The Effect of Technology-Supported Co-Sharing on L2 Vocabulary Strategy Development

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ABSTRACT

Strategies play an important role in learning a second or foreign language (L2). The aim of the current study was to develop and evaluate a co-sharing-based strategy learning system for L2 vocabulary learning known as "Mywordtools." Mywordtools is designed specifically for lexical learning, enabling learners to use the currently available vocabulary learning strategies (VLSs) as well as e-tools provided within this system to learn L2 vocabulary for both indoor and outdoor settings during learners' free time. The effects of Mywordtools on L2 learners' word learning were evaluated over a 5-week period. Sixty-one sixth-grade learners of English as a foreign language (EFL) participated in this study. The results of this study demonstrate that students using Mywordtools to practice and share VLSs outperformed both those who did not use Mywordtools and those who used the platform but without sharing. It was also found that strategy sharing helped L2 learners to construct more VLSs, and they consequently performed significantly better than those who did not implement strategy sharing. The overall results indicate that the use of co-sharing with Mywordtools not only benefits the development of VLSs by EFL students but also helps them to gain more in L2 vocabulary learning.

Introduction

Vocabulary acquisition is important for second or foreign language (L2) learners (Laufer, 1986; Llach & Gómez, 2007; Nation, 1990; Tavìl & Ìşìsağ, 2009) since it affects their grammar competence, ability to communicate, and perceptions about the relative importance of vocabulary (Barcroft, 2004). Furthermore, L2 learners' vocabulary acquisition is related to their listening (Smidt & Hegelheimer, 2004) and reading comprehension (Cobb, 2007; Kern, 1989). Unfortunately, acquiring an adequate vocabulary is initially highly problematic for L2 learners (Meara, 1982). Given the important and challenge role of vocabulary acquisition in L2 learners' target language acquisition, the development of approaches to help students to acquire new words has been an important issue in language education (Aist, 2002; Gilman & Kim, 2008; Huyen & Nga, 2003; Kern, 1989; Kojing-Sabo & Lightbown, 1999; Smidt & Hegelheimer, 2004; Stockwell, 2010; Townsend, 2009). The relationship between vocabulary learning strategy (VLS) instruction and vocabulary acquisition is one of the main issues of concern (Gu & Johnson, 1996; Lawson & Hogben, 1996). According to Dansereau (1985) and Rigney (1978), learning strategies are actions performed by learners to aid the acquisition, storage, subsequent retrieval, and use of information. Strategies are especially important for L2 learning because they are tools for active and self-directed involvement, which is in line with the argument of constructionist learning in which learners construct mental models to understand the L2 knowledge. Oxford (1990) further indicated that appropriate language learning strategies (LLSs) result in improved proficiency and greater self-confidence. Numerous studies have confirmed Oxford's arguments, such as in learning Spanish (Morin, 2003) and English (e.g., Fan, 2003; Gu & Johnson, 1996; Kojig-Sabo & Lightbown, 1999).

LLSs are specific actions or behaviors accomplished by L2 learners to enhance their learning. After a certain amount of practice and use, learning strategies—like any other skills or behaviors—can become automatic. Thus, LLSs can be taught and modified through strategy training (Chang et al., 2010; Mayer, 2008; Velluntino, 2003). It has been recommended that strategy training should form an essential part of language education (Oxford, 1990, 2003; RAND, 2002). Through training, L2 learners are able to learn strategies that are useful for their acquisition of the target language, and consequently to take charge of their learning in all respects, including determining the objectives, selecting methods and techniques to be used, monitoring the procedures, and evaluating what has been learned (Holec, 1981). In such an L2 setting, teachers have new roles in the process of language acquisition by L2 learners, acting as facilitators, helpers, diagnosticians, and advisers, and being responsible for identifying students' learning strategies, conducting training in learning strategies, and helping learners to become more independent.

Most research findings on VLSs have been obtained either by using questionnaire surveys to determine what strategies were used by L2 learners (e.g., Fan, 2003; Gu & Johnson, 1996; Kojig-Sabo & Lightbown, 1999) or by investigating the effects of individual strategies on L2 learners' vocabulary acquisition, such as mnemonic VLSs (e.g., Morin, 2003; Sagarra & Alba, 2006). Questionnaire surveys provide rigid information regarding our understanding of how L2 learners use VLSs, while specific strategies provide only a partial knowledge of the effects of VLSs on L2 learners' vocabulary acquisition. However, the development of VLSs is a dynamic continuum. Through training, practicing, and modifying, L2 learners are able to use LLSs automatically, without additional mental effort (Chamot, 1987). Therefore, L2 learners require timely support during the VLS development continuum. Furthermore, because the development of VLSs is a dynamic process, L2 learners usually need scaffolding to first practice and then master and finally automate their strategies. Considering the timely support needed in the development process of L2 learners' VLSs, information that can reveal an L2 learner's strategy-learning status is essential for L2 learners themselves or their teachers to adapt learning approaches or to make appropriate teaching decisions, respectively. However, research into the process of L2 learners' strategy development or how to provide the essential information needed to make teaching or learning decisions for VLSs remains insufficient. Moreover, most previous studies on VLSs have focused on adults or college students, with few having investigated the development of LLSs among children. Even though some research on the effective approaches to helping children learn L2 vocabulary can be found (e.g., Kalaycioğlu, 2011; Tavìl & İşìsağ, 2009), those research focus neither on children's usage of VLSs in learning L2 vocabulary nor children's development of VLSs. Children's cognitive stages are different from adults' and therefore there is a need to identify what and how VLSs will be used by children.

Language acquisition is a co-construction process (Ellis, 1985; Jacoby & Ochs, 1995). The genesis of new knowledge construction lies in social interactions, since language learning is viewed as a social process rather than as the individual acquisition of vocabulary and language structures (Rogoff, 1994). Therefore, language learning involving the participation in social practices may facilitate the construction of new knowledge (Lan et al., 2011). Numerous studies have shown that collaboratively built activities in which audiences are seen as co-participants benefit language performance (Lan et al., 2008; Regan & Zuern, 2000). Dagenais et al. (2008) also found that knowledge sharing during students' co-construction benefited new target language knowledge. Upon the literature reviewed above and Vygotskian´s (1978) "zone of proximal development," are novice L2 learners able to construct skills (here meaning VLSs) in the context of rich peer sharing that they otherwise would be unable to construct on their own during the VLSs development process? It is an interesting question worthy of more researchers' efforts, but has not been investigated yet.

