Effectiveness of vocabulary learning via mobile phone

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Abstract
Whereas the penetration of mobile phones in Asian countries keeps climbing, little research has explored the application of the short message service (SMS) in second language learning. This study aims to examine the effectiveness of SMS vocabulary lessons of limited lexical information on the small screens of mobile phones. Thirty high school students were randomly distributed into two groups and given two sets of English words either on paper or through SMS messages during two weeks. Students recognized more vocabulary during the post-test after reading the regular and brief SMS lessons than they did after reading the relatively more detailed print material. Qualitative data from interviews offer information about the learning process as well as the benefits and limitations of m-learning. Results of the questionnaires show that students in general hold positive attitudes towards learning vocabulary via mobile phone. On the other hand, technological limitations, unfamiliar presentations and learning activities may prevent students from reading SMS lessons.

Keywords
m-learning, mobile phones, SMS messaging, vocabulary learning.

Introduction
English as a foreign language (EFL) learners in Taiwan face the challenge of lacking exposure to English. For the majority of them, the English class is the only time to use English. Yet there are only 2–4 h per week for the English class in most vocational high schools (Leu 2004). Because of the class time constraint, vocabulary reinforcement and study is frequently the responsibility of the student outside the classroom (Grace 1998). There is an urgent need for English teachers in Taiwan to find an effective self-study approach for vocational high school students to enlarge their vocabulary size.

An abundance of evidence from research suggests that m-learning (learning assisted by mobile technologies) has great potential in providing EFL learners with large exposure to the target content as learners can do self-learning anytime, anywhere with the assistance provided by mobile technology (e.g., Norbrook & Scott 2003; Thornton & Houser 2003, 2004, 2005; McNicol 2004; Naismith et al. 2005; Roschelle et al. 2005; Chin nery 2006). Among the mobile devices, the mobile phone is the most popular in Taiwan. According to the prominent survey, IT Facts,1 the penetration of mobile phones in Taiwan already exceeded 100% in 2004. Text messaging via the short message service (SMS) is one of the major capacities, second to voice communication. In 2005 there were 2796 million messages sent in Taiwan, doubling the volume in 2001 (DGT 2006). To understand the use of SMS text messaging in the vocational high school where the present study would be conducted, I distributed a survey to the four classes (10th to 12th graders) I was teaching in May 2006. All the 137 students reported that they owned at least one mobile phone.

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mobile phone and only five students did not carry one with them every day. The most frequently used capacities included voice communication, text messaging through SMS and playing games. The students reported that they read their messages literally anytime, everywhere – in commuting, between classes or even before going to bed. When asked to choose the preferred medium for learning English between the mobile phone and the PC, 127 of the surveyed students chose the mobile phone. They responded that mobile phones were available to them, and that PCs were not as convenient as mobile phones because they had to spend more time logging on it. These responses indicate that the mobile phone can be a potential learning medium for Taiwanese vocational high school students.

Thornton and Houser have explored the effectiveness of learning via mobile phone on Japanese college students’ vocabulary gains (Thornton & Houser 2003, 2004, 2005). In their 2005 study, participants who learned vocabulary through Internet e-mails via mobile phone \( (n = 13) \) had significantly more vocabulary gains than those who learned through the Web via PC \( (n = 13) \). The results of the second experiment showed that another mobile phone group \( (n = 25) \) gained significantly more vocabulary than the group using paper materials \( (n = 43) \). Thornton and Houser concluded that the regular messages sent by mobile phone could generate the spacing effect (c.f. Dempster 1987; Greene 1989), which facilitated vocabulary retrieval. To examine the extent of the spacing effect, a follow-up experiment using vocabulary lessons of different lengths was conducted. The long version contained a full context (two sentences paraphrasing the target word and three example sentences) whereas the short version listed only one paraphrasing sentence and one example sentence. No significant difference in vocabulary gains was found between learning from the longer and shorter lessons. Thornton and Houser posited that mobile phones enhanced regular study, which in turn, led to more exposure to the target words and more vocabulary gains than did the detailed presentation of the lessons. Their finding is in accordance with the empirical evidence in the cognitive psychological research that constant and distributed practice has a more beneficial effect on memory and learning than massed practice. Words are memorized significantly better when they are presented temporally apart than when they are presented together at one time (Dempster 1987; Greene 1989; Nation & Meara 2002). The positive effect caused by the spaced distribution of presentations is referred to as the ‘spacing effect’.

