m-Learning: An experiment in using SMS to support learning new English language words

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Abstract
There is an increase use of wireless technologies in education all over the world. In fact, wireless technologies such as laptop computers, palmtop computers and mobile phones are revolutionising education and transforming the traditional classroom-based learning and teaching into anytime and anywhere education. This paper investigates the use of wireless technologies in education with particular reference to the potential of learning new technical English language words using Short Message Service (SMS) text messaging. The system, developed by the authors, called mobile learning tool (MOLT), has been tested with 45 1st-year undergraduate students. The knowledge of students before and after the experiment has been measured. Our results show that students enjoyed and learned new words with the help of their mobile phones. We believe that using the MOLT system as an educational tool will contribute to the success of students.

Introduction
There has been significant interest and growth in the number of institutions using mobile devices to support learning and teaching. Mobile learning, or m-learning for short, is a new concept, and is very closely related to e-learning. Stone (2004) defines m-learning as a ‘special type of e-learning, bound by a number of special properties and the capability of devices, bandwidth and other characteristics of the network technologies being used’. Milrad (2003) defines e-learning as ‘learning supported by digital electronic tools and media’, and m-learning as ‘e-learning using mobile devices and wireless transmission’.

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m-Learning is often defined as learning that takes place with the help of portable electronic tools (Quinn, 2000). A portable device that supports learning may be freely moved, but learner is mostly stationary, even though they are using a mobile device. Although the device is mobile and portable, the learning as an event cannot be described as mobile (Ahonen, Pehkonen, Syvanen & Turunen, 2004). Moreover, when people access information via different tools, there is still much usability, compatibility and accessibility related questions that hinder seamless mobility and m-learning.

A survey carried out at the Near East University showed that only a very small percentage of students owned personal digital assistants (PDAs), thus making them unsuitable for m-learning experiments. Mobile phones on the other hand are relatively cheaper and a survey indicated that they are owned and used by every student at the University. The widespread use of mobile phones amongst our students has led us to consider how this technology might help us to improve the motivation of students and help in teaching.

The authors looked at language-teaching capabilities of mobile devices to consider how wireless technologies are being adapted to meet changing educational needs. An important question is how to create a mobile system for teaching new words, which has added-value features for its user. The aim of this experimental study has been to find out the potential of using mobile phones in teaching new technical English language words to 1st-year undergraduate students. During the experiment, new words and their meanings are sent to students throughout the day in half hourly intervals, and their learning abilities were assessed by performing tests before and after the experiment.

**Review of related literature**

Mobile computing is still at its infancy and can be considered to be in its first generation. It is claimed by Pownell and Bailey (2001) that handheld computers are at the forefront of the fourth wave in evolution of educational technology. The first wave was dominated by large, expensive mainframes, which were used in education to make administration and managerial tasks easier. The second wave started in 1970s with the advent of desktop computers, which were also called personal computers (PCs), and schools introduced computer literacy courses for students to learn about the technology and how to use it. The third wave started in 1990s by the development of the Internet and the World Wide Web. The fourth and the current phase started around 2001 and involve the use of palmtop computers and mobile phones. Although many educationalists in the field see great potential for the use of mobile devices in m-learning, there are currently very few successful implementations to consider as the best practice.

m-Learning is implemented on palmtop computers or mobile phones. The distinction between the two types of devices is becoming less and less obvious. Most palmtop computers now include mobile phone functionalities. Similarly, mobile phones now have palm-like functionalities such as calendar, database, scheduler, alarm clock, etc. These are often referred to as ‘smart phones’. Smith (2003) suggests that in the next 3 years, mobile phone use by younger students will migrate to smart phones; whereas PDAs or phone enabled PDAs will not be popular except where they support specialists’
courses. Also, a number of hybrid devices are now available which combine the phone and palm functionality.

There are many reported successful usage of palmtop computers in schools. Shields and Potfak (2002) report that exchanging messages by beaming between palmtops has a direct effect on learning, especially for collaborative working and group working, and increases the amount of writing produced.

