

SMS-based Vocabulary Learning for ESL Students

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List of Abbreviations

Abbreviation	Meaning
1. AUT	Auckland University of Technology New Zealand
2. EAS	English for Academic Study
3. ESL	English as a Second Language
4. SMS	Short Message Service
5. mLearning	mobile learning

Attestation of Authorship

“I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.”

Yours sincerely,

Chun Li

2009

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Abstract

The utilization of mobile technology among students has given birth to a new form of learning known as mobile learning (mLearning), where learning is supported by mobile devices, ubiquitous communications and intelligent user interfaces. There has been significant growth in mLearning research in the last half decade. The action research undertaken in this study was conducted to investigate how short message (SMS), which is a popular mobile application among tertiary students, is able to assist English as a Second Language (ESL) students' vocabulary learning. The study set a dual goal: first, provide an mLearning service, in order to investigate the effects of a novel learning method, and students' acceptance and usage of it. Second, modify and refine the mLearning strategy, in order to give students an opportunity to integrate mobile technology into their study seamlessly, to change or extend where and when they learn, and to "flexibilize" their learning interactions / conversations with teachers (or assistant teachers). The two-cycle study, conducted in an English for Academic Study (EAS) class at Auckland University of Technology (AUT), allowed the researcher to gather substantial information in order to achieve the research goals.

Nine data collection techniques, including a reflective journal, interview, questionnaire, observation, informal conversation, students' word test records, SMS transmission history, a professional presentation and a portfolio, were used to gather data. Both deductive and inductive methods were employed to analyse data. The findings of the two research cycles demonstrated that SMS-based vocabulary learning was able to enhance ESL students' learning by adding flexibility and providing a stronger motivation for study. The results suggest that mLearning contributed to an improvement in students' learning. Student-centred design played an important role in the success of the integration of mobile technology into learning activities. The pedagogical content for mLearning can be greatly enhanced in the future.

“Learning is good – it feels good.

It is right, it is natural,

It can be enjoyable,

And it is what we do here.

It is a natural act – like eating, sleeping, or breathing.”

-----Martin Haberman

(as cited in Arhar, Holly & Kasten, 2001, p. 11)

Chapter 1: Introduction

The utilization of mobile technology among students has given birth to a novel form of learning known as mLearning (Sharples, 2002). mLearning applications allow users to conduct learning activities and achieve learning goals anywhere, anytime (Organero & Kloos, 2007).

mLearning can be defined in the context of devices employed. According to Quinn (2000), mLearning means learning using mobile computational devices. Sharma and Kitchens (2004) define mLearning as “Learning supported by mobile devices, ubiquitous communications and intelligent user interfaces” (p.205).

A different perspective is provided by Nyiri (2002) according to whom, mLearning arises as a result of person-to-person mobile communication.

The high level of mobile phone ownership among tertiary students contributes to the feasibility of deploying an mLearning environment within universities in New Zealand (Petrova, 2007a). In addition, the high acceptance of SMS (Short Message Service) by young people generates a large number of potential SMS-based learning users (Ozok & Wei, 2007).

mLearning has already penetrated and benefited the realm of language learning. As Kiernan and Aizawa (2004) state, “the benefits of mlearning in language education have been widely documented.” (p. 46).

The advantages of mLearning, such as its flexibility and ubiquity, have inspired organizational initiatives to establish relevant infrastructures and systems, and have attracted significant research interest in investigating and evaluating emerging issues (Page, Hepburn, Lehtonen, Thorsteinsson & Arunachalam, 2007).

1.1 Research Motivation

My initial research motivation arose from my own English language study experience in 2006. I was a student in an EAS (English for Academic Study) class at AUT. When I was learning new English words, I preferred to memorize their meaning iteratively and practice them regularly. As Takač (2008) and Lessard-Clouston (2008) suggest, repeating words and learning them in context promotes vocabulary learning for ESL students.

However, traditional paper-based learning or Internet accessible, computer-assisted e-learning, limited my English study to school or home. I sought innovative approaches to more flexible learning activities.

Through my personal academic background and previous study experience, my postgraduate study and research focus was drawn to flexible learning. Some of the course papers I took, such as Ubiquitous Computing (408207)¹ and Readings on Methodology and Method used in mLearning Research (408200)², focused on mobile applications and mobile learning.

In addition, there is a growing body of research on mLearning, both in New Zealand and internationally (Fielden & Malcolm, 2008). In the current decade, many conferences and journals events are being held which embrace mLearning related issues (Naismith & Corlett, 2006).

Both my personal interest and the influence of the wider research environment contributed to my choice of mLearning as a research topic.

^{1 2} The number is the paper code. Information about the paper is available on www.aut.ac.nz

1.2 Research Objectives

The study aims to investigate mobile technology assisted learning activities, specifically an SMS-based English language learning opportunity provided to students of AUT EAS classes.

The investigation of mLearning will include the process of setting up a mLearning environment, introducing the learning technology to students, providing users with and maintaining a learning service, and evaluating and improving the mLearning system.

The study embodies a dual goal: first, provide an mLearning service, in order to investigate the effects of a novel learning method, and students' acceptance and usage of it. Second, modify and refine the mLearning strategy, in order to give students an opportunity to integrate mobile technology into their study seamlessly, to change or extend their learning time frames and places, and to "flexibilize" their learning interactions / conversations with teachers (or assistant teachers). The objectives were set out as follows:

- (1) Involve students' English vocabulary learning by equipping them with mLearning technology.
- (2) Observe and analyze any changes in students' learning styles, which may have been caused by the use of the novel mLearning method.
- (3) If there are any changes, determine their features, positive or negative; if no changes occur, investigate the reasons.
- (4) Identify and analyze any difficulties emerging from the process described above.
- (5) Identify and analyze the success factors for integrating mobile technology into learning activities.
- (6) Gain an in-depth insight into mLearning systems and develop a model.