Indeed, mobile phones ‘are particularly useful computers that fit in [a student’s] pocket, are always with [students], and are nearly always on’ (Prensky 2005). The portability and immediacy allow students to learn in their preferred time and place. Another appeal to the busy students is the bite-sized lessons provided by most mobile-phone learning programs such as StudyCell (McNicol 2004). Learners feel that the chunks of those lessons are more manageable than the lengthy and usually too detailed lessons on paper. Last but not least, the ‘pushing messages’ (Thornton & Houser 2005) to individual learners’ mobile phones offer cumulative lessons which maximize the exposure to the contents (Nation 2001). Over time, this efficient exposure enhances the information processing activities, makes the activation and recognition automatic, and leads to greater retention (Hulstijn 2001). By contrast, the traditional paper material, which usually includes lengthy presentation of vocabulary lessons, has no such advantages. The paper material is unable to deliver pushing messages like mobile phones can. Its lengthy presentation is unmanageable and, hence, unappealing to students. The benefit of its probability and immediacy may not be generated.

However, the limitations of the mobile technology pose challenges in promoting learning via mobile phone. The reduced screen size, inherent in the portability of the mobile phone, makes the texts delivered via mobile phone distinct from traditional texts on paper or other texts delivered via big-screened computer (Chinnery 2006). Students have to adopt a more concentrated, line-by-line strategy in reading the lessons on their mobile phone. Given the difficulty in skimming a long text on the small screen, it is reasonable to propose that learning vocabulary with wordlists seems to be the most suitable form of instruction when applying the mobile phone to language learning. Empirical studies on approaches to learning vocabulary show that the systematic approach, in which learners learn vocabulary ‘by working through a list of L2 words together with their L1 translations and memorizing the word-gloss pairs’, provides a good foundation for vocabulary development, particularly in foreign language environments where learners have limited exposure to the target language outside the classroom (Read 2000, p. 40).
Although Thornton and Houser support the potential of mobile phones in vocabulary learning, there are three unaddressed issues in need of further exploration. First, only 10% of their participants reported reading their mobile phone messages on time, while up to 57% read the messages only once a day. A reward-based scheme may encourage participants to read the messages frequently. Furthermore, a correlation analysis between students’ gains and their frequency of reading the vocabulary lessons is worth conducting. Second, Thornton and Houser delivered the Internet e-mail via mobile phone with an average length that was ‘between desktop PC email and the short SMS’ (Thornton & Houser 2005, p. 219). In Taiwan, by contrast, the SMS messaging is more common. Before conducting the present research, I tried to e-mail two SMS lessons of different lengths to several students. They complained that the lessons containing example sentences were chopped into several lines and thus were difficult for them to read. Although Thornton and Houser have examined the factor of lesson lengths, their shorter version of vocabulary lesson still included two complete sentences. The question worthy of further exploration is: whether the positive effect of the e-mail lessons via mobile phone exists in the lesson delivered via SMS messaging without example sentences. Third, Thornton and Houser did not describe how their participants used their mobile phones to learn vocabulary. Nor did they try to explain the causes for the success and failure in recalling the vocabulary learned via mobile phone. Qualitative research is needed.