Danesh, Inkpen, Lau, Shu and Booth (2001) describe an application called Geney which runs on palmtops and help children explore genetic concepts using a collaborative problem-solving approach. The Docklands Learning Acceleration Project (McTaggart, 1997) aimed to increase the amount of children’s reading and writing skills. The project was run by the National Literacy Association, and distributed 35 Acorn Pocket Book computers to 15 schools in the inner London Borough of Newham and Southwark. McTaggart reported that an improvement in the children’s literacy skills was observed because they could use the spellcheck and the thesaurus while he could be free to work on the content of their work.

The literature review generally presents a positive picture of palmtops in education. However, some problems are also reported. Jackson (2002) and Perry (2003) warn about the physical fragility of palmtops in the rough environment of schools and the likelihood of theft, but reports from actual trials suggest that these are not significant problems in practice. The importance of keeping batteries recharged is also important, otherwise work could be lost (Perry, 2003). Mifsud (2003) suggests that the new types of mobile phones and PDAs offering extra functions, such as voice and image recording, can also act as a disruptive technology.

There have been applications in the literature for the use of SMS text messaging in education. Ananova (2001) report a study where SMS messaging is used for revision support in secondary schools in Merseyside, UK. Soloway et al (1996) describes a trial using SMS text messaging at the Kingston University (UK) to support 1st-year degree students in terms of time management and ensuring that essential core learning is not missed at an early stage. SMS is also used to complete exercises which facilitate learning and to complete assessed work (Stone, Briggs & Smith, 2002).

Theoretical framework

There are many learning theories in the literature, but we will briefly review some of the popular ones that are most relevant to m-learning—informal learning and constructive learning.

m-Learning could be thought to be a form of ‘informal’ learning. Informal learning can happen anywhere and anytime. In fact, this type of learning happens all the time. Learning is through interaction with others. Much of the learning that takes place in organisations is informal, outside of structured learning programs: asking colleagues for help; searching the network and Internet; and through trial and error. Because this
type of learning can happen anytime and anywhere, much of m-learning takes place as informal learning.

‘Constructive learning’ is based on the idea that people learn by constructing new ideas based on their current and past knowledge. In other words, ‘learning involves constructing one’s own knowledge from one’s own experiences’. Here, the learners motivate themselves during the learning process. According to Von Glasersfeld (1989), sustaining motivation to learn is strongly dependent on the learner’s confidence in his or her potential for learning.

**The aim**
The aim of this experimental study has been to find out the potential of using mobile phones in teaching new technical English language words to 1st-year undergraduate students to support their normal English language lectures.

In order to reach this aim the authors have sought answers to the following questions:

1. What are the opinions of students about the mobile phone-based learning system?
2. Are there significant differences between the pretest and posttest results?
3. What are the students’ suggestions for the development of the system?
4. How often should the words be sent?
5. During which hours of the day should the words be sent?

**Method**

*Setting*
This experimental study has been carried out at the Near East University, Department of Computer Information Systems, during the Spring (2007) semester. In order to send the SMS text messages, a Windows-based program has been developed by the authors on a PC, called the Mobile Learning Tool (MOLT).

*Subjects*
The experimental study was carried out with 45 1st-year volunteer students, randomly selected and willing to participate in the experiment. Before the beginning of the experiment it was checked that all the participants had mobile phones and carried by them at all times. The model and the features of mobile phones used were not important in this experiment because any mobile phone can receive and display SMS messages.

*Software*
The software is based on the visual basic programming language. The ActiveX control package Logiccode GSM SMS Active X DLL (2007) was used in the program to format the SMS text messages and send them to a mobile phone attached to the PC via the Bluetooth interface. Any model of standard mobile phone could be used as long as it had Bluetooth interface. The mobile phone received messages and phone numbers from the PC and then sent these messages to the recipient students at the times requested by the PC. Figure 1 shows the block diagram of the system developed by the authors.
The computer program consists of a single Graphical User Interface-based display and Figure 2 shows a snapshot of the screen when the program is run. The program operates by entering the starting and ending dates and times of the experiment, and once it starts, it runs throughout the experimental period, terminating automatically at the requested date and time. Before the program is run, two text files are created: File \textit{MESSAGES.DAT} stores the messages (i.e., the selected technical English words and their meanings) to be sent to all the students. Similarly, file \textit{PHONES.DAT} stores mobile numbers of all the students participating in the experiment.