Due to the lack of research on the effects of providing a co-sharing scheme on young L2 learners' VLS development, and on how to provide dynamic and continuous information for young L2 learners regarding VLS usage, the aim of this study was to develop and evaluate a co-sharing-based learning system, known as "Mywordtools," to determine how Mywordtools can help young L2 learners to learn new English words and to construct VLSs, and how co-sharing affects young L2 learners' VLS construction. Three research questions would be addressed in this study as follow. (1) Does Mywordtools help young L2 learners to learn new English words? (2) Is co-sharing beneficial for young L2 learners to construct VLSs? And (3) is VLS usage beneficial for young L2 learners' word performance? The interrelationship between vocabulary strategy use and vocabulary knowledge, with and without the co-sharing, was determined in a cohort of English as a foreign language (EFL) students over a 5-week period. During the experimental period, data were collected and analyzed to evaluate the effects of Mywordtools based on both the L2 EFL learners' performance of the vocabulary test and the results of strategy use.

The following sections briefly describe the VLS learning system (Mywordtools), followed by the methodology. Analytical results for the 5-week experimental period are then presented and discussed, and conclusions are then drawn from the study results.

Mywordtools: A co-sharing-based VLS learning system

The development of Mywordtools focused on learning by doing and co-construction. The design of the system was guided by the intention to support L2 learners to develop VLSs via co-construction and self-regulation. According to Ehrman and Oxford (1990) and Oxford (1990), 12 VLSs (as shown in Appendix A) embedded e-tools were developed. In addition, both schemes for self-regulation and co-sharing were also developed in Mywordtools for the aforementioned purposes. Mywordtools comprises three modules: a learning map for self-regulation, a strategy construct for learning by constructing, and a strategy co-sharing for co-construction.

Learning map module

Self-regulated learning is important to students as it relates to their academic success and lifelong learning. Self-regulating students are not only more likely to succeed academically, but view their futures optimistically (Zimmerman, 2002). Self-regulation skills include: goal setting, adopting new approaches, process or action monitoring, physical and social context restructuring, time management, and reflection. Upon self-regulation, the learning map module provides L2 learners with a scheme with which to manage their learning, including making a learning plan, checking their learning process record, automatically arranging a learning schedule according to learners' plans, and delivering daily learning materials. Three different symbols that acknowledge the learning status of the L2 learners are displayed on the screen, depending upon how well the learner is achieving (behind in the learning plan, up to date with the learning plan, and great strategy construction). Figure 1 shows a screenshot of this module.
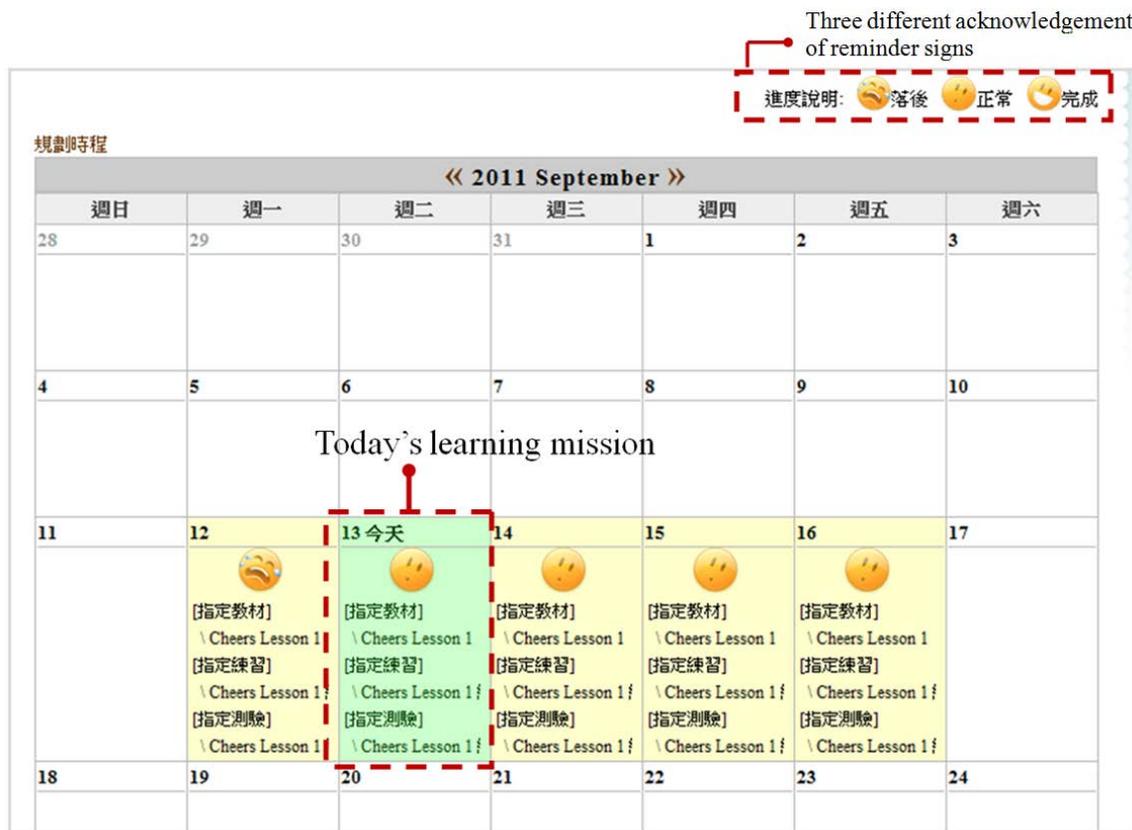

Figure 1. Screenshot of the learning map module

Strategy construct module

L2 students may learn effectively when learning through doing, and producing their target language by themselves (Lan et al., 2009). Additionally, children gain knowledge when learning something which relates to their own environment and experiences (Llach & Gómez, 2007), which is in line with constructive arguments that emphasize a learning process, allowing students to experience a learning environment and to create their own knowledge (von Glaserfeld, 1989). There are 12 different VLSs and 5 different e-tools embedded in the strategy construct module to support young L2 learners construct their own strategies. Table 1 presents the embedded VLSs and accompanying e-tools for constructing each strategy. In Table 1, "V" indicates that L2 learners can use the VLS via the e-tools to learn a new word. For example, if an L2 learner chooses the contextualization strategy, then he/she will have four options (e.g., audio, video, image, and note) to record his/her learning process. An example can be found in Figure 2.