The present study aims to explore effectiveness of using the mobile phone in English vocabulary learning. Research questions include:

• Is using SMS messages via mobile phone a more effective approach to self-learning vocabulary than using paper materials for vocational high school students in Taiwan?
• Is the vocabulary gain positively correlated to students’ self-reported frequency of reading SMS lessons?
• What are Taiwanese vocational high school students’ use and perspectives of learning vocabulary via mobile phone?

As there was little research in Taiwan on mobile learning to date, the results of the present study may offer information relevant to understanding mobile learning, particularly on vocabulary learning via SMS messaging. Information about students’ perspectives may point out a direction for material writers as well as software developers.

Research methods

Participants

One class of 31 vocational high school students (10th graders) was invited to join the study. They were accustomed to using SMS messaging, but none of them had learned languages through this access. They had been learning English for 6 years on average. Their English proficiency level was intermediate according to their scores on the English test of the entrance examination and their ranking at school. One of them did not carry a mobile phone every day. Except his data, the data of the remaining 30 participants (22 and eight females) were analyzed in this study. The 30 participants were assigned to the two conditions in the S-shape distribution according to their rankings in class with their English grades so far in this semester as the proficiency index. The average English proficiency of each condition is supposedly equal.

In the first week, 15 participants learned the first 14 target words via mobile phone (group M1), while the other 15 learned the same vocabulary using print materials (group P1). In the second week, the two groups switched their media for another 14 target words (group P2 and group M2). That is, group M1 became P2 while group P1 became M2. Both groups of participants were encouraged to read the lessons as often as they could. They were told they would have recognition tests on the target words on the last day of each week. A reward-based scheme was clearly announced to arouse their interest in studying the vocabulary lessons.

Materials

The 28 target words (TWs) were the correct answers to the vocabulary tests of the entrance examination for 2-year and 4-year technological colleges in 2004 and 2005. The first 14 TWs consisted of five nouns, five verbs, and four adjectives, whereas the second 14 TWs contained four nouns, five verbs, and five adjectives. For the M groups, the 14 TWs were divided into seven
pairs and delivered by SMS messaging twice each day during students’ commuting time. Each of the lessons listed two target words, followed by their Chinese translations and syntactic categories. The P groups were given the paper materials listing the 14 TWs on the first day of the week. The lesson included not only the information for the M groups but example sentences and their translations, which presentation is the same as that in the English textbooks students have been using since they started learning English in fifth grade.

**Procedures**

The pre-treatment questionnaire and test were conducted in the first week in June. In the following two weeks, participants received their vocabulary lessons. On the day when the final SMS lesson was delivered, the immediate post-test, the post-treatment questionnaire, and the interviews were conducted. Soon after the post-test for the second group of TWs was conducted, the summer vacation started. Participants were not informed of the delayed post-test. According to my knowledge of the students, it is presumed that participants would receive little reinforcement on the target words as few, if any, would review their vocabulary lessons during the vacation. Three weeks later on the back-to-school day during their summer vacation, participants took the delayed post-test.

**Pre-treatment questionnaire**

Participants answered three questions about their use of mobile phones. Data were computerized to find the baseline information.

**Pre-treatment test**

Participants were required to recognize 50 words – 28 target words and 22 non-target words with similar length to the target words – and write down their Chinese translations. One point is given for each correct answer to the 28 TWs. Each participant has two pre-treatment test scores for the two TW groups.

**Treatments**

Students of the M group received two SMS lessons every day, at 7 AM and 5 PM from Monday afternoons to Thursday afternoons, during their commuting time (Thornton & Houser 2005). Students of the P groups were given paper material on Monday mornings.

**Post-treatment questionnaire and interview**

At the end of the treatments, participants of the M groups filled out the questionnaire containing six items of five-point evaluation and two open-ended questions about learning vocabulary via mobile phone. They were also required to report their frequency of reading the vocabulary lessons. Participants involved in the issues emerging during data analysis were interviewed for clarification or further investigation.

**Post-tests**

At the end of each week, an immediate post-test for the 14 TWs was conducted. Three weeks after the treatments, a delayed post-test for the 28 TWs was conducted. Participants were required to write down the translation of each TW. One point was given for each correct answer.

