if form and meaning appear together, is moderate if learners have to search for the meaning of the item and strong if learners have to search for the form to express the meaning.' Evaluation 'involves deciding if a word choice is appropriate or not. Evaluation is moderate if the context is provided and is strong if the learner has to create a context.' For example, if a learner reads a text and has to answer comprehension questions, and the vocabulary in the text relevant to the answers to those questions is glossed, need will be moderate, but search and evaluation will be non-existent. If a learner is given a list of words with their meanings and told to write a sentence using them, need will be moderate, search non-existent and evaluation high.

3.1 Study 1

3.1.1 Aim

The aims of this study were two-fold: first, to investigate how well vocabulary learning took place through the CALL exercises; second, to see if productive retrieval tasks would result in more learning than receptive ones.

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3.1.2 Design

On the basis of current theories about vocabulary learning reviewed in the previous section, the following types of task were created. At the noticing stage, vocabulary was presented though a matching task. This used the simple matching of L1 and L2. As Nation suggests, this simple procedure ensures a fairly rapid and immediate grasp of the relevant meaning, which is important at the first stage. On average, approximately 14 words were presented in two consecutive tasks. Thus students had to match seven English words to seven Japanese words per task. Students would typically know 2–3 of these words. While in previous experiments a hint function had been included to assist in matching the remainder, it was clear from observation that students preferred to make educated guesses and repeat the matching until they got all answers correct. This process encouraged them to look carefully at the words for clues and took little time, typically less than a minute per task. Thus they matched form to meaning for new words by good guesses or trial and error. In the second stage, retrieval, productive versus receptive retrieval was a manipulated factor, as shown in Table 1. In the Laufer and Hulstijn model described above, this would be the 'search' stage. Receptive retrieval, finding meaning for form, would, according to their theory, result in *moderate* task involvement while productive retrieval, finding form for meaning, would result in *strong* task involvement with proposed greater gains in learning for the latter. The final stage, generation, was built into the retrieval tasks. Typically, in the first of these, Task 2, students had to read a simple definition and use the correct word from the new items introduced in Task 1 to complete or match it. In the second, a sentence in which fairly typical use of the word was exemplified had to be completed by inserting one of the newly-learned words. This provided receptive or productive retrieval of the word in two new contexts, which Laufer and Hulstijn define as one type of generative use. The word's meaning was kept the same in the new context as was the grammatical form. Examples of both types of sentence are as follows.

Table 1 *Sequence of tasks for productive and receptive learning of vocabulary*

	Productive	Receptive
Task 1		Match L1<->L2 (Drag & Drop: JMatch)
Task 2	Complete definition sentence by typing in word. (Text input: JQuiz)	Match definition sentence to word. (Drag & Drop: JMatch) or Complete definition-like sentence by choosing right word. (Multiple choice: JBC)
Task 3	Complete typical sentence by typing in word (Text input: JQuiz)	Align jumbled typical sentence (Drag & Drop: JMix) or Complete definition-like sentence by choosing right word. (Multiple choice: JBC)

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Definition: Sonoko is in the same class as me. She is my ---------. (classmate)
Sample sentence: My --------- often helps me with my homework. (classmate)

Task 1, the matching task, was done by both groups. For Task 2, the definition sentence, the productive retrieval group had to type in the word, the receptive retrieval group had to either match definition sentence and word though drag and drop or complete the definition by choosing the word in a multiple choice that consisted of a selection of the items that had just been introduced in Task 1. In Task 3, the sample sentence, the productive group did the same as for Task 2, the receptive group either aligned a jumbled sentence or did a multiple choice as for Task 2. All new words appeared in each task. The sentences were exactly the same for both groups. Depending on the unit, the number of items ranged from twelve to sixteen words. Each word was seen a minimum of three times during the exercises.

It should be noted that vocabulary presented in this CALL work was based on the content of the textbook being used in class and thus constituted preparation for a range of listening and speaking exercises to be done in class. The overall project of which these studies form a part, which has as its aim investigating effective ways to integrate CALL with the classroom, has been partially reported in Allum (2003).