Table 1. The embedded LLSs and available e-tools for each strategy

e-tools	VLSs											
	Practice	Note taking	Key word	Contextualization	Grouping	Imagery	Recombination	Deduction	Analysis	Physical	Translation	Transfer
Audio	V		V	V							V	
Video				V						V		
Image	V			V	V	V				V		
Note	V	V	V	V			V	V	V	V	V	V
Mind map					V		V		V			

Once an L2 word is chosen, the L2 learner can select the strategy he/she wants to use to help him/her to learn and memorize the word. Mywordtools will show all of the e-tools that accompany the selected strategy. The L2 learners can then further choose one or multiple e-tools to upload their strategies for helping them to learn and memorize the word. For example, if the L2 learner chooses the word "elephant" and uses contextualization strategy, he/she can first listen to the pronunciation and read the syntactical functions and sample sentence containing the word "elephant" (① and ② in Figure 2); then after he/she selects a contextualization strategy to help him/her to remember the word (③ in Figure 2), Mywordtools will present all of the available e-tools (images, videos, notes, and audio tools) with which the learner can construct his/her strategies. Figure 2 shows a screenshot of VLSs with the accompanying e-tools, as well as the learning materials for the word "elephant." Figure 3 depicts some strategy examples that were constructed using this tool.
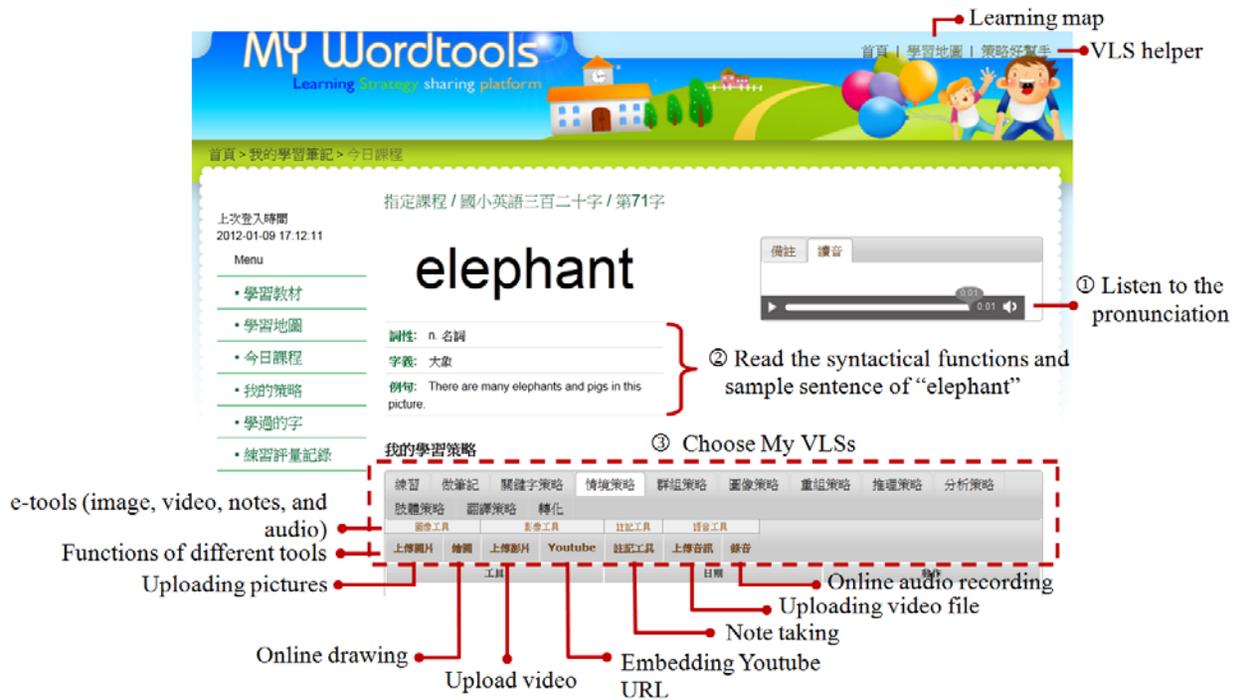

Figure 2. Screenshot of the learning materials for the English word "elephant" and the VLSs with their corresponding e-tools provided by Mywordtools
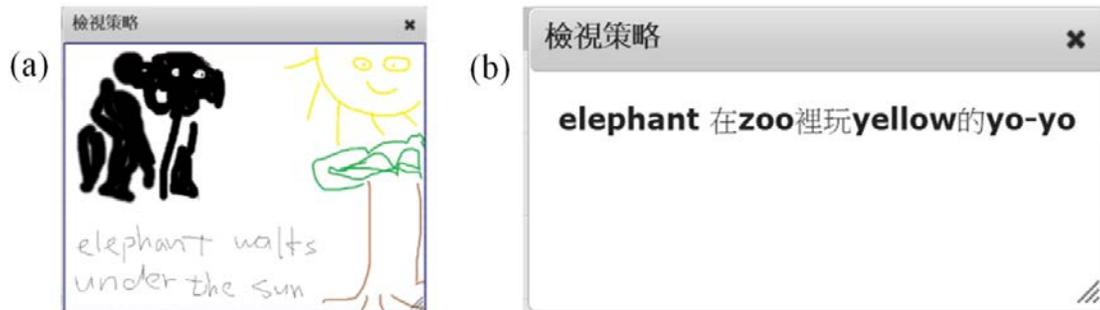
Figure 3. Some contextualization strategy examples constructed by (a) the image tool and (b) the notes tool

Strategy co-sharing module

Soon after L2 learners uploading strategies, this module provides them with the function to look up the strategies that have been used by all of the other learners in Mywordtools. Strategies can be searched either by a specific word or by a strategy. Through using a strategy co-sharing module, it is expected that L2 learners are able to self-evaluate their own strategies, then to be aware of their knowledge gaps, and to finally re-construct their strategies or build their self-confidence, as the input processing argument put forward by VanPatten (2002). In addition, in the present study, the strategy co-sharing module was used especially by those using Mywordtools with the co-sharing function to conduct co-sharing activities. Figure 4 shows the screenshots of vocabulary and e-tools searching results by contextualization strategy.

Figure 4. Screenshots of strategy searching results by contextualization strategy

Method

Participants

The participants comprised 61 sixth-grade students attending 3 classes at an elementary school in Taipei, Taiwan. Each class was randomly assigned to three groups: learning with Mywordtools with the co-sharing function (MWT-S,

20 students), learning with Mywordtools without the co-sharing function (MWT, 20 students), and learning under traditional instruction (TSI, 21 students).