**Results and discussion**

**Vocabulary gains via different media**

Table 1 shows test scores and vocabulary gains for each group. The within-group comparison of the pre-treatment test and the immediate post-test scores shows that both groups, regardless of their medium, made sig-

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Table 1. Vocabulary gains.

<table>
<thead>
<tr>
<th></th>
<th>The first week</th>
<th>The second week</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mobile phone (M1) Paper (P1)</td>
<td>Mobile phone (M2) Paper (P2)</td>
</tr>
<tr>
<td></td>
<td>$n = 15$</td>
<td>$n = 15$</td>
</tr>
<tr>
<td>Pre-test</td>
<td>2.00 (SD = 1.96)</td>
<td>3.53 (SD = 1.46)</td>
</tr>
<tr>
<td></td>
<td>2.13 (SD = 1.19)</td>
<td>3.33 (SD = 1.35)</td>
</tr>
<tr>
<td>Post-test</td>
<td>9.73 (SD = 3.75)</td>
<td>9.07 (SD = 3.58)</td>
</tr>
<tr>
<td></td>
<td>7.07 (SD = 3.81)</td>
<td>7.93 (SD = 3.79)</td>
</tr>
<tr>
<td>Gain</td>
<td>7.73 (SD = 2.69)</td>
<td>5.53 (SD = 3.14)</td>
</tr>
<tr>
<td></td>
<td>4.93 (SD = 3.15)</td>
<td>4.60 (SD = 3.31)</td>
</tr>
</tbody>
</table>
significant progress in learning the 28 TWs (two-tailed t-test comparing the pre-treatment test scores and the immediate immediate post-test scores of each group; \( t = 2.620^*, \ df = 28, \ P < 0.05; \) SPSS 10.0). This gain, however, decreases in the delayed post-test. None of the delay gains in the four groups reaches the significant level. Overall, the mobile phone groups have greater vocabulary gains than their paper-group counterparts in both immediate and delayed post-tests. In the first week, the difference of the immediate gains between the two groups reaches the significance level (two-tailed t-test comparing the gains; \( t = 2.620^*, \ df = 28, \ P < 0.05; \) SPSS 10.0). The benefit of SMS lessons diminishes in the delayed post-tests, yet the first mobile group could remember nearly three words out of the 14 target words which had been previously unknown to them, with little reinforcement during the three weeks.

Correlation between gains and frequency of reading SMS lessons

The average frequencies of reading the SMS lessons reported by the first-week and the second-week mobile groups are 15.93 times (\( \sigma = 9.73 \)) and 8.93 times (\( \sigma = 4.23 \)), respectively. The Pearson correlation coefficients of the vocabulary gains and reading frequency (two-tailed analysis; SPSS 10.0) shows that there is no significant correlation between students’ self-reported frequency of SMS reading and their vocabulary gains.

However, it is reasonable to presume that the lack of significant statistical correlation may result from the large deviation of self-reported reading frequency. Thus, the data of students who reported the highest frequency of reading the SMS lessons and those who reported the lowest frequency in each group were re-examined. Table 2 shows the data of the four cases. A positive correlation between frequency of SMS reading and vocabulary gains emerges after comparing their immediate vocabulary gains and the average gains of their group. It is clear that the higher the reading frequency, the higher the vocabulary gains, and vice versa. Helen, who reported to have read the SMS for 40 times in a week, had the vocabulary gain far above average in her group. So did Chris. On the other hand, Greg and Yale, both of whom reported the lowest frequency in their groups, had vocabulary gains below average. Greg’s vocabulary gain was even among the lowest in his group.