The first research objective is derived from my original research motivation: the adoption of mobile technology to enhance learning activities. The next research

objectives (2 and 3) determine whether improvement occurs or not. Research objectives (4 and 5) aim at finding obstacles and/or success factors for implementing mLearning. The mLearning model in research objective (6) is generated from and outlined after the analysis of changes and success factors.

These six research objectives guide the study. It is hoped that accomplishing these objectives could inform mLearning deployment in the future.

1.3 Structure of the Dissertation

This dissertation develops theories of SMS technology integration into English academic vocabulary study for ESL (English as a Second Language) students by employing action research as a research paradigm. This dissertation constitutes nine chapters in total, which comprises two research cycles.

Chapter 2 provides research background by reviewing prior research on mLearning in both New Zealand and international contexts.

Chapter 3 describes the study's research methodology, including: building the research framework, explaining the choice of research paradigm, formulating the research questions, and developing data collection and analysis methods.

Chapter 4 embarks on a practical research journey by describing the research findings collected during research cycle one, it is followed by Chapter 5, which presents the analysis of data.

The modified research settings in the second research cycle are presented in Chapter 6, along with a detailed account of the research findings and the data analysis of research cycle two (Chapters 7 and 8 respectively).

Chapter 9 discusses the significance of the research findings and endeavors to answer the research questions formulated in Chapter 3. An mLearning model is presented, based on the analysis of the changes and success factors identified through a process of action research, for informing further work in this area. The limitations of the study are outlined, and a brief conclusion summarizes the main results.

Chapter 2: Research Background

This chapter provides a brief overview of previous research on mLearning related to the use of SMS and/or English language study. The significance of the present research topic is then explained. Third, the chapter outlines four educational theories, which underpin the research. Finally, Action research, which is employed as a research method in this dissertation is introduced.

2.1 Relevant Research on mLearning

In the last half a decade, researchers' attention has been drawn to both mLearning for language study, and to using SMS for learning generally.

Ownership of a mobile device plays a crucial role in implementing mLearning technologies among students (Corlett, Sharples, Chan & Bull, 2004). In recent years, mobile phones are widely used by young people not only in New Zealand but also in Asia, Europe, America, and South Africa (Green, 2007). SMS, as a popular mobile phone application, provides an excellent resource for the deployment of an mLearning environment among university students (Stone, 2004). Therefore, several researchers have focused their research on SMS-based mLearning.

Petrova (2007a) conducted research on evaluating SMS-based revision. Previous research on the ownership and usage of SMS among undergraduate students at AUT (Auckland University of Technology) in New Zealand has justified the feasibility of deploying mLearning using SMS.

Petrova (2007a) concluded that “mobility support”, “information density” and “information relevance” play a significant role in achieving an optimal cost-effectiveness balance.

Based on research, practitioners endeavored to establish mLearning systems. For example, StudyTXT, an SMS-based study system, was developed by Peter Mellow (Mellow, 2005). A similar platform was also proposed by Petrova (2007b).

In addition to the above, language learning has become more popular and more important in “the global village” for both minors and adults (Morgan & Ramanathan, 2005). Mobile devices, such as PDAs, MP3/iPod players and mobile phones, have been involved in assisting language learning making it effective and flexible (Houser, Thornton & Kluge, 2002). Meanwhile, research efforts have been made to investigate emerging issues. Cooney and Keogh (2007) investigated how mobile phones and iPods assisted Irish language learning. 69 students aged 14 to 15 and their teachers were recruited as participants. Positive feedback from both learners and teachers indicated that mobile technologies would be confidently used as learning tools.

Lin and Mase (2006) adopted PDAs for learning Japanese Kanji character by foreign students. Audio files were designed and created as pedagogical materials, and used successfully to facilitate memorizing the writing of Kanji.

Ally, Schafer, Cheung, McGreal and Tin (2007) conducted research on SMS-based English grammar learning for employees, for whom English was their second language. A comparison of the results of “pre-tests”, “post-tests” and “retention tests” indicated an improvement in participants’ grammar, and achievement scores.

2.2 Significance of the Research Topic

The significance of the present research topic will be justified from five perspectives, namely: economic, educational, technological, research paradigm and research settings perspectives.

2.2.1 Economic Significance

An innovative learning method is proposed to assist English language learning, which is an essential phase for most international students' further study in New Zealand. The New Zealand economy gains much benefit from the education export industry. According to Stroombergen (2008), "From 2007 to 2008, export education industry generated around \$2.3 billion of foreign exchange..., contributed to New Zealand's GDP is estimated at approximately \$2.1 billion..., and supported over 32,000 full time equivalent jobs" (p.1).

ESL (English as a Second Language) students from Asian countries, such as China and Korea, form the majority of international students. Therefore, "English language schools account for the largest group" of the overall international student population (Stroombergen, 2008, p.2).

The study presented here focuses on mobile technology-assisted English language learning at the Language School at AUT in New Zealand. Hopefully, the outcome of the research has the potential to improve language education quality and promote the New Zealand export education industry of New Zealand.

2.2.2 Pedagogical Significance

A mobile application (SMS) was used to assist the learning of English words. More specifically, this novel method focused on English academic vocabulary learning, which plays a pivotal role in ESL students' further study at universities (Kaur & Hegelheimer, 2005).

The pedagogical material delivered to students was based on the AWL (Academic Word List), as compiled by Averil Coxhead at Victoria University of Wellington, New Zealand (Coxhead, 2000).

According to Coxhead (2000), the words selected in the AWL are those ones that “appear with high frequency” in English-language academic articles, covering disciplines including: “arts (including history, psychology, sociology, etc.), commerce (including economics, marketing, management, etc.), law and the sciences (including biology, computer science, mathematics, etc.)”(p. 220).

Therefore, the pedagogical approach was aligned with accepted teaching practice and determined to be useful for ESL students in their further study in various academic fields.