\textbf{Application}

The operation of the computer program is as follows:

- The program operates within the hours of 9:00 a.m. to 5:00 p.m. which is the normal office hours. Dunn and Dunn (1993) have found that the optimal time to learn is during the daytime (30\% during the morning, 30\% during the afternoon, 30\% in the evening) and this is one of the reasons why the experiment has been carried out during the daytime.
- Every half an hour the program reads a new message from the messages file and sends this message as an SMS to all of the students participating in the experiment.
- Students receiving the messages are expected to read and learn the new words wherever they happen to be.
16 messages were sent daily during the 8-hour operating time. In total there were 48 messages. These 48 messages were arranged randomly in three groups—A, B and C—each group having 16 messages, and each group receiving the same 16 messages three times during the experiment. Thus, the experiment was completed in 9 days.

The messages were sent in the following sequence:
- Group A: days 1, 2 and 7;
- Group B: days 3, 4 and 8;
- Group C: days 5, 6 and 9.

The importance of repetition in learning cannot be underestimated. Learning to speak a language, learning to swim, playing a game, learning to type, or driving a car—all are learned with repetition. Spaced repetition has been known to improve learning (Wozniak, 1990). This is why the messages were repeated and same messages were sent on three separate days.

Figure 3 shows some of the messages (words) sent to students together with their meanings. The description of the meanings of words were chosen as short as possible,
so that the recipients can read these messages on their small screens without having to scroll down many times.

Data collection and analysis
In order to find out the learning abilities of students, a pretest and a posttest have been carried out. In both tests, the meanings of the words used in the experiment were asked, and it was expected that after the experiment, students would learn the words and thus score higher marks. The test conditions (e.g., the duration of the test and the environment) were identical in both tests.

Survey questionnaire
Students were asked to carry out a written survey at the end of the experiment in order to receive their feedback on the use of the MOLT system. The survey was administered at the University by asking the students to fill the survey questionnaire during a lecture session, where the students were given 20 minutes to complete the questionnaire. ‘The Scale of Student Opinion on MOLT System’ was prepared by authors in the form of a questionnaire related to students’ opinion. Content and validity of questions were investigated by 12 experts (experts of educational technology, assessment and measurement experts) in this field and were found to be satisfactory. The internal consistency of the questionnaire was found to be 0.94 using Cronbach alpha. Twenty-four carefully prepared questions were given to students to answer in the class. The questionnaire consisted of two sections, and each question (see Figure 4) was phrased to determine whether or not there was a positive response to the MOLT system. First section of this

Figure 3: Some of the words sent

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### Section A

<table>
<thead>
<tr>
<th>Question</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I found the MOLT system enjoyable.</td>
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<td>2. I think all my friends who used the MOLT system are happy about it.</td>
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<td>3. I can easily remember the words that I received on my mobile phone.</td>
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<td>4. The words I learned with the MOLT system have increased my vocabulary.</td>
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<td>5. I would like a similar system to be used in all of my other lessons.</td>
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<td>6. With the help of MOLT system I learned new words easily.</td>
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<td>7. MOLT system helped me correct the meanings of words I knew wrongly.</td>
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<td>8. Using the current technology with the MOLT system has motivated me.</td>
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<tr>
<td>9. Using a new novel teaching tool has motivated me.</td>
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<td>10. Because I am very occupied during class hours it is more difficult to learn new words. But I can learn and remember new words easier during my leisure time.</td>
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<td>11. It would be nice if the MOLT system supported “searching” where I could search for a new word.</td>
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<td>12. It would have been more effective if I could use two-way communication with the MOLT system.</td>
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<td>13. I preferred the messages to come as multimedia messages.</td>
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<td>14. I would like to see the MOLT system to be used in next semesters as well.</td>
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<td>15. I found learning new words with the MOLT system very effective.</td>
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</table>

### Figure 4: Survey questions

16. In your opinion what should be the word sending frequency in MOLT system?
   - Every 15 mins
   - Every 30 mins
   - Every hour
   - Every 8 hour