The two salient cases – Helen, the girl who read the SMS lessons the most often among all the participants and got full marks at the immediate post-test, and Greg, the boy who reported the least frequency and lagged far behind – were interviewed. Helen is an active learner in class. She has been learning English for 8 years and used to learn English by emailing her private tutor. When she received her first SMS lesson, she sent back two sentences she made with the target words and asked for feedback. Transcript (1) suggests her attitude towards and process of learning vocabulary via mobile phone (hereafter LVMP). The positive correlation between her success and her motivating attitude corresponds to the utility of ‘the richness approach’ to vocabulary fluency in Nation and Meara (2002) and the benefit of increasing the ‘involvement load’ in Hulstijn and Laufer (2001), both of which can be achieved in any CALL activity with an interaction function.

(1) I was curious which words I would receive and looked forward to reading the messages. I think learning a word involves not only remembering its meaning but using it. So after reading them, I tried to use them to make sentences. If I was not sure about the usage, I would look up the dictionary inbuilt in my mobile phone. In order to spell the words right and make correct sentences, I had to check the SMS lessons several times. I think it helped me remember the words.

(Helen; interview; 9 June 2006)
Greg, by contrast, is a slow learner in English but highly interested in computer technologies. He took a positive attitude to LVMP (average of his preference: 3.3 in the Likert five-point scale) and mentioned no disadvantage of LVMP in the post-treatment questionnaire. But there was a mismatch between his attitude and action. He agreed that LVMP helped him memorize vocabulary more easily; however, he also reported that he seldom read the SMS lessons. His confession in transcript (2) points out the potential constraint of the mobile phone as an instructional medium, namely, the ‘dominance of the entertainment function’. It also corresponds to the finding in previous studies that students may not be doing what the instructor intends them to do in CALL activities (e.g., Collentine 2000; Hwu 2003). To maximize its utility, the instructional software may need a tracking mechanism so as to allow instructors to detect certain behaviours in order to intervene in time to offer assistance. The use of such a tracking mechanism certainly requires full disclosure on the part of the instructor and full knowledge and acceptance of the participants.

(2) Although the SMS lessons were good, I liked playing games more. It seems I have picked up the habit of playing games every time when I use my mobile phone.

(Greg; interview; 9 June 2006)

A positive correlation between reading frequencies and vocabulary gains again emerges when students’ gains via mobile phone and paper are compared. Chad is a slow learner in class. After the first week using the traditional paper materials, he gained no vocabulary at all. But in the second week, he scored 5 by studying SMS lessons. In the post-treatment questionnaire, he agreed that LVMP enabled him to memorize vocabulary easily and commented that four words per day via mobile phone were more manageable than 14 words at a time in the paper material.

Peter’s grades in English have always been among the top three in class. After learning the vocabulary via SMS, he had a great gain at the immediate post-test, although he reported reading the SMS lessons only eight times in the 4 days. In the second week when he learned another set of vocabulary via paper, however, he had incredibly low gains in the immediate post-test. He even forgot the words that he had known at the pre-treatment test! Transcript (3) explains Peter’s unexpected failure. It seems some students need the regular and ‘alerting’ lessons, which can be offered via mobile phone.

(3) I lost the paper handout and totally forgot the lesson and the posttest thing. So I did not prepare for the second set of vocabulary at all.

(Peter; interview; 16 June 2006)

The last divergent case is Sam, whose grades in English have been among the lowest in class. Despite the low frequency of reading, his vocabulary gains were high. Transcript (4) explains why he performed quite well. His case proves that how the learner learns the word counts no less than the reading frequency or the medium. It also supports Meara’s (1980) argument for the intention of studying and proves the utility of the reward-based scheme in the present study.

Table 3. Data of counter-examples.