3.1.3 Procedure

Although the final goal was to have the students do the tasks as self-study preparation for class work, in this experimental case they were done in class time with the instructor present. The only interaction with students during this time was to provide technical help on a few occasions.

The two groups were formed by dividing one class into two groups according to seating, resulting in fifteen students per group. These two groups received alternate task types, productive or receptive retrieval, on alternate weeks. Group A would do receptive tasks on Unit 1 and productive tasks on Unit 2, group B the opposite.

Time on task was the same for both groups. The exact length of time depended on the instructor's judgment of when the majority had finished. Time taken was 20/30 minutes. The tasks were delivered over the Internet from the hotpotatoes.net site, and all were made in *Hot Potatoes*.

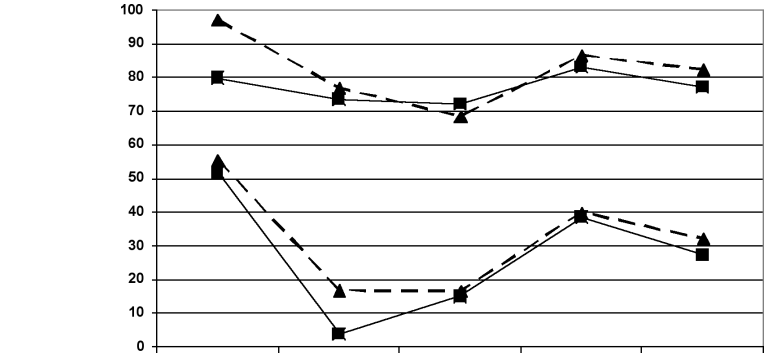
The same test was administered to both groups before and after the CALL work. The test was a recall test with half the words being receptively tested (L2->L1) and half the opposite. Results for both types of item were collated.

3.1.4 Study 1 – Results

Results are presented for Units 2, 3, 5 and 6 (Figure 1). There was one 90-minute class a week over a twelve-week semester, and one unit provided enough work for two 90-minute classes. No data was kept for Unit 1 as this was used to accustom students to the CALL tasks. Unit 4 is omitted because there was not enough time to collect all data. With Unit 2 the same test was repeated at intervals of one and two weeks to see if retention was better for the productive retrieval group (Figure 2).

The overall gains on the basis of the immediate post-test were 50% for both receptive and productive retrieval groups. This resulted in an average final score of about 80%. This means that the CALL work resulted in the learning of approximately 30 words in

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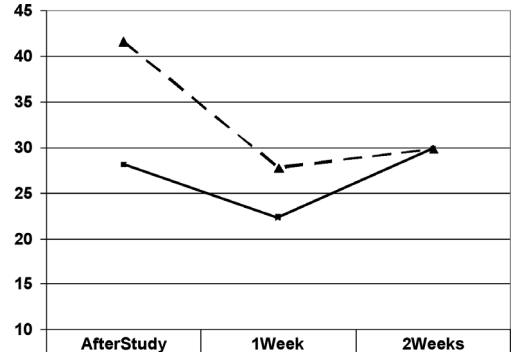
	U2	U3	U5	U6	Total
ProductivePre	56	17	17	40	32
PassivePre	52	4	15	39	27
ProductivePost	97	77	69	87	82
PassivePost	80	74	72	83	77

Fig. 1. Results of vocabulary learning for first study Figures are score as a percentage

total and, if done out of class, would have brought students into class knowing 11.2 of the targeted average of 14.5 words per unit as opposed to knowing only 4.5.

3.1.5 Discussion of Study 1 results

The most salient point is that overall the two groups made very similar and substantial gains. This confirms previous studies that show CALL is an effective way to deliver vocabulary learning exercises. The fact that the groups made similar progress overall seems to provide initial evidence against the claim made in Laufer and Hulstijn (2001) that learning is more thorough when 'search' is strong, that is when learners have to find the form for the meaning. However, if the first unit, Unit 2, is looked at in isolation, the productive retrieval group has made substantially greater gains. A cross-sectional study based on this unit alone would have supported their theory.