17. Between what times do you think the words should be sent in the MOLT system?
   - 09:00-17:00
   - 08:00-22:00
   - 09:00-24:00
   - 10:00-24:00
   - 08:00-22:00 – 17:00-22:00
   - After 17:00

18. Which effects would you like to see in received words?
   - Sound
   - Picture
   - Animation

19. Would you like to receive words at the weekends?
   - Yes
   - No

20. I wish the MOLT system had search facility.
   - Yes
   - No

21. How would you like the valuation to be done?
   - With MOLT system
   - With paper (classical) methods

22. Would you like the MOLT system to be supported by chat and forums?
   - Yes
   - No

23. Would you like to receive the summaries of lecture notes on your mobile phone?
   - Yes
   - No

24. Would you like to receive University messages such as adverts, exam dates, results etc to your mobile phone?
   - Yes
   - No
questionnaire is formed in 5-point Likert scale type questions, consisting of 15 items, with 5 being a response of strongly agree and 1 representing strongly disagree. Each question was phrased so that strongly agree represented a positive reaction to the project in section A.

The second section of the questionnaire consisted of nine carefully prepared questions to find out what improvements or modifications the students wished to see in the MOLT system.

**Results**

Two major goals of this experimental study have been:

- Observe the usage of the MOLT system with undergraduate students and obtain feedback on their opinions of this m-learning tool; and
- Determine the student success and thus the value of this m-learning tool.

**The success rate of students in learning new words**

The results given in this section are based on the student grades obtained in pretest and posttest. In order to find out whether or not there was any statistically significant difference between students’ success rate in pretest and posttest, a paired sampled t-test was carried out and the results are shown in Table 1. Results clearly indicate that before using the MOLT system ($M = 24.68$, $SD = 12.44$), students had lower success rates than after using the MOLT system ($M = 89.77$, $SD = 7.18$). A paired sampled $t$-test based on pretest and posttest results has indicated a significant difference between the two tests ($t = 32.29$, $p < 0.05$) in favour of the posttest.

**Opinions of students about the MOLT system**

The mean opinion scores and standard deviations of students’ survey responses are given in Table 2. At a glance, the results suggest that students had highly positive opinions of the MOLT system (14th question, $M = 4.40$).

The first question ‘I found the MOLT system enjoyable’, the third question ‘I can easily remember the words that I received on my mobile phone’, and the eighth question ‘Using the current technology with the MOLT system has motivated me’ have the same high scores ($M = 4.38$). One of the reasons for this is that students enjoyed using the MOLT system as a tool as it brought greater flexibility into their learning, as now they could learn anywhere anytime. We can say that the interest of students to the use of mobile phones have also helped them learn new words.

<table>
<thead>
<tr>
<th>Table 1: The success rate of students</th>
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<tr>
<td>N</td>
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<tr>
<td>Posttest</td>
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<tr>
<td>Pretest</td>
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</table>

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It is very interesting to notice that the least meaningful response to the MOLT system is ‘I preferred the messages to come as multimedia messages’ ($M = 3.29$). This shows that students were happy to receive text messages instead of multimedia-based messages. We believe that a different response could have been obtained for the teaching of other subjects that include visual aspects, such as geography, biology, etc.

Another important result of the survey is the response to the fifth question (‘I would like a similar system to be used in all of my other lessons’; $M = 4.20$). According to this result, we can say that students enjoyed learning with the MOLT system. We can also conclude from question ‘It would have been more effective if we could have two-way communication with the MOLT system’, ($M = 3.84$) that students would like to participate in the mobile phone learning process by being more interactive.

**Student opinions for the improvement of the system**
We have asked several questions in the survey to find out the suggestions of students for the improvement of the system. In response to question ‘In your opinion what should be the word sending frequency in MOLT system?’; the majority of students (55.6%) preferred to receive the messages every 30 minutes, which was, by coincidence, the time...
used in the experiment. Also, in response to question ‘Between what times do you think
the words should be sent in the MOLT system?’, the majority (42.2%) preferred the
interval 9:00 a.m.–5:00 p.m., which again was the time interval used in the exper-
iment. We also wanted to find out whether or not the system should be used during
weekends. In response to the question ‘Would you like to receive words at the week-
ends?’, the majority (73.3%) responded positively. This result shows that students
enjoyed learning with their mobile phones even at weekends.