<table>
<thead>
<tr>
<th>Students reporting frequency above average but having gains below average</th>
<th>Students reporting frequency below average but having gains above average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency of reading SMS lessons</td>
<td>Chad (M2)</td>
</tr>
<tr>
<td>Gain for LVMP</td>
<td>Chad (M2)</td>
</tr>
<tr>
<td>Gain for LV via paper</td>
<td>Chad (M2)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Frequency of reading SMS lessons</th>
<th>Chad (M2)</th>
<th>Peter (M1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gain for LVMP</td>
<td>Chad (M2)</td>
<td>Sam (M2)</td>
</tr>
<tr>
<td>Gain for LV via paper</td>
<td>Chad (M2)</td>
<td>Sam (M2)</td>
</tr>
</tbody>
</table>
I was afraid to fail English again this semester, so the reward-based scheme meant a lot to me. I really needed the bonus. Although I did not read the vocabulary lessons every day, I spent almost an hour before the post-tests memorizing the target words by writing them on paper again and again. To me, it was the motivation and concentration instead of the media that made a difference.

(Sam; interview; 16 June 2006)

Table 4. Evaluation of LVMP, reported on a scale of 1–5, where 5 = strongly agree; 1 = strongly disagree (n = 30).

<table>
<thead>
<tr>
<th>Questionnaire item</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) LVMP is convenient.</td>
<td>4.0</td>
<td>0.79</td>
</tr>
<tr>
<td>(2) LVMP is interesting.</td>
<td>4.0</td>
<td>0.69</td>
</tr>
<tr>
<td>(3) The SMS vocabulary is easier for me to memorize.</td>
<td>3.37</td>
<td>0.67</td>
</tr>
<tr>
<td>(4) I read the SMS vocabulary lessons more often than the paper lessons.</td>
<td>3.83</td>
<td>0.87</td>
</tr>
<tr>
<td>(5) I prefer LVMP.</td>
<td>3.50</td>
<td>0.78</td>
</tr>
<tr>
<td>(6) I hope to continue LVMP.</td>
<td>3.47</td>
<td>0.90</td>
</tr>
</tbody>
</table>

Students’ perspectives of learning vocabulary via mobile phone

Table 4 shows students’ evaluation of LVMP after they used their mobile phones to learn the target words. Scores average 3.7 on a scale from 1 to 5. All scores are significantly positive (one-tail t-test comparing each question with an expected mean of 3, with $P < 0.05$ for each question). Overall, students felt that LVMP was convenient and interesting. They could memorize the vocabulary in the SMS lessons more easily. They preferred learning vocabulary via mobile phone and looked forward to continuing LVMP.

Tables 5 and 6 show the results of the open questions asking for students’ comments on learning vocabulary via mobile phone. When asked about the advantages of LVMP, more than half of the participants appreciated the convenience and effective time management in LVMP. A quarter of the participants enjoyed the novel experience of LVMP. Seventeen per cent of the participants reported that the SMS lessons helped them memorize vocabulary because of the brief and clear presentation. One of them mentioned that vocabulary became easier to remember by connecting it to the surroundings where she read the SMS lessons. To sum up, it seemed that the positive comments were mostly meta-cognitive or affective whereas the cognitive benefits of the SMS lessons were less reported.

When asked about the disadvantages of LVMP, seven students gave no negative comment. More than half of the remaining 23 students commented on the techno-

Table 5. Positive comments on LVMP (n = 30; number of total tallies = 42).

<table>
<thead>
<tr>
<th>Category</th>
<th>Frequency (%)</th>
<th>Example comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ubiquity</td>
<td>31</td>
<td>I can memorize the vocabulary everywhere.</td>
</tr>
<tr>
<td>Fun</td>
<td>26</td>
<td>I never used my MP for learning; it’s novel and fun. I look forward to receiving the SMS messages and read them.</td>
</tr>
<tr>
<td>Effective time management</td>
<td>17</td>
<td>I can make good use of the trivial time to study.</td>
</tr>
<tr>
<td>Manageable amount of content</td>
<td>17</td>
<td>The lessons are short and easily to read.</td>
</tr>
<tr>
<td>Helpful for study</td>
<td>10</td>
<td>The scheduled and regular lessons help me learn better.</td>
</tr>
</tbody>
</table>
logical limitations in applying mobile phone in learning. Slightly over a quarter of the participants were not satisfied with the content of the SMS lessons. Nineteen per cent of the participants did not like the learning activity of LVMP. Overall, students seemed to be more concerned with the convenience of the medium than the content of the SMS lessons or the LVMP activity.