2.2.3 Technological Significance

The high percentage of SMS users among young people occurs not only in New Zealand but also globally. The acceptance and popularity of SMS will potentially boost SMS-based learning strategies (Riordan & Traxler, 2005). However, compared to the state of SMS usage, contemporary research on SMS based mLearning is relatively limited. Therefore, this research may provide significant results relating to SMS-based mLearning, and suggestions for practitioners in this area.

2.2.4 Research Paradigm Significance

A “Research paradigm” was defined by Kuhn (1962) as a framework, which determines the knowledge acquirement approach, and organizes and guides research activities. This dissertation employs action research as a research paradigm. According to Cohen, Manion and Morrison (2007), action research is a “powerful tool for change and improvement” (p.226) with an “impressive” (p.226) scope which includes almost all research settings and involves people. In addition, Yasmeen (2008) claims action research is the most appropriate strategy in educational context research.

However, compared with case study research, which is the most common qualitative research method used in computer and information sciences, (Alavi and Carlson, 1992),

only a limited number of mLearning research papers adopting action research were found. One example is the International Conference on mLearning (mLearn) - the first and one of the most successful events in this area. At the mLearn Conference 2007, only Matthee and Liebenberg's (2007) research conducted in South Africa used action research as their "ideal strategy" (p.158). It is necessary for mLearning research to "borrow methods" (Clear, 2004, p.101) from other disciplines (e.g. education).

With the aim to improve students' language learning, the present research in mLearning employs action research as the most appropriate paradigm. (A more detailed justification for choosing action research is presented further in chapter 3.)

2.2.5 Research Settings Significance

mLearning researchers have striven to promote this novel and promising area in the last five years (Sari & Tedjasaputra, 2008). Many issues, such as the usability of portable devices, have been investigated to narrow or fill the gap between practice and research. However, Kukulska-Hulme and Traxler (2005), and Fies and Marshall (2006) point out that there is still a lack of research in five particular areas, which are summarized by Litchfield, Dyson, Lawrence and Zmijewska (2007) (Table 1) and discussed below.

Table 1. Gaps between practical situations and research settings (adapted from Litchfield et al., 2007, p.590-591)

	Practical situations	Research settings
Gap 1: Discipline	A range of discipline realms.	Only one subject area.
Gap 2: Guide	"Manipulation manual" is necessary for lecturers to utilize mobile devices.	No "consolidated body of knowledge to guide teachers in implementing mLearning" (Litchfield et al., 2007, p.591).
Gap 3: Cost	"Low-cost solutions" (Litchfield et al., 2007, p.591) are required.	"Lack of sustainability" (Litchfield et al., 2007, p.591) because of high cost of project.

Gap 4: Requirements	Requirements of mLearning vary among users in different discipline areas.	Assumption: all users have similar requirements of mLearning.
Gap 5: Mobile technology education	Mobile technology needs to be taught effectively to potential researchers.	Researchers or potential researchers lack background in mobile technology.

As mentioned, there are five gaps between “research settings” and “practical situations” in contemporary mLearning research. The study presented here addresses four of the identified gaps to various degrees.

- Gap 2: Action research empowers the researcher to play a role as an assistant lecturer, who has a responsibility to provide mLearning service and maintaining SMS data. The researcher involved was suited to implementing the proposed mobile technology due to his academic background (computer and information sciences) and more than five years’ SMS use.
- Gap 3: The research involves an SMS application. The low cost of sending text messages and there being no charge to receive them would generally be acceptable to the targeted mobile learners and the researcher. At the time of research, Vodafone, a telecommunications company in New Zealand, offered a particularly economical plan for promoting SMS consumption.
- Gap 4: the researcher acknowledges users have different requirements in different subjects. The scope of the research cannot cover all academic disciplines. However, the research focuses on a specified area: English academic words study for ESL students. The single and simple discipline setting guarantees that users have similar or the same requirements of mLearning.
- Gap 5: the researcher has the necessary educational background in mLearning. Several of his programme papers, such as Ubiquitous Computing (408207), were drawn from the mLearning area. In addition, a Readings paper (408200) explored the methodologies and methods used in mLearning research in detail. (The research methodology and methods used in this research will be discussed in Chapter 3.)

Therefore, the research setting of this study is able to fill most of the research gaps identified by Kukulska-Hulme and Traxler (2005), and Fies and Marshall (2006).

2.3 Educational Theories

This section attempts to explain how implementing mobile technology in the educational realm can be underpinned by educational theories with a special focus on SMS-based learning and teaching activities.

The results in Hartnell-Young's (2007) research suggests that educational theories, such as behaviorism (Pavlov, 1927) and constructivism (Dewey, 1910), may have a more significant impact on teaching, than technology does. However, the theory behind mLearning is still in the process of being developed (Sharples, Taylor & Vavoula, 2007), therefore, it was appropriate to base the mLearning strategy and process in this study on the outcomes of a review of traditional educational theories. The theories applied in research cycle one and two will be illuminated further in Chapter 3 and Chapter 6.

Wilhelm, Baker, and Dube (2001) summarized five traditional education theories and divided them into two categories: "one-sided models" and "socio-cultural model". (Table 2)

Table 2. Explanation of educational theories (Wilhelm, et al., 2001)