Design

This study adopted a quasi-experimental design. Students in the three study groups (MWT-S, MWT, and TSI) recorded their VLSs while learning the assigned materials, which comprised 320 essential words for Taiwanese elementary EFL students, during the experimental period from October 1 to November 1, 2011. The learning activities did not take place in regular EFL classes, but rather during the students' free time (both at school and at home) at anywhere (both indoor and outdoor); therefore, the learning activities in the present study were self-directed. Students in the MWT-S group learned the words and co-share their VLSs with the help of Mywordtools, and especially to take a look at what VLSs their peers had uploaded onto Mywordtools. Students in the MWT group used Mywordtools to learn and record their VLSs, but without co-sharing or discover what their peers had done on Mywordtools. In contrast to these two Mywordtools groups, each student in the TSI group was given a notebook with 320 words in which to record their VLSs and vocabulary learning during the experimental period. Additionally, all three groups were taught by the same EFL teachers.

Both the vocabulary test scores and VLSs constructed by the participants were collected and analyzed. Baseline scores were obtained 1 week before the experiment (pretest), and then after the treatment (posttest), the vocabulary performance scores of all the participants were collected via a vocabulary performance test. In addition to the test scores, for the MWT-S and MWT groups, the VLSs constructed during the treatment were all kept in the Mywordtools database for later analysis; for the TSI group, their notebooks were collected and scanned to analyze the recorded VLSs used by the students. The participants' English scores from their mid-term exam which was administered before the treatment were also provided by the EFL teacher to serve as a covariant during the data analysis process.

Instruments

Vocabulary performance test

This test consisted of two sub-tests for each of 320 words: transformation (e.g., "hospital ①家②學校③醫院④車站") and a closed test (e.g., "Peter is from Taiwan but ____ can't speak Chinese. ①who ② he ③is ④four"). The answers to all of the test items were confirmed by three EFL teachers. During the test, 7 minutes were allowed for answering each sub-test, and participants tried their best to answer as many as items possible. Each correctly scored item was awarded 1 point.

Learning materials: Essential words for Taiwanese elementary EFL students and 12 VLSs

The learning material comprised 320 essential words for Taiwanese elementary EFL students, as shown in Appendix B. The TSI group was given a printed word list, while the MWT-S and MWT groups were given IDs and passwords to enable them to log into Mywordtools to learn whenever they were available for self-directed learning. An explanation and basic instruction of the 12 VLSs (Appendix A) was also provided to all the participants.

Procedure

The experiment took place over a 5-week period, from October 1 to November 1, 2011. Before the treatment, all of the participants performed a vocabulary performance test, after which the MWT-S and MWT groups received training in the operation of Mywordtools. All of the participants then constructed their vocabulary learning plans for learning all 320 words during this period; the 2 groups learning with Mywordtools made the plan directly via the system, while the students in the TSI group wrote down their plan in their notebooks. After their learning plan was confirmed, they began to learn the 320 words in their free time, either at or after school, as per their plans. The EFL teacher reminded them to check whether their learning progress met their plan every week. In addition, the VLSs

used by the MWT-S and MWT groups were kept in the Mywordtools database, while those used by the TSI students were kept in their notebooks. All of the participants performed the same vocabulary performance test 1 week after the end of the 5-week experimental period. Figure 5 outlines the study procedure.
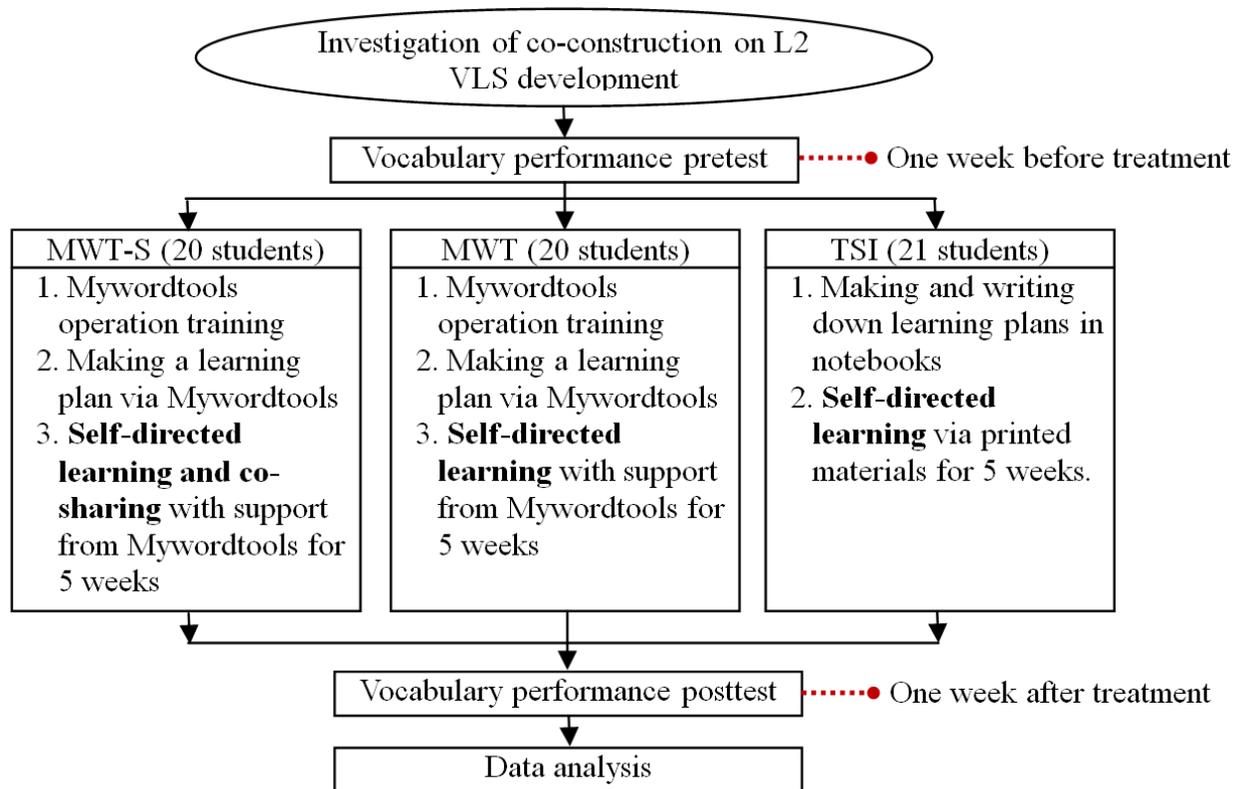