**Conclusion**

Corresponding to the results in Thornton and Houser (2005), mobile groups in the present study had greater vocabulary gains than their paper-group counterparts. This superiority was not retained in the delayed tests. The attrition of vocabulary was considerably large in 3 weeks, and there was little difference across conditions. The analysis of the salient cases implies that there may be a positive correlation between frequency of reading the SMS lessons and vocabulary gains, which also supports the cognitive benefit in learning via mobile phone. Students who read the SMS lessons more frequently retrieved vocabulary more and those who seldom read the SMS lessons retrieved less. Moreover, information from students’ interviews indicates that an interaction function, a reward-based scheme, and a tracking mechanism are required to maximize the advantages of LVMP. Finally, results of the questionnaires show that students in general took positive attitudes towards learning vocabulary via mobile phone for its portability, immediacy, novelty, legibility and the spacing effect it generated. On the other hand, technological limitations and unfamiliar presentations might prevent students from reading SMS lessons.

The SMS vocabulary lessons were likely to provide several of the optimal psychological conditions for the effectiveness of any vocabulary activity described by Nation (2001). First, for EFL learners, vocabulary learning is efficient if the meaning of the word is conveyed by an L1 translation (p. 66). Second, cumulative learning is the most effective (p. 81). Learners are more capable of dealing with a limited amount of information at a time. Too much information may confuse them or de-motivate them. Third, motivation and interest are the important enabling conditions for noticing, which is the first step in learning (p. 63). The SMS lessons offered a novel learning experience as well as a relaxing condition. The lessons are manageable chunks and learners can study whenever they use their mobile phone, which is connected with the rather enjoyable memory. Fourth, learners need to choose items to study (p. 307). The separate SMS lessons enabled students to choose which words they wanted to review and they could change the order of the words more easily. Language teachers, material writers, and developers of future CALL software or m-learning programs should take these findings into consideration.

**Implications and limitations**

The SMS messaging of mobile phones is an instruction tool of great potential owing to its high popularity among young adults and to its economical capacity for
one-to-many communication. The immediacy and novelty of SMS lessons and its manageable amount of information can foster students’ vocabulary learning. Moreover, the positive effect seems to compensate for the constraint of mobile phones’ small screens. Future instructional projects via mobile technology should take advantage of m-learning to increase students’ exposure to the target language. To maximize the utility of learning material, software designers as well as paper-based material writers should take learners’ needs and learning styles into account. To learners of the ‘m-generation’ (Prensky 2005), bite-sized but regularly delivered information via mobile phone SMS is manageable while the one-shot massed paper material in a rather traditional manner fails to arouse their interest to study.

As the finding in this study demonstrates, mobile learning facilitates certain forms of learning that are difficult with a traditional paper-based approach. The specific features of the SMS message via mobile phone arouse learners’ motivation. The text messages can be easily sent at pre-determined times with ‘distributed repetition at optimal intervals’ (c.f. Baddeley 1990). They are stored systematically and accessible for later retrievals. The lessons delivered via mobile phone are more appealing to students. Carrying a mobile phone and checking the SMS messages anytime and anywhere is trendy among students, which is absolutely not the case with reading the paper-based learning material. Hence, the mobile phone can be a more effective medium for self-learning English vocabulary than the paper material in that it arouses learners’ motivation, which in turn increases frequency of reading the lessons and maximizes the exposure to the target language.