	AfterStudy	1Week	2Weeks
Productive	42	28	30
Passive	28	22	30

Fig. 2. Retention over a two week period for Unit 2. Figures are percentage gain from original pre-test

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Four observations may be worth making. First, in relation to the result of Unit 2, students had not known a post-test was coming. Later, when it became apparent to the students that a post-test was inevitable, it seems likely they found a compensatory strategy to assist their learning. As the semester progressed, it became noticeable that students were increasingly taking notes. Typically, they wrote down new words in a bilingual list in their notebooks, copying them from the screen. They could, presumably, use these to strengthen their recall. Given the ethical considerations, it was not possible to stop them. The result from Unit 2 may be taken to indicate that, provided other strategies are not used, CALL exercises that stimulate productive retrieval provide better results. The closeness of both groups' results in the following units might be accounted for by the compensatory strategies of note-taking and possible review for recall. If this tentative conclusion is true, it still leaves open the question of whether CALL tasks that encourage productive retrieval produce better learning than those that only require receptive retrieval when either or both are used in combination with student note-taking or other strategies that support productive recall.

From another point of view this activity was an encouraging sign. Students were adopting an effective strategy to learn new vocabulary. Nation suggests that this should be a main focus in vocabulary teaching after a core of 2000 words has been taught. Given the fact that these students were at the lower end of the scale in terms of ability within the Japanese university system, were poorly motivated and taking English as a required first year course not related to their specialty, this was even more encouraging. A further benefit of this note-taking strategy would be that were students to do the CALL work as preparation for class work, they would be able to bring their notes to support the use of the vocabulary in class or review. Thus differing results for Unit 2 and the following units may have resulted from note-taking, but such a conclusion raises interesting questions about the respective validity of pure research in which potentially useful behaviors may be suppressed, and learning in practice. A second observation is that a task flow that requires students to retrieve words after just one noticing task may put an unduly heavy strain on the productive retrieval group. Students in that group typically went back from Task 2 or 3 to refer to the matching task quite frequently, especially before note-taking became more common. The third observation is that students in the productive retrieval group took longer to complete their exercises. It was quite common for them to have to enter the answer several times, often because of spelling errors. That productive retrieval takes longer and costs more effort is the conclusion reached by Nation following review of work by Stoddard (1929), Waring (1997a) and Griffin (1992). Thus, in this study, it was usual for the students doing receptive retrieval exercises to have finished ahead of the productive group. Any potential gains from learning through productive retrieval need to take this into account in an assessment of effectiveness.

From the repeated tests over two weeks on Unit 2, it was clear that both groups lost some of the learnt items after a week, but retained or even improved slightly in the second week. However, the productive retrieval group lost more than the receptive retrieval group and both groups ended up retaining the same number of new items. There was no immediate support for the idea that learning through productive retrieval is more thorough in so far as that is evidenced by rate of retention. This result may have been affected by the fact that the new words were used in additional in-class exer-

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cises within the units for which they were pre-taught by CALL. Overall, one would expect such additional exposure to have improved retention but this factor was not controlled.

In this study, no separate data for receptive and productive sections for the tests was kept. Initially, the aim had been to see if, in general terms, there was a difference in result for the two types of retrieval task. Further, there was experimental evidence to show that productive learning led to better receptive as well as productive test results (Ellis & Beaton, 1993) and thus in either test, receptive or productive, productive would likely show better results. However, there has been evidence contrary to this in earlier studies (Nation, 2001: 31–33) showing that receptive learning leads to better results on receptive tests and productive learning on productive tests. In the second study, a brief investigation into this was made.

3.2 Study 2

3.2.1 Aim

The purpose was to replicate the first study but to analyze the results of receptive and productive testing separately.

3.2.2 Design

The design replicated Study 1, though the contents and students were different.

3.2.3 Procedure

The procedure replicated that in Study 1. The number of students per group was the same.