Figure 5. The study procedure

As depicted in Figure 5, the TSI group learned via a paper-and-pencil approach, while the other two groups learned with the support of Mywordtools. Furthermore, since Mywordtools can be run on diverse electronic devices (i.e., PC, smartphone, iPad, or tablet PC), the MWT-S and MWT groups were able to log into Mywordtools in different environments, at their convenience. Figure 6 shows an overview of vocabulary learning via Mywordtools.
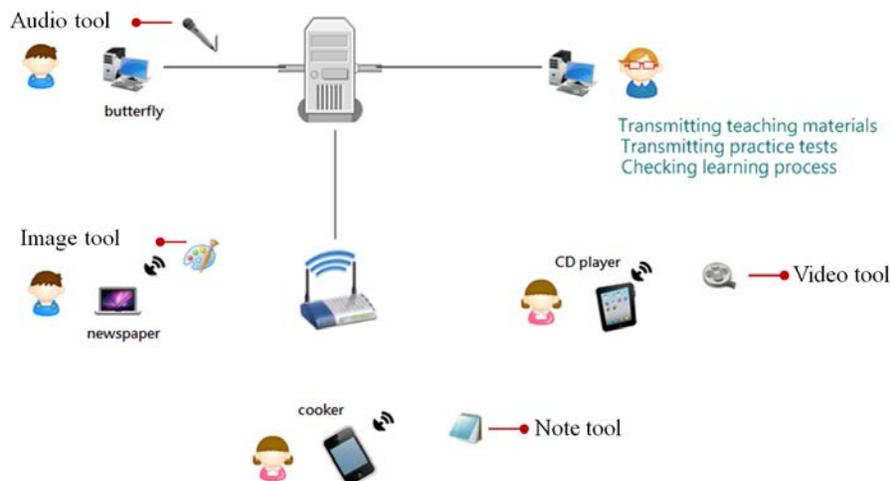

Figure 6. An overview of vocabulary learning via Mywordtools

Results

The analysis focused on answering the three research questions: how Mywordtools benefits L2 learners' vocabulary learning, how co-sharing affects L2 learners' vocabulary learning and VLS construction, and how VLS usage benefits L2 learners' word performance. Word learning achievement was evaluated by analyzing the participants' vocabulary performance test scores, whilst the VLS learning result was evaluated by analyzing the strategy construction records kept in the Mywordtools database.

RQ1: Does Mywordtools help young L2 learners to learn new English words?

To answer the first research question, comparison of the vocabulary performance test results was conducted. All participants took the same vocabulary performance test one week before and after the treatment. A two-way mixed-design analysis of covariance was conducted to determine how the vocabulary performance differed between the participants in the three groups (MWT-S, MWT, and TSI). The independent variables were the group (MWT-S, MWT, or TSI) and the test (pre- or posttest), while the covariate was student EFL scores from the mid-term right before the treatment. The level of statistical significance was set at $\alpha = .05$. Table 2 lists the means and standard deviations for the vocabulary performance test scores.

Table 2. Means and standard deviations (SDs) of the vocabulary performance test scores for the three experimental groups

Test	MWT (*N*=20)		MWT-S (*N*=20)		TSI (*N*=21)	
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*
Pretest	103.00	53.02	112.35	55.66	100.76	53.69
Posttest	132.00	68.43	153.75	67.65	120.91	46.50

Comparison of vocabulary performance scores between the three groups was conducted. The homogeneity test results for regression coefficients were not significant [$F(1,57) = 0.06$, $p > 0.05$]. Two-way ANCOVA revealed a significant interaction between group and test scores [$F(1, 58) = 4.51$, $p < 0.05$], with the magnitude of the difference varying according to level. A simple main-effect analysis demonstrated no statistically significant difference between the three groups in the vocabulary performance pretest scores [$F(1, 53) = 0.67$, $p > 0.05$]. However, the three groups performed significantly differently in the posttest [$F(1, 53) = 3.26$, $p < 0.05$], indicating that the performance in the knowledge of English vocabulary was the same in all three groups before the study, while the vocabulary performance differed significantly among the three groups after the experimental period. Post-hoc testing revealed that the MWT-S group performed significantly better in the posttest than both the MWT [$F(1, 37) = 5.52$, $p < 0.05$] and TSI [$F(1, 38) = 6.00$, $p < 0.05$] groups, and the MWT group performed better than the TSI group even not reached a significant level.

There was also a significant pre- versus posttest effect on the performances of the three groups in vocabulary performance tests, with all three groups performing significantly better in the posttest than in the pretest [MWT: $F(1, 58) = 19.92$, $p < 0.05$; MWT-S: $F(1, 58) = 40.59$, $p < 0.05$; TSI: $F(1, 58) = 10.19$, $p < 0.05$]. Furthermore, the progress made by the three groups differed: it was greatest in the MWT-S group, followed by the MWT group and then the TSI group.

Based on the comparison of the results, it is proved that Mywordtools can benefit L2 learners' L2 word learning, especially when they performed the sharing of VLSs with other online learners.

RQ2: Is co-sharing beneficial for young L2 learners to construct VLSs?

The VLS usage records of different groups were compared to answer the second research question. Following completion of the experiment, the VLSs used by the three groups were compared based on both frequency percentages and strategy categories. Regarding the strategy usage records, those of the MWT and MWT-S groups were downloaded directly from the Mywordtools database, while those for the TSI group were collected and scanned from the notebooks that they used. However, even though all students in the TSI group were given notebooks in which to document down their strategies, few records were found at the end of the treatment. This may be

attributable to the lack of academic credit given for the activity, and the fact that students do not habitually write down what strategies they have used to learn new words. Furthermore, the experiment itself was a kind of informal learning in which students learned the strategies during their free time, and no additional pressure was given by the teachers to push them to record their strategies.

In order to make up the missing data and figure out how the TSI group learned L2 words, interviews with the EFL teacher and the students of that group were conducted. The interview results depicted that repeated practice (writing a word many times until it is memorized) and oral repetition (i.e., reading aloud and writing a word many times until it is memorized) were the most taught VLS by the EFL teacher and used her students. Table 3 lists only the frequency percentages of strategies used by the MWT and MWT-S groups rather than the three different groups. This is due to the lack of actual strategy records from the TSI group even though the interviews from this group provided us some answers to the phenomenon.