	One-Sided Models		Sociocultural Model
	Curriculum-centred	Student-Centred	Teaching/learning Centred
Historical Roots	Skinner, Pavlov, Thorndike	Piaget, Chomsky, Geselle, Rousseau	Vygotsky, Rogoff, Bruner, Hillocks, Dewey: <i>Child and Curriculum Experience and Education</i>
Theoretical Orientation	Behaviourism	Progressivism Cognitivism	Coconstructivism Socioculturalism
How learning occurs	Transmission of knowledge: Teaching is telling	Acquisition of knowledge	Transformation of participation
Implications for instruction	Both teacher and student are passive; curriculum determines the sequence of timing of instruction.	Students have biological limits that affect when and how they can learn; teachers must now 'push' students beyond the limits. Knowledge is a 'natural' product of development.	All knowledge is socially and culturally constructed. What and how the student learns depends on what opportunities the teacher/parent provides. Learning is not 'natural' but depends on interactions with more expert others.
Student's role	'Empty vessel'	Active constructor	Collaborative participant
Teacher's role	Transmit the curriculum	Create the environment in which individual learner can develop in set stages-implies single and natural course	Observe learners closely, as individuals and groups. Scaffold learning within the zone of proximal development, match individual and collective curricula to learners' needs. Create inquiry environment.
Dominant instructional activities	Teacher lectures; students memorise material for tests	Student-selected reading, student-selected projects, discovery learning	Teacher-guided participation in both small-and large-group work; recording and analysing individual student progress; explicit assistance to reach higher levels of competence
Who is responsible if student does not progress?	The student: He can't keep up with the curriculum sequence and pace of lessons or meet the demands of prescriptive school program.	The student: He has a 'developmental delay', a disability, or is not 'ready' for the school's program. Often, family or social conditions are at fault.	The more capable others: They have not observed the learner closely, problem-solved the learner's difficulty, matched instruction to the learner, made 'informed' decisions, or helped the learner 'get ready'.

As shown, behaviourism is the theory underlying a “curriculum-centered” model of teaching and learning. Here knowledge is conveyed by teachers, and students are passively receiving (Pavlov, 1927). Learners can acquire skills by training and

reinforcement (Pavlov, 1927). Behaviorism is still employed in many classrooms today. Uncertainty is not encouraged in this theory.

Cognitivism and progressivism are the theories on which “student-centered” models are based. Cognitivism is related to another theory - constructivism, and is sometimes called “endogenous constructivism or cognitive constructivism” (Cobb, 1994). Cognitivism is based on theories developed by Piaget (1977). Progressivism was termed by Windschitl (2002) who states that “Progressive pedagogies are likely to be based on the rhetoric of constructivism” (p.131). In the present study, the term constructivism refers to progressivism and cognitivism.

It is important to note that according to the constructivist theory, knowledge cannot be transmitted, rather “...Knowledge building is a constructive activity directed towards the creation of knowledge itself, while learning is a personal consequence, enhancing one’s own abilities and dispositions” (Dewey, 1910).

Socio-culturalism is derived from constructivism and it involves and emphasizes the mediating role of environmental factors on learning activities (Hartnell-Young, 2007). Tudge and Winterhoff (1993) advocate it as “constructing knowledge through social interaction”. Socio-culturalism is also referred to as “social constructivism” (Rogoff, 1990) or “co-constructivism” (Tudge & Winterhoff, 1993).

The socio-cultural theory (Vygotsky, 1978) claims that the environment strongly impacts on individuals’ activities. For example, interaction between learners and the objects or people surrounding them occurs in learning activities. Scaffolding (Chen, Chang & Wang, 2008) is developed based on the perspectives of socio-cultural theory.

Behaviourism, constructivism and socio-culturalism have had significant influence on teaching and learning (Hartnell-Young, 2007). The relevance of these theories on SMS-based learning activities will be discussed in research cycles one and two.

2.4 Action Research

As mentioned, this study employs action research as a research paradigm. This section provides an overview of the paradigm. First, the characteristics of action research are described and its position as a research paradigm is demonstrated. Second, the screw-like fashion research process involving research cycles is discussed. Third, the features of participatory action research, which are acting as a framework overarching the approach, and the organization of the study are also presented. The section generally outlines the methodological approach of the study. A detailed description of the methodology used can be found in chapter 3.

2.4.1 The Characteristics and Position of Action Research

The term “paradigm” was used by Thomas Kuhn (1962) to refer to people’s perceptions of the world, and as a means of defining the approach of research being conducted. The paradigm chosen guides both data collection and data analysis.

Prevalent views of the world undergo changes, and alternative views emerge throughout history. From the 17th century to the 20th century, modernism associated with positivism dominated as a world view. Quantitative methods, such as mathematics and statistics, were advocated as being able to provide “absolute truth” (Seaman, 2008, p.36). In the middle of the 20th century, responding to complexity and fuzzy problems faced by social scientists, postmodernism emerged along with interpretivism, critical theory and participatory theory. A summary of these paradigms is provided in Table 3.

Table 3. The position of action research in alternative research paradigms (adapted from Lincoln & Guba, 2000, p.168-173)

Period	Modernism	Postmodernism		
Paradigm	Positivism	Interpretivism/ Constructivism	Critical Theory	Participatory*
Ontology	Naive realism – “real” reality; universal and general; apprehendable	Relativism - local and specific; constructed realities	Historical realism - virtual reality; shaped by social and political values	Participative reality; subjective-objective reality
Epistemology	Dualist/objectivist; findings true	Transactional/subjectivist; created findings	Transactional/subjectivist; value mediated findings	Participatory; experiential; propositional; co-created findings
Knowledge interests	Technical	Practical	Critical/emancipatory	Practical - critical/emancipatory
Methodology	Experimental/manipulative; verification of hypotheses; chiefly quantitative methods	Hermeneutic/dialectic; fieldwork, ethnography, phenomenography; chiefly qualitative	Dialogic/dialectic; analytical; action research	Participation in collaborative action inquiry; practical; use of language; shared experience; action research
Knowledge accumulation	Accretion-“building blocks” adding to “edifice of knowledge;” generalisations and cause-effect linkages	Vicarious experience; understand perspective of participants	Historical revisionism; critique social injustices; change; emancipation	In communities of inquiry; relational, reflexive, representational forms of knowledge
Inquirer posture	“Disinterested scientist;” informer of decision makers, policymakers and change agents	“Passionate participant;” facilitator of multi-voice reconstruction	Researcher and object of study interactively linked; participant; change agent	Primary voice in aware self-reflective action; secondary voices in illuminating theory
Values	Excluded – influence denied	Included – formative – influence acknowledged		
“Goodness” or quality criteria	Conventional benchmarks of “rigour,” internal and external validity, reliability, and objectivity	Trustworthiness and authenticity	Historical situatedness; erosion of ignorance and misapprehensions; action stimulus	Congruence of experiential, representational, propositional, and practical knowing
Control	Resides solely in researcher	Shared between inquirer and participants	In “transformative intellectual;” returns to community in new constructions	Shared to varying degrees
* Entries in this column are adapted from Heron and Reason (1997)				