In response to the question ‘Would you like the MOLT system to be supported by
chat and forums?’, the majority (84.4%) answered positively. Similarly, 88.9% said
‘yes’ to the question ‘Would you like to receive the summaries of lecture notes on your
mobile phone?’, which again supports students’ preferences to use their mobile
phones for learning. Majority of students (75.4%) also preferred to receive
nonlecture-based material such as adverts, exam results, etc through their mobile
phones.

We also wanted to find out whether or not students preferred any special effects to be
added to the received words. In response to the question ‘Which effects would you like
to see in received words?’, the majority (44.4%) said they preferred images, 28.9%
preferred to receive animation and only 26.7% said they preferred to receive sound
effects.

Conclusions and recommendations
The survey results were very positive and in favour of the mobile phone-based teaching
system. All of the participants expressed their satisfaction and enjoyment of learning
away from the classroom with the help of their mobile phones. Virvou and Alepis
(2005) who have studied the use of mobile phones in teaching also report that both
instructors and students who evaluated their system found it to be very useful. Students
suggested that other lectures should also use mobile phone-based teaching to support
the main teaching activities in the classroom. In addition, students preferred to receive
university notices, exam dates, exam results, etc in their mobile phones.

The frequency of sending the messages was thought to be satisfactory by the students.
Stone et al (2002) found results very similar to ours as they report that students liked
using SMS, and the response rates were high and the quality of the messages were very
good. Furthermore, a large majority believed that receiving messages every half an
hour was just right. The working period was also acceptable as most students preferred
not to receive messages after 5:00 p.m.

All of the participants expressed an interest in multimedia-based messages and this is
an important result of the survey. These results agree with the suggestions and results
obtained by Kadyte (2004) for the teaching of a foreign language using mobile
phones.
The experimental study carried out another important result, which indicated that students learned new words after the experiment. The average scores before and after the experiment were 24.68 and 89.77 respectively, which is a clear indication of the success of the experiment. The beauty of this system is that the learning process takes place away from the classroom environment while the students are involved with their everyday activities.

Most teaching members of the Department were interested with this study and they kept an eye on it throughout its duration. When the results were announced, they showed interest by asking questions to find out more about the study, and also discussed the possibility of using similar tools in their own lecture sessions.

The cost of sending SMS messages to a large group of students every half an hour could sometimes be high, and students could not be expected to bear the costs. During this study, the local mobile phone company provided financial help by not charging for the cost of the messages. It is the authors’ opinion that most mobile phone service provider companies usually offer reduced cost services for educational use, and such a scheme will greatly reduce the implementation costs of this project.

The overall goal of this study has been to value-add to the anytime and anyplace flexibility of m-learning. Although the teaching of new words using the mobile phones has been successful, the project can be improved in several ways:

- In the experiment, only text-based SMS messages are used. There are many words whose meanings are difficult to describe with words. For example, when describing what a ‘computer keyboard’ is, it is more elegant and easier to understand if a ‘keyboard’ picture is displayed rather than sending a text several lines long. Most mobile phones support messages in the form of pictures and simple animations. In addition, it is easier to remember a picture than to remember its description. Sounds can also be used, especially to teach the pronunciation of new words.
- MOLT system has been developed for the teaching of new technical words. The system can be enhanced and used for the teaching of other subjects as well. For example, brief summaries of lecture notes can be sent to students before the start of a lecture.
- MOLT system is currently unidirectional, i.e., from the university to the student. The system can be made bidirectional so that student responses, feedback or answers to particular questions can be received and processed by the lecturers.
- The use of Java enabled mobile phones is increasing as most phone manufacturers now offer such phones at low cost and with rich features. It is recommended by the authors that future mobile phone-based teaching activities should be based on the use of Java enabled mobile phones. Students will then be able to carry out more complex and more enjoyable learning tasks, such as revision, solving multiple-choice questions, watching short interactive movies about lectures, etc instead of reading simple text, as was the case in this study.
It is the aim of the authors to develop and further test the MOLT system by including the recommendation summarised in the previous discussion.

References