Table 3. The frequency percentages of each strategy used by the MWT and MWT-S groups

Groups	Practice	Note taking	Key words	Contextualization	Grouping	Imagery	Recombination	Deduction	Analysis	Physical	Translation	Transfer
				Frequency percentages								
MWT	**85.58**	**2.88**	**1.55**	**4.99**	0.13	0.03	0.07	0.03	0.13	0.07	**3.84**	0.69
MWT-S	**59.35**	**9.60**	2.43	**17.56**	**4.12**	**4.07**	0.56	0.40	0.73	0.56	0.28	0.34

The five strategies used most often by the MWT group were practice, contextualization, translation, note taking, and key words. By contrast, the five strategies used most often by the MWT-S group were practice, contextualization, note taking, grouping, and imagery. However, although practice was the strategy used most often by both groups, the degree to which they used this strategy differed significantly ($\chi^2 = 27.99$, $p < 0.05$) between them: over 85% in the MWT group but less than 60% in the MWT-S group.

The total frequencies of strategies used for the two groups were 3024 for MWT and 1771 for MWT-S. The raw frequency was much higher for the MWT group than for the MWT-S group, while the numbers of strategy categories used by the two groups varied in the opposite direction; the relevant data are compared in Table 4. *T*-test analysis revealed that the categories of used strategies between the two groups were significantly different ($t = 5.60$, $p < 0.05$), indicating that the MWT-S group used more kinds of VLSs to learn new words then did their peers in the MWT group. Therefore, despite the missing data happened in TSI group, the data obtained from the database of Mywordtools provide a preliminary answer to the research question: Co-sharing benefits L2 learners' strategy construction in strategy categories rather than frequency record.

Table 4. Means and SDs of strategy categories used by the MWT and MWT-S groups

MWT (*N*=20)		MWT-S (*N*=20)	
Mean	*SD*	*Mean*	*SD*
2.9	1.59	4.4	2.35

RQ3: Is VLS usage beneficial for young L2 learners' word performance?

Due to the lack of printed strategy usage record of TSI group, only the data of MWT and MWT-S are used to figure out the answer to the research question. Synthesizing the data listed in Tables 2, 3, and 4, a positive answer to the question can be obtained. Both MWT-S and MWT groups made significant improvement at posttest. In addition, the former made more progress than the latter. Furthermore, the MWT-S group significantly outperformed the MWT group in posttest. However, the significant differences existed in posttest between the two groups seems not caused by the frequencies of strategy usage but categories. The strategy usage frequency of MWT group is much higher than that of MWT-S group (3024 to 1771); nevertheless, the frequency of MWT group was more centered on fewer categories of strategies. Thus, we can infer that the more VLS categories used, the greater benefits students can get from L2 word learning process.

Discussion

Three research questions were addressed in the current study. In addition to the answers to the research questions based on the data analysis explained above, some further discussion will be given below.

The benefits of Mywordtools for young L2 learners' vocabulary learning

Comparison of vocabulary performance tests among the three groups (Table 2) revealed that while all three groups made significant progress on the tests, the progress was much greater in the two groups that learned with the support of Mywordtools. According to further interviews from TSI group, rote practice was the mostly used strategy by TSI group. In contrast, via the support of Mywordtools, young L2 learners tried different strategies to help them memorize vocabulary. More interestingly, young L2 learners loved to embed vocabulary into the context of a story, (see Table 3). In contrast to rote repetition, connecting vocabulary with their own experiences or imagination to create a story might have benefited young L2 learners' vocabulary learning. The results fit in with young learners' learning characteristics: children's foreign language learning depends on what they experience and they actively try to construct meaning (Cameron, 2001).

Furthermore, this study encouraged young L2 learners to use their free time to learn the target words and to construct their own strategies. Based on the 5-week experimental results, it seemed that Mywordtools encouraged young L2 learners to learn vocabulary, even without the teachers' commands or assignments. Additionally, the learning map module of Mywordtools provided users with a scheme to set learning goals and to monitor one's own learning condition. The self-regulation scheme seemed to help them pursue success in vocabulary learning. To confirm those possible effects of Mywordtools, longer experimental time period, more participants, and multi-perspective evidences are needed in future study.

The benefits of Mywordtools for young L2 learners' VLS construction

According to Table 3, with the support of Mywordtools, L2 learners developed many other VLSs such as contextualization, note-taking, grouping, imagery, and keywords, in addition to the rote practice strategy. This finding is consistent with that of Mayer (2008) and Chang et al. (2010), that VLSs are teachable. Furthermore, according to the current study, it can be said that VLSs are also learnable via scaffolding-based self-construction. The target VLSs embedded in Mywordtools are available for L2 learners to conduct self-learning in their free time. In addition, all of the VLS construction processes are recorded in the Mywordtools database, and so L2 learners can easily view their learning status and review what VLSs have been used by themselves during the process. Reviewing the construction process might contribute to L2 learners' VLS development. This represents a kind of meta-cognitive ability, which has been proven important for L2 learners' performance (Anderson, 2002; Oxford, 1990).

In addition to the process-reviewing function, the multiple e-tools embedded within each kind of VLS are also easy for L2 learners to use in VLS construction. The multiple choices of e-tools or VLSs provided by Mywordtools might also encourage L2 learners to record their VLSs according to their individual preferences, rather than the traditional pencil-and-paper-based recording approach. Numeral examples can be found in the Mywordtools database where L2 learners have tried to use multiple e-tools to construct VLSs to learn a single word. For example, one student used three VLSs to help remember the word "cow": note taking (note tool), contextualization (image tool), and imagery (image tool).

The results obtained from this study also reveal the importance of providing young L2 learners with multiple easy-use tools in teaching VLSs and L2 vocabulary. The students of TSI group did not leave any records in their notebooks. This might be caused by the tools they had, (a paper and a pencil), which were not suitable for recording their strategies. Furthermore, regarding individual differences, whether there exists a relationship between L2 learners' learning styles/genders and the chosen VLSs/ e-tools of Mywordtools is worthy of more efforts to explore.

The effect of co-sharing on young L2 learners' VLS construction

Comparison of VLS categories used by the MWT-S and MWT groups revealed that the former used significantly more kinds of VLSs than the latter. This finding can be explained by the notion of Vygotsky (1978) of a zone of proximal development. Through co-sharing, L2 learners learned from their peers' idea of VLS usage, and increased their VLS construction trials. It appears to echo to vanPatten's input processing theory, in which L2 learners shorten their VLS knowledge gaps through co-sharing and develop more VLSs to support their vocabulary learning. This finding further supports the previously reported idea that VLS is learnable.

However, this result may also be attributable to the "audience effect," as in the research conducted by Regan and Zuern (2000) on computer mediated composition, which found that EFL writers composed articles with higher quality and quantity because of their online audience. Irrespective of the reason for these results, be it peer-learning or the audience effect, the MWT-S participants outperformed their MWT peers in VLS construction records despite the lack of real dialogue or interaction in the social context, in line with the work of Raphael et al. (2009).