As shown, as a methodology, action research can be posited in the “participatory” column. Action research is both “situated and reflective” (Kupetz & Ziegenmeyer, 2006), with the intention to solve problems and improve practice. As Reason and Bradbury (2001) write:

“Action research is grounded in a participatory worldview ...It seeks to bring together action and reflection, theory and practice, in participation with others, in

the pursuit of practical solutions to issues of pressing concern to people, and more generally the flourishing of individual persons and their communities. (p.1)”

2.4.2 Action Research Process

A typical research process in action research is structured within several phases, which are iteratively pushed forward and refined in each research cycle. The research process is often viewed as a spiral, as shown in Figure 1.

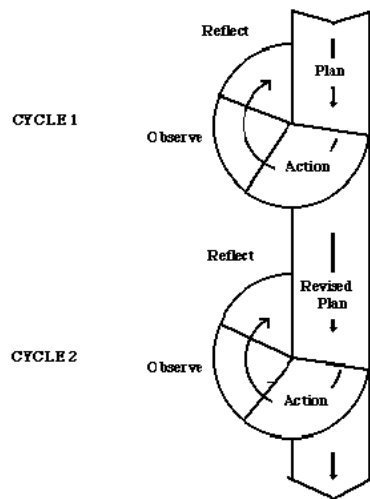


Figure 1. Action research process (O'Brien, 1998)

At the beginning of research cycle one the proposed changes are planned. In the action and observation steps, researchers implement changes, such as an innovated technology or strategy, work with a group of people, and observe the outcomes. The data collected is reflectively analyzed, and the planning of more changes brings the research into the next research cycle.

Although only two research cycles are illustrated in Figure 1, an action research project may involve more cycles, depending on the research subjects and the researcher's concerns. However, action research does not always flow as neatly as shown in Figure 1. Sometimes, research phases overlap. However, the quality of the action research is

relatively unaffected. As Kemmis and McTaggart, (2000) suggest, the criteria for successful action research is improving and developing people's practice, not following the process precisely. The study presented here comprises two research cycles.

2.4.3 Action Research in Education

Action research was utilized by Corey (1953) in the realm of education about five decades ago and since then has become a powerful instrument in this area (Cohen, Manion & Morrison, 2007). The key features of participatory action research are summarized by Wadsworth (1998) as follows:

- The researcher plays a role as a participant, and is concerned with and experiences changes throughout the process.
- The researcher is the main research instrument and guides the research.
- The researcher is interested in participants' perspectives and feedback. Researcher and participants collaborate to further develop and improve current practice.

2.5 Conclusion

mLearning has drawn research interest in the last five years. In this study, the research topic is significant in the realm of mLearning. Educational theories underpinned the application of SMS in vocabulary learning. Action research is employed as a powerful instrument.

Chapter 3: Research Methodology

In this chapter, the methodology used in the study is presented in detail. Although in action research, the process is fluid and research settings may vary, the frameworks introduced here guide the research activities undertaken; at the same time offering enough room for possible changes should they occur in the two research cycles.

First, the implementation of action research within two recursive research cycles is described. Second, the research setting of each cycle is explained. The data collection instrument and data analysis technique are also presented. A brief overview of the two research cycles is outlined in the latter sections of the chapter.

It must be noted that the research project was conducted in the second semester of 2008. However, the researcher had initiated planning the research and had been approaching language schools since the end of 2007. Therefore, the research activities in the first research cycle were planned in advance. The research plan for cycle one will also be presented in the corresponding sub-chapters.

3.1 Action Research Implementation

As indicated in chapters one and two, the present study employs the action research paradigm to design and conduct the research. There are five parts in this section: first, the research questions guiding the study are stated. Second, the design of the project, which includes two research cycles, is described. Third, the process of participant recruitment is presented, followed by a description of the roles of the researcher in the study. Finally, a justification of the choice of action research is provided.

3.1.1 Research Questions

The present study intends to investigate issues emerging from the process of integrating mobile technology with English language learning. Two research questions guide the study. The original two research questions were elicited from the six research objectives outlined in Section 1.2. The relationship between the two questions and six objectives is illustrated in Figure 2.