3.2.4 Results

While this class was being used for another, unrelated study, pre-teaching of vocabulary

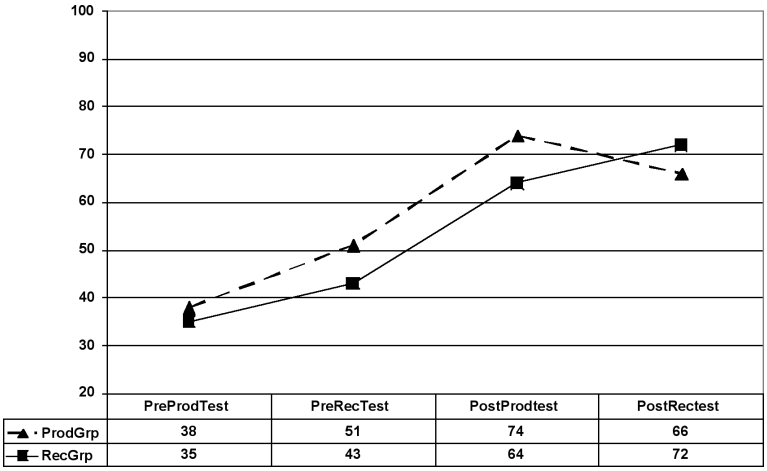
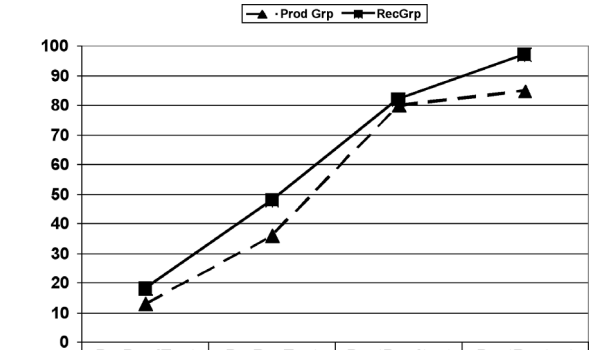


Fig. 3. Result for Unit 7 on productive and receptive tests for productive and receptive groups

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	PreProdTest	PreRecTest	PostProdtest	PostRectest
Prod Grp	13	36	80	85
RecGrp	18	48	82	97

Fig. 4. Result for Unit 9 on productive and receptive tests for productive and receptive groups

for two units was used to check on the productive versus receptive test results. Results for two units, Units 7 and 9, are presented. There was a two-week gap between the two samples in which Unit 8 was studied for which no vocabulary-specific tests were given.

For Unit 7, the productive group shows a gain of 38% on the productive test but only 15% on the receptive test. On the other hand, the receptive group shows a gain of 29% on the productive test and the same on the receptive test. However, looking at the same two groups three weeks later, with the group that was productive for Unit 7 now receptive, a different picture emerges. See Figure 3.

With Unit 9, the productive group make gains of 67% on the productive test and 49% on the receptive, while the receptive group make gains of 64% on the productive test and 49% on the receptive test (see Figure 4). There is little to distinguish between them on the two measures in terms of gain. Overall the gains for the productive group on the two units were 38% resulting in an average post test score of 68%, and those of the receptive group were 43% resulting in an average final test score of 70%. This amounts to learning about 12 new vocabulary items in total. In other words, if this CALL work had been done before the class, students would have come knowing about 22 as opposed to 10 out of the targeted 32 items in the two units.

3.2.5 Discussion of Study 2 results

As with Study 1, Study 2 clearly shows that CALL is a potentially effective way to pre-teach vocabulary.

The results for Unit 7 offer some support for the idea that task type can lead to better learning of the specific skill, receptive or productive recall. However, as with Unit 2 in Study 1, the students did not clearly realize that a post-test specifically aimed at vocabulary was to follow Unit 7. The vocabulary pre-test was administered in conjunction with a listening test. Up to then, they had been using CALL that included non-productive vocabulary exercises, but as a preparation for CALL listening, and the measurements taken had focused on listening comprehension of passages that included that vocabulary, in other words receptive retrieval in context.

The results for Unit 9 are remarkable for the similarity in gains. In the case of Unit 9,

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the students were alerted by the vocabulary pre-test that a post-test was likely coming. Note-taking was clearly evident with eleven out of fifteen of the receptive group taking notes and six out of fifteen in the productive group doing the same. While it is not certain that this accounts for the similarity in gains, it is likely that it assisted overall learning of the new items.