Additionally, based on the results obtained from this study, a more detailed analysis of young L2 learners' developing process of VLS should be conducted to provide more evidences to explain how co-sharing influences young L2 learners' VLS acquisition process.

The effects of VLS usage variety on young L2 word learning

Based on the results, it is found that the greater the variety of VLS used, the better the vocabulary would be performed. The MWT-S group used on average more categories of VLSs and significantly outperformed both of the other groups in the posttest vocabulary test performance. They also made more progress. These results might be caused by the difference in the depth of mental processes used while L2 learners learned the words. The MWT-S group not only used more categories of VLS but also more VLSs that require greater levels of processing—such as contextualization, note taking, and grouping—than did the MWT group. The most often used VLS by the MWT and MWT-S groups was practice; even though the total frequency of VLS records was much higher for the MWT group than for the MWT-S group (the raw frequency records for the two groups are 3024 and 1771), the results were inconsistent. According to related research on cognitive models of lexical processing, in both first-language and L2 studies, VLSs requiring deeper processing have been found to result in a better retention of words than strategies involving shallower levels of processing (Au & Glusman, 1990; de Groot & Van Hell, 2005). In the work of Gu and Johnson (1996), simple repetition of new words was the strongest negative predictor of L2 learners' vocabulary size and general proficiency.

The findings discussed above also draw forth the effect of co-sharing on both L2 learners' VLS construction and word performance during the dynamic VLS construction process. This is an important finding because it adds to the knowledge about the relationship between VLS and L2 learners' vocabulary acquisition. As mentioned in the Introduction section, most research on VLSs has focused on distinguishing the strategies used by higher-performing L2 learners via questionnaires, from which instruction suggestions were made to L2 teachers. Furthermore, many studies have concluded that more VLSs were used by higher-performing L2 learners (e.g., Sagarra & Alba, 2006; Gu & Johnson, 1996). However, the current study found that young L2 learners with same level of word performance at the beginning of the experiment performed significantly differently thereafter depending upon whether or not they used Mywordtools and whether they co-shared their VLSs: those who constructed more VLSs via co-sharing outperformed their peers who did not use co-sharing.

Conclusion

The purpose of this study was to develop and evaluate a co-sharing VLS system for young L2 learners' vocabulary learning and VLS development. Several important findings have been obtained in this study. First, it is confirmed that VLS is learnable. Second, scaffolding-based self-construction and co-sharing appear to be able to effectively enhance young L2 learners' VLS development and vocabulary learning. Third, through co-sharing, young L2 learners seem to be able to develop the VLSs beyond their cognitive stage. Some issues for future research are also suggested, including the effects of self-regulation, gender difference, and learning styles on young L2 learners' VLS

development via Mywordtools; and the detailed analysis of young L2 learners' VLS development process. In addition, how L2 learners speaking a different first language develop VLSs with the support of Mywordtools is also an important issue for future study. In sum, this study can be viewed as a first step in building the knowledge of L2 learners' VLS development via technology supports and definitely more efforts should be made. It is a precious goal to pursue even it is a long way to go.

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Appendix A

The 12 embedded VLSs in Mywordtools

Strategies	Explanation
Practicing	Simply practice the vocabulary by repetition, such as by writing it down on a piece of paper, or by speaking it out repeatedly.
Note-taking	To take note of the vocabulary and its important or useful information, such as its meaning, pronunciation, word structure (e.g. prefix, root, stem, suffix.), or the parts of speech, etc.
Key word	Connect the word pronunciation to the similar pronunciation of another word in students' L1 or the words they have learned, and try to connect the meaning of the original word and the homophone word to reinforce learners' memory. For example, the word *dilemma*, which means a difficult situation requiring a choice between equally undesirable options, sounds like "a landmine" in learners' L1, Mandarin. Thus, we can connect the original word "dilemma" by enhancing the image of the difficult choice of stepping on a landmine, which makes it difficult to choose what to do.
Contextualization	Give the target vocabulary a context as to narrate a simple story or a plot. For instance, here we use four words to make a short story: *waffle, lizard, church, and Korea*. Mr. *Lizard* goes to a *church* in *Korea* to eat a *waffle*.
Grouping	Group the vocabulary by their shared characteristic. For example, *airplane*, *bicycle, ferry* and *boat* can be categorized in the group of "transportation".
Imagery	To utilize visual aids such as images and pictures to enhance vocabulary learning.
Recombination	To combine the words learners have learned with the words being learned to learn new vocabulary, such as the following example: combine the words students have already known with the new word "*post*" to learn new words such as: *post office, postmark postman, postbox, postcard,* etc.
Deduction	Remember the elements or rules to use or structure words, to reason or infer the meaning of the vocabulary being learned. For example, "*un-*" is the prefix for "not, against", which helps learners to reason the following words: *unarm, unsure, uncomfortable*, etc. Another example is "*over-*" as "excessive or above", which reasons the words overbook, overdose, overdress, etc.
Analysis	Analyze the word structure with prefix, stem, root, suffix, etc. and learn how to use them. For example, the word *unkindness* could be analyzed as three parts: *un-* (not) + *kind* + *-ness* (noun as state, condition, or quality).
Physical response	This is based on the coordination of language and physical movement. Learners' respond with the corresponding movement as they think of the target vocabulary being learned. For example, learners could show the action of drinking when they are learning the vocabulary "*drink*".
Translation	Directly translate the target vocabulary base on learners' L1, or the words learners have learned. For example, pet shop, book store, blueberry, etc.
Transfer	To understand the concept of new vocabulary by understanding from learners' L1, or utilizing vocabulary's rules, structure, grammar, etc. For example, the word "smooth" and "smoothly" are used for describing the texture of objects, as the basic concept (e.g. the table looks smooth). However, they could also infer a situation goes without interruption, such as, "The meeting went smoothly." Hence, the noun "smoothie" for food could be connected to the smooth texture as well.