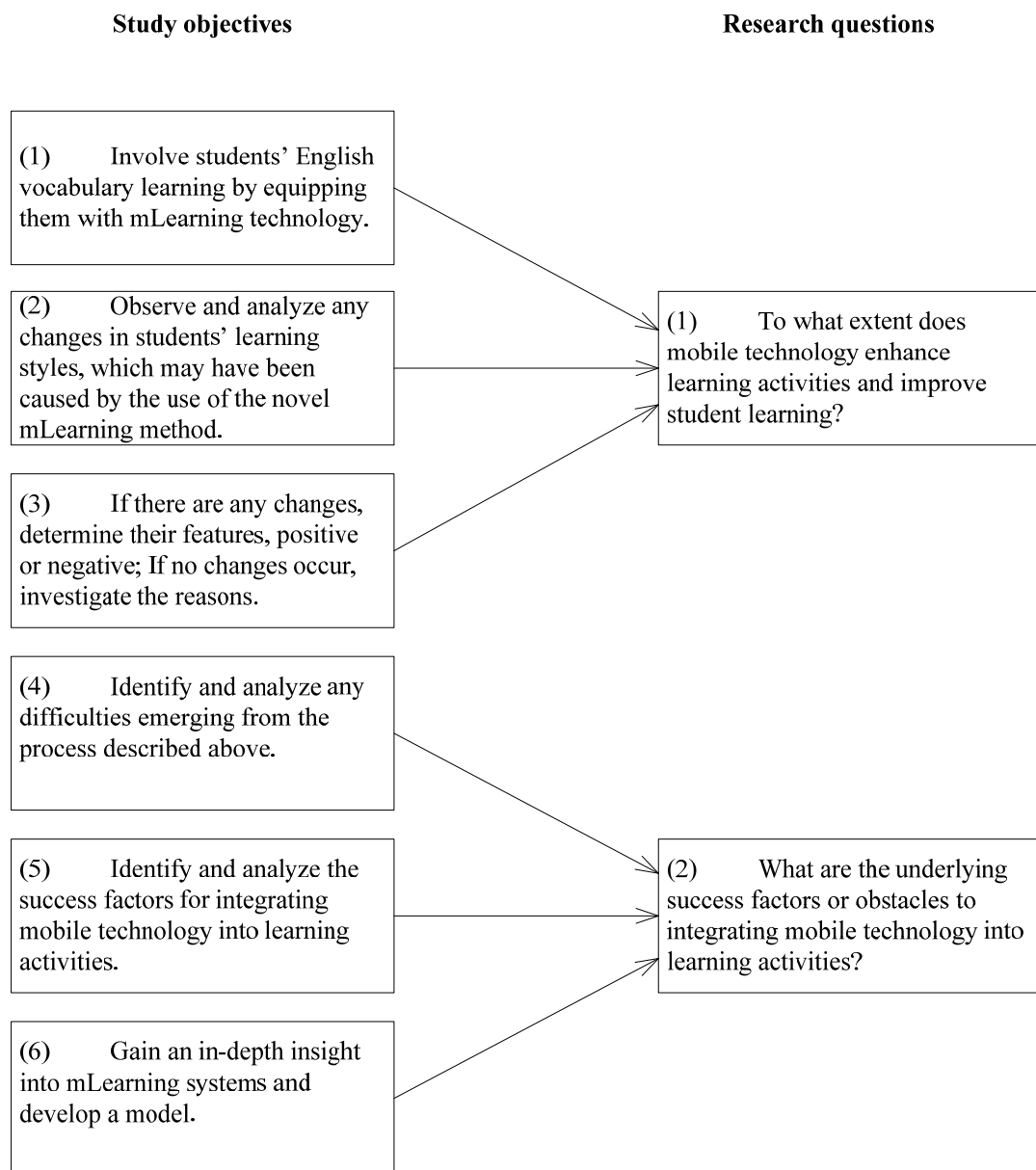


Figure 2. The relationship between the study objectives and research questions

The research question (1) guides the investigation based on the first three study objectives as changes are produced (objective 1), discovered (objective 2) and analyzed (objective 3). It may be possible to gain an understanding of the significance of the mLearning method identified as a change factor.

The second research question is aligned with objectives (4), (5) and (6). It aims to gain an in-depth insight into concrete reasons for the changes (or lack of change). Identifying obstacles and success factors may also lead to the building of a model for further study of the mLearning system under investigation.

The two research questions guide all research activities in the project. Appropriate sub-questions are developed in each research cycle as related to the particular situation. These will be introduced in the chapters describing the research cycles.

3.1.2 Research Process and Duration

The project was planned to be conducted in the second semester of 2008 from July to November, in two research cycles. Each research cycle embraces all typical research phases, including plan (re-plan), action and observation, and reflection. The arrangement and the duration of the two cycles are shown in Figure 3.

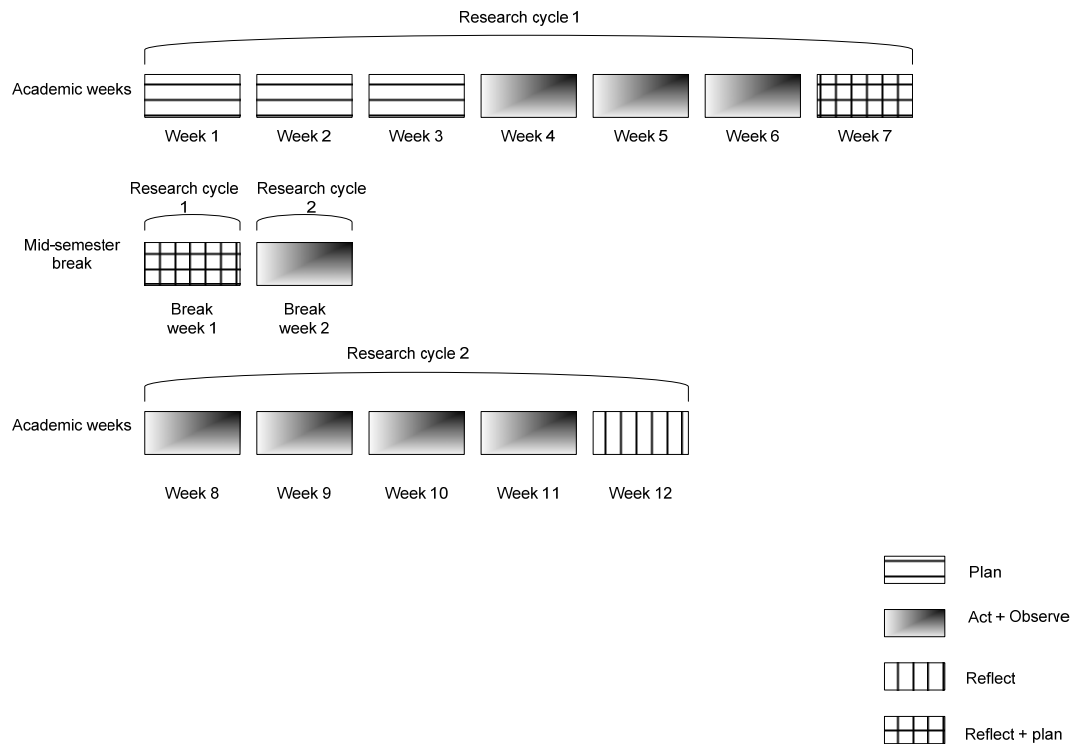





Figure 3. Research cycles and their duration

The two research cycles are placed in both academic weeks and in mid-semester break weeks. Research cycle one comprises eight weeks. From week 1 to week 3, the researcher plans learning activities and research activities for cycle one. In addition, the proposed mobile technology, SMS, is introduced to potential participants (students from an EAS class stream). All research activities, participant's obligations and benefits, are fully explained to students in the class. Participant recruitment also takes place in these three weeks.