The next step was to combine the results of these two studies in a series of tasks to pre-teach vocabulary as part of a listening course. The preparatory work also included a listening component. This was to see if students would perform equally well when working on their own, typically doing the work from home or a university computer lab, over a longer period. A questionnaire was administered to obtain some idea of the degree of motivation students felt.

3.3 Study 3

3. 3.1 Aim

The main aim as far as vocabulary was concerned was to test whether the lessons learned in the previous two studies could be used to bring students to class with most of the targeted vocabulary learned before class. However, this study was part of a larger project to bring students well-prepared for a listening class. Thus the pre-class CALL work included a substantial listening element.

Table 2 *The flow of exercises in Study 3*

Task	Task type	Realization	HP Exercise
1	Noticing – Translation	Matching L1 & L2	JMatch (drag and drop)
2	Retrieval – Receptive Generative Use – new context	Matching two halves of a written sentence in which the new word appears – read, match, then listen to check	JMatch or JBC (multiple choice)
3	Retrieval – Productive Generative Use – new context	Completing definition or sample sentence with new word.	JQuiz (text entry)
4	Retrieval – Receptive Generative Use – new context	Listen to passages that include new words. Answer comprehension questions.	JBC orJQuiz
5	Retrieval – Receptive or Productive Generative Use – new context	Make sentences about own experience using some of the new words	Done on a worksheet
6	Retrieval - Receptive	Listen and fill in blanks – cloze of some of same listening passages	JQuiz or JCloze
7	Retrieval – Receptive or Productive	Listen and summarize some of same listening passages	Done on worksheet

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3.3.2 Design

All students did a mixture of receptive and productive exercises. The typical flow is displayed in Table 2.

As a result of observations in the previous studies, a receptive retrieval task always occurred before productive retrieval. Thus students had two exposures before they tried productive retrieval. This was to make the tasks easier and hopefully, a little quicker. Repetitious inputting of a word even with the excellent feedback resulting from automatic string-checking in JQuiz could become demotivating and distract mental resources from focusing on the new words. Exercise 4 moves the focus to listening comprehension and the word is now contextualized. Exercise 5 attempts to provide an opportunity for 'strong' search (Laufer & Hulstijn, 2001), and also to link work outside class with in-class work where the self-produced sentences would provide the basis for information exchange exercises. Exercise 6 is primarily for students to check the accuracy of their listening but once again allows focus to be put on the new words by gapping them. The last exercise focuses on overall comprehension, hopefully with the understanding of the word more or less secure and thus allowing students to digest the overall content of what they hear. This series of exercises provides good opportunities for receptive and productive retrieval as well as for generative use. It also specifically encourages written production in combination with the CALL exercises, which appears to have the capacity to strengthen learning as well as providing a useful link with class work.

3.3.3 Procedure

A class of 32 students accessed the exercises over the Web. The pages were hosted on hotpotatoes.net. A vocabulary quiz was given at the beginning of each class. This test was productive, translation of Japanese into English. It was followed by a listening quiz after the vocabulary answer sheets had been handed in. Although students used these exercises for eight weeks of a twelve-week semester, complete data were only obtained for five units. Students were informed that the tests would not contribute to their grades directly. However, the class proceeded on the basis that students were familiar with most of the vocabulary and with the listening passages, and had any resulting written homework ready to use.

3.3.4 Results

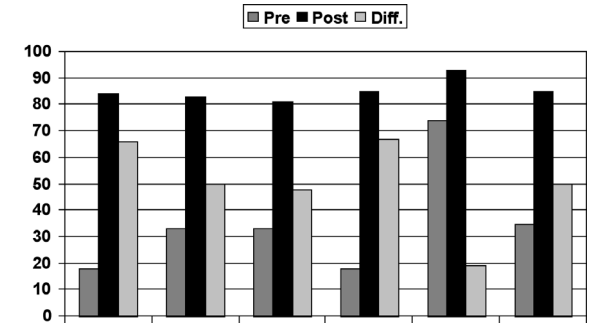
There was substantial learning of new items, with an average increase of 50% in score indicating that about 37.5 new words, 7.5 per unit, were learnt through pre-teaching delivered by CALL. Thus students who had completed the homework arrived in class knowing an average of 85% of the total of 74 targeted words, 12.5 out of the 15 targeted per unit, as opposed to knowing only about 35% or 5 per unit, see Figure 5.