Appendix B

320 essential words for Taiwanese elementary EFL students

Grades 1-2	Grades 3-4	Grades 5-6
a (an)一個 apple蘋果 am是 are是 is是 bag袋子 ball球 bird鳥	and和,而且 apple蘋果 arm手臂 at(介)在… bag袋子 ball球 baby 嬰兒 banana香蕉 bear熊 bed 床 bee蜜蜂	angry生氣的 art藝術,美術 aunt阿姨,伯母 back(n)背部,後面的 bike腳踏車 bathroom浴室 bedroom臥房 bookstore書店 bread 麵包 breakfast 早餐 brother兄,弟 brown咖啡色
	bird鳥 black黑色,黑的 blue藍色,藍的 car汽車 cake蛋糕 can(助v)能,會 chair椅子 class班級 color顏色 cow母牛 cry (v) (n)哭,叫喊(11)	bus巴士 but但是 candy糖果 card紙牌,卡片 cloudy多雲的,陰天的 Chinese中國人,中國的 coat外套 chicken雞,雞肉 coffee咖啡 clean乾淨的,(v)打掃 close(v)關閉,接近的 classroom教室 cold冷的,感冒
blue 藍色,藍的 book書 box盒子 boy男孩 cake蛋糕 cat貓 color顏色cow母牛	day天,白天 desk書桌 doctor醫生 doll洋娃娃 door門 down (副)向下 eat (v)吃 eye(s)眼睛 ear(s)耳朵 eight 8 elephant 大象 (11)	come (v)來 computer電腦 cook (v)煮做,(n)廚師 cookies餅乾 cool涼快的 cry (v) (n)哭,叫喊 drive (v)開車 dance(v)跳舞 dear親愛的 dirty髒的 dinner晚餐 drink(v)喝,(n)飲料 draw(v)畫圖
		duck鴨子 easy容易的 e-mail電子郵件 eraser橡皮擦 English英語 eleven11 eighteen 18 fan風扇;粉絲 eighty80 excited感到興奮的 fall (n)秋天(v) 落下 fast快的,快地 father爸爸 feel (v) 感覺,覺得
	face臉 fan風扇;粉絲 five 5 fine 美好的 fly (v)飛 foot腳,足 for(介)為了,給… four 4 from來自 friend朋友 fun樂趣,有趣的 go(v)去 (12)	fire火 food食物 from(介) 來自,從...起 fries薯條 fourteen14 for(介)為了,給… forty40 flower花 fifteen15 fifty50 fruit水果 fly (v)飛 get (v) 獲得;得到,到達 give (v)給
cup杯子 Dad爸爸 dog狗 egg蛋 fish魚,魚肉 girl女孩 green綠色,綠的	game遊戲,比賽 green綠色,綠的 hand(s)手 (11) has(v)有,吃 have (v)有,吃 head頭 grandma祖母 grandpa祖父hamburger漢堡 he他 happy快樂的	glasses眼鏡 good好的 gray灰色 head頭 help (v)(n) 幫助 here這裡, (副)在這裡 her她的,她 his他的 him他 home家, (副)在家 hot熱的 house房子 how(副)怎樣,如何 hundred百
	in(介)在…裡面 juice果汁 jump(v) 跳 key鑰匙 kid小孩 kite風箏 leg腿 like (v)喜歡 lion獅子 long長的 make (v) 做;使 marker麥克筆 (12)	hospital醫院 hungry餓的 ice cream冰淇淋 jacket夾克 job工作;職業 Japan日本 jump(v) 跳 (14) kitchen廚房 know(v) 知道;認識 late遲的晚的;得知 let (v) 讓,允許 library圖書館
	milk牛奶 monkey猴子 mouth嘴 mother媽媽 name名字 no不,沒有 nose鼻子 not不nine 9 one 1 on(介)在…上面 orange柳橙,橘色(12)	love愛;喜愛 listen(v)聽 live(v)住 living room客廳 lunch午餐 mad生氣的 many 許多(後加可數名詞) math數學 my我的 Monday星期一 moon月亮 music音樂 MRT捷運 much許多(後加不可數名詞)
I我 it它,牠 Mom媽媽 my我的 pencil鉛筆 pig豬 red紅色,紅的	park公園 pen筆 pencil鉛筆 pet寵物 pig豬 pink粉紅色,粉紅的 play (v)玩,打(球) pizza比薩 red紅色,紅的 ruler尺 run(v)跑 read(v)讀 (12)	need (v)需要 new新的 nice美好的 nineteen 19 ninety 90 now (副)現在 noodles麵條 nurse護士 o'clock點鐘 old 老的,舊的 open(v)打開,打開的 our 我們的 park公園(v)停放(車)
		pants長褲 PE 體育課 pie派 plane 飛機 police officer警察 police station警察局 pull(v)拉 push(v)推 post office郵局 purple 紫色 rain雨,(v)下雨 rainy下雨的 rabbit兔子 read(v)讀
	sad難過的 say(某人)說 see(v)看見 school學校 sing (v)唱歌 singer 歌手 sister姊,妹 six 6 sleep(v)睡覺 she她 short 矮的,短的 seven7 (12)	restaurant餐廳 rice米飯 ride(v)騎,乘 sandwich三明治 Saturday星期六 science科學 shop商店,(v)購物 ship船 shoes鞋子 shorts 短褲 sick生病的,噁心的 sky天空 slow慢的 small小的
	talk(v)說話 tall高的 that那個 the 這… these這些 they他們 tea茶 thin瘦的,薄的 this這個 tree樹 three 3 those那些 today今天 (13)	smile (v)微笑 song歌曲 socks襪子 sofa沙發 soup湯 some一些,某個 spring春天 speak (v)演講 student學生 stand(v)站立 star星星,(v)主演 story故事 study書房,(v)研讀
that那個 this這個 what什麼 yellow黃色 you你,你們 yo-yo溜溜球 zoo 動物園	tiger老虎 time時間 toy玩具 two 2 ten 10 up（副）向上 under(介)在…下面 want(v)想要 we我們 what什麼 who誰 white白色,白色的 your 你的,你們的 (13)	sit (v)坐 sixteen 16 sixty 60 summer夏天 sun太陽 sunny晴朗的 supermarket超市 swim(v)游泳 sweater毛衣 seventeen 17 seventy 70 table桌子 Taiwan台灣 take (v)拿,取
		tape膠帶 taxi計程車 think (v)想,認為 teacher老師 tell (v)告訴 test測驗,考試 thank感謝 their他們的 tired累的 today今天 train火車 T-shirt there(副)在那裡 time時間 Tuesday星期二
		Thursday星期四 twelve 12 thirteen13 thirty30 twenty 20 use (v) 使用,利用 uncle 舅,叔,伯 (13) the USA美國 the UK 英國 walk (v) 走;散步 wash (v)洗 watch (n)手錶 (v)注視 water (n)水(v)澆水
		warm 溫暖的 weather氣候 wear(v)穿 Wednesday星期三 week週,星期 when(副)何時, (連)當...時 where在哪裡 why為什麼 window窗戶 with(介)和,有… work工作(n.v) write (v)寫 windy刮風的;多風的 winter冬天 year年, 歲數