From week 4 to week 6, SMS-based vocabulary learning method adoption commences and the mLearning service is provided to students. Acceptance and feedback from participants is collected.

In academic week 7 and the first week of mid-semester break, the mLearning service is suspended: the researcher stops sending formal pedagogical short messages, but still "remains online" to receive short messages from participants and continues informal

conversation using a mobile phone. In these two weeks, the information collected in the first cycle is analyzed reflectively. The reflection on the first research cycle informs plans for the next round: research settings need to be amended and refined. The research phases do not follow the theoretic action research process shown in Figure 1 precisely: the reflection and the re-planning parts overlap. In Figure 3, the shading of the rectangles () for these two weeks is a combination of the those for “reflect” weeks () and for “plan” weeks ()

From the second week of the mid-semester break to academic week 11, the researcher restarts the mLearning service for participants with a modified design. Data about participants’ perspectives on the usage of the modified mLearning method are gathered. In addition, changes in performance of mLearning, and attitudes to mLearning, are identified by a comparison with the findings in research cycle one.

From academic week 12, onwards the mLearning service is terminated. Research findings are analyzed in order to address the research questions. Although the research process shown in Figure 3 stops at week 12, the work of reflection, structuring, writing and compiling the report continues after that.

3.1.3 Participant Recruitment and Selection

Recruiting and selecting participating students occurs in the first three academic weeks. All participants are required to own SMS capable mobile telephones, and to be able to be contacted during the research process.

The targeted group of students belong to an EAS class at AUT. English is their second language. However, they have studied English for a certain number of years and have achieved 5.5 points¹ or above in their IELTS (International English Language Testing System) scores before enrolling in the EAS class.

¹ The information about the entry requirement of the EAS class is available on http://www.aut.ac.nz/resources/schools/languages/entry_requirements.pdf

The potential participants have diverse cultural backgrounds as they are from various countries such as Korea and Iran. Their cultural views and rights are respected and protected, as guaranteed by the ethics application approved by AUTECH (Auckland University of Technology Ethics Committee). Participation consent is sought. The researcher is responsible for ensuring the privacy of the participants and keeping personal information confidential.

The participating students are volunteers. As Zeichner (2007) suggests, entering research voluntarily yields high quality research outcomes. About 15 to 25 student participants is an acceptable sample size.

3.1.4 The Roles of the Researcher

Action research involves researchers in multiple roles during the process. Inherently, the researcher has the responsibility for guiding and organizing research, and reflecting on it. In this study, the researcher plays additional roles; as a student in the class, and as an assistant lecturer outside the class.

The EAS students have a vocabulary class every Tuesday during academic weeks. The researcher joins in the class, sits and practices word exercises with the rest of the “classmates”, listens to and is taught by the lecturer. Experience as a learner and being “zero distance” from participants may help to gain first-hand information about participants’ requirements.

Outside the class, the researcher plays the role of an assistant lecturer. All SMS-based pedagogical materials are compiled, edited and sent by the researcher. The sequential teaching and learning activities are also arranged by the researcher. Maintaining the SMS-learning service provides an opportunity for the researcher to gain insight into the deployment of a mLearning system in a university context.

The researcher has a background as a student in an EAS class at AUT, and has kept in touch with EAS lecturers. The familiarity with the learning environment and the course structure, and the rapport with the teaching group, has facilitated the researcher being included as a peer rather than an outside researcher, which was believed to be an effective way to accomplishing the research goal.

3.1.5 Justification for the Choice of Action Research

Action research is arguably the most appropriate approach for educational research (Cohen et al., 2007). The specific nature of the study undertaken also favoured the choice of action research.

The study embodies a dual goal: first, by providing a mLearning service, to investigate the effects of a novel learning method, and students' acceptance and usage of it. Second, by modifying and refining the mLearning strategy, to provide students with an opportunity to seamlessly integrate mobile technology into their study, to change or extend their learning time frame and learning place, and to "flexibilize" their learning interactions / conversations with teachers (or assistant teachers).

The dual goal requires a research approach which is flexible and also allows the gathering of substantial information. Somekh (2006) suggests abundant data can be collected in action research. In addition, the defining features of action research fit well with the study:

- Action researchers conduct research with the intention of improving people's practice (Heikkinen, Kakkori & Huttunen, 2001). This feature aligns well with the objective of the using of SMS-based learning to improve students' vocabulary and enhance students' personal experiences with learning.
- Action research activities are involved in the community where researchers aim to change people's practice (Heikkinen et al., 2001). This feature is consistent with the

setting of the research: mLearning will be implemented in real time, and data will be gathered from participants in real time as well.

- In action research, the researcher is interested in participants' perspectives, which is also the core of the participant-centered design proposed. For example, the modification of the mLearning strategy takes place after the analysis of data collected from interviews with participants.
- Action research allows the researcher to be an active participant. In this project, experiencing mobile technology assisted learning as a student and as an instructor and reflecting on it makes the researcher an active participant.
- The two cycles of the study provide the researcher with the opportunity to modify the research design as needed, and may inform future deployment of an mLearning environment.
- Action research is concerned with change. The reflection on change (or lack of change) is instrumental to the unearthing of the important success factors or obstacles related to the integration of mobile technology into learning activities. The outcomes may produce useful insights on mLearning technology use among teachers and students.