As Roschelle et al. (2005) concludes, learning management may best be enhanced by a combination of mobile technologies and human assistance. The results of the present study imply that for the best results of vocabulary learning via mobile phone, instructors should create three optimal conditions. First, a reward-based scheme which arouses learners’ motivation to study the lessons should be integrated into any CALL curriculum. Second, a tracking mechanism assisted by, for example, WebCT’s tracking system, can be supplemented in the m-learning projects or any CALL software under the principle of not intruding users’ privacy. This kind of tracking mechanism should allow instructors to monitor learners’ learning and detect certain behaviours in order to intervene in time to provide assistance (Hwu 2003). It may also increase the reading frequency of the lessons and maximize the efficacy of the self-study approach. Third, an interaction function, which allows students to use the language and teachers to give feedback, should be supplemented. This kind of student-initiated use of language, supported by teachers, can foster vocabulary acquisition by increasing the ‘cognitive involvement load’ (Hulstijn & Laufer 2001). By using the word to make a sentence, sending it to teachers via SMS text messaging, and reading the feedback, learners can build a net of well-connected and well-practised paths and thus retrieve the target word more easily.

Multiple materials and multiple modules can facilitate learning (Chapelle 2001). The mobile phone, along with other computer technologies, is expanding the list of instructional tools for teachers and students. It can be an alternative instructional tool for learners of special needs or a complementary teaching material that offers multiple learning opportunities. With support from technology advancement, other forms of computer application in second language acquisition are around the corner, for example, quizzes via SMS, a classroom response system using SMS as a tool for conducting language activities, learning projects integrated with more ‘game’ elements, and the planner function to help students organize their learning (cf. Traxler & Riordan 2003; Naismith et al. 2005).

Limitations of this small-scaled study give direction to future research. The vocabulary lessons contain only 14 target words for 1 week. The amount is very small compared to that in the regular syllabi for the vocational high schools in Taiwan. Only receptive knowledge about the vocabulary is examined, whereas productive knowledge is also important (Read 2000) and may be included at the post-test in future research. The amount of experimental time is short – only 2 weeks. The small number of participants in each group may lead to individual extreme scores having a disproportionate effect on overall mean scores.

Owing to the lack of a tracking mechanism, the frequency of reading the SMS vocabulary lessons is self-reported by students. The validity of the relevant results may be affected by students’ self-bias. If participants had been required to send their response by SMS, for example, making sentences with the TWs such as what Helen, the most successful learner in this study did, they would have been pushed to be more involved in reading
the SMS lessons. The features of interaction and immediacy of the mobile phone as a learning medium would be highlighted. In one sense, this interaction activity can function as a tracking mechanism to see whether students read the SMS lessons. The higher reading frequency of the SMS should make the investigation of the effectiveness of using the mobile phone as a learning medium more valid.

The serious attrition of vocabulary shown in the decreased effectiveness of the learning via mobile phone in the delayed test underscores the recycling of vocabulary in materials and instruction (cf. Waring & Takaki 2003). Distributed repetitions at not too long intervals are one of the optimal conditions for vocabulary retrieval (Baddeley 1990). The SMS messaging via mobile phone may help create such a condition as instructors can send SMS lessons repeatedly at pre-determined times via computer. Future research may investigate whether vocabulary recycling occurs in this approach.

Future study may also expand the experimental time with more participants learning more target words. Including other experimental groups, for instance, a combination of SMS lessons and paper lessons. Learning via mobile phone with an integration of tracking or the interaction function, may be a new investigation direction for future research. Equally important is the qualitative research. Data gathered by interviewing participants about how they use the SMS lessons or through closer and longitudinal observation of their use of mobile phones may add critical information to research into this area.

Notes

1Mobile penetration in Taiwan and Hong Kong reaches 110% and 105.75%, according to the posting on IT Facts weblog: http://www.itfacts.biz/index.php?id=P2235 (last accessed 4 June 2006).

2Participants were told their scores would be ranked. The top 10 would be rewarded with five bonuses, the second 10 would get three bonuses, and the remaining would get one bonus for their participation. The bonuses would be converted to the marks towards their semester grades.

References