80% of the students did the work regularly. The number of students doing the work increased week by week from 73% in the early stages to 88% near the end.

In terms of time on task,[1] the average time for these tasks was about 50 minutes a unit. A

1 Hotpotatoes.net keeps a record of the duration of exercises that are completed, but not of those that are not. An estimate of total time has to be made by looking at the log of exercises that were started but not finished. Only the start time is recorded, not the duration or finish time. By looking at the times of completed and unfinished exercises, it is possible to make a rough calculation of how much time to add for incomplete exercises.

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	Unit 10	Unit 11	Unit 12	Unit 14	Unit 16	Average
Pre	18	33	33	18	74	35
Post	84	83	81	85	93	85
Diff.	66	50	48	67	19	50

Fig. 5. Scores in vocabulary tests over 5 units covering 7 weeks. Numbers represent average score as a percentage

substantial part of this went to the listening and writing of sentences using the new words.

In terms of satisfaction as expressed in answers to a questionnaire at the end, 77% indicated a positive attitude to this approach, while 80% of students agreed with the statement 'Computer exercises make me do more homework than usual.'

3.3.5 Discussion of Study 3

Study 3 showed that equal gains could be expected even when students were doing the work on the Internet outside of class time. There was, of course, the pressure of the test, and the fact that doing the homework was essential to be able to participate fully in the first half of the class. Nevertheless, the students themselves indicated that CALL homework stimulated them to more effort, and more participated as the semester progressed.

4 Conclusions

The main conclusion is that for targeted vocabulary learning, pre-teaching by CALL is very effective. Not only do students learn the majority of the words, but this knowledge helps to enable more effective use of class time by allowing more productive or freer exercises that are essential for progress, but which CALL cannot handle. This is, perhaps, particularly true with the large classes (30+) that are quite common in universities, where it is important that students are ready to participate if a certain amount of productive work is to be achieved by all students. Clearly success increases motivation, and the increase in time spent on homework over the period of Study 3 indicates that students were motivated by the extra benefits to be reaped in class if well prepared. Thus not only does the pre-teaching increase vocabulary it results in an enriched classroom environment.

The issue of whether CALL's ability to handle productive retrieval exercises would give it a particular advantage was not clearly answered in these studies. The overall conclusion might be that productive vocabulary learning may tend to increase vocabulary learning provided other means of engaging in productive work, such as note-taking, are

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not or cannot be adopted. However, the substantial overall effect for both the receptive and productive tasks suggests that if the design of the series of tasks follows the general guidelines derived from theory, the factor manipulated, receptive versus productive retrieval has no more than a limited effect on outcomes over time in a 'real' as opposed to experimental setting. As with any study that assumes a visible behavior is indicative of certain invisible cognitive processes, the evidence must be treated with some caution,

In both Study 3 and other work done by the writer, students have consistently indicated in questionnaires that they do more homework with CALL than they would with printed media alone. This has been further borne out by surveys of how much homework students actually do before the use of CALL as a homework support and after its introduction. While it might be said that there is no specific CALL factor that is manipulated in these studies, though a case for CALL having special abilities to respond to productive input is made at the beginning, it could also be said that CALL brings together a variety of pedagogic tasks and modalities that it would be difficult to deliver as effectively through any other medium and thus is more likely to produce more learning than other media. Examples of arguments supporting this view can be found in Pusack & Otto (1997).

These studies formed part of a larger investigation into how best to integrate or blend CALL into the curriculum in order to get better results for the same limited amount of classroom time without great additional expense. There are many studies that indicate that close integration is both preferred and more effective (e.g. Felix, 2001; Crompton, 1999; Warschauer *et al*. 2000; Ayres, 2002). Pre-teaching of vocabulary seems an excellent candidate for delivery through CALL outside the classroom as part of such an integrated approach.

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