The considerations above underpin the choice of action research as the research paradigm for this study.

3.2 Research Setting

The research design of this study is built on the results reported in the literature. The research setting model is built based on a previous study, "Focus and Setting in MLearning Research: A Review of the Literature" (Petrova and Li, 2009). In this section, the model is introduced and the setting of cycle one is presented.

The study was designed with the intention to build on contemporary research trends in mLearning and to gain the research outcomes for informing mLearning practice in the future. Therefore, the research setting model was developed considering all the findings

summarized in the previous study conducted by Petrova and Li (2009), as shown in Figure 4.

Research Setting model

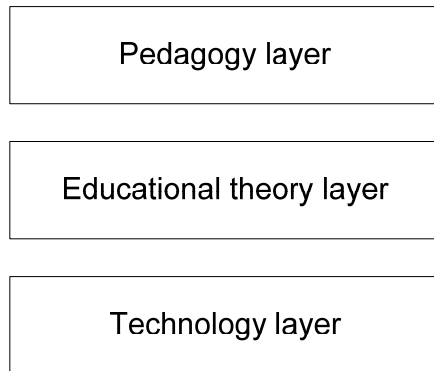


Figure 4. Research setting model

The research setting in both research cycles follows the layered model (shown in Figure 4). In this section, research settings in research cycle one in particular are discussed. The features of the setting in each layer shown in Figure 4 are outlined from the bottom to the top, as derived from Petrova and Li (2009).

First, the technology layer introduces mobile devices, telecommunications service and available associated stable technologies.

The researcher used a smart phone, Nokia N82 (please see appendix II), to maintain the SMS service. In addition, “TXT 2000”, which is a plan for customers provided by Vodafone New Zealand, was used as an add-on, so that the price of sending an SMS was reduced from 0.2 NZD (New Zealand Dollars) per text message to 0.005 NZD per text message (the total number of sent messages provided does not exceed 2000¹). The relevant low cost allowed the mLearning method designed in the present study to be feasible and may further promote SMS-based mLearning approaches (Cavus & Ibrahim, 2009).

¹ The information about the TXT 2000 plan is available on www.vodafone.co.nz

The amount of data transmitted between students and the researcher was expected to be substantial. The Nokia PC Suite¹ developed by the Nokia Company installed on the researcher's laptop was used to maintain a high quality mLearning service and facilitate the storage and management of information generated from the data flow between mobile phones. The researcher's mobile phone was connected to the laptop with the Nokia PC Suite, enabling the sending and receiving of SMS data using the laptop. The use of a computer makes it possible to manage text messages more effectively. The interface of the software is illustrated in Figure 5.

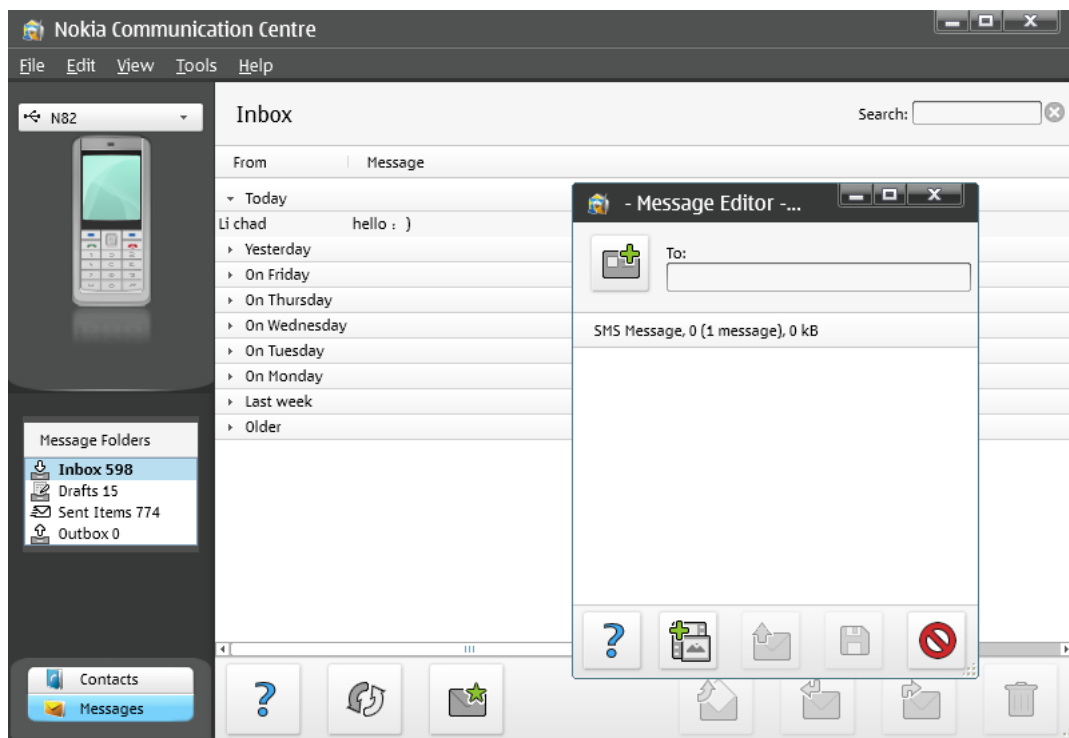


Figure 5. The interface of Nokia PC Suite as installed on the researcher's laptop

The software emulates all necessary functions of the mobile phone, including the listing of text messages received or sent in the main window, editing, replying and sending messages in the pop-up window. In addition, messages can be backed up for further analysis.

¹ The software can be downloaded from <http://www.nokia.co.nz/>

As well as text messages, E-mail was adopted. The researcher and students used PCs to send and receive E-mails, as using mobile Internet (via a mobile phone) may have been too costly and unavailable to all participants.

At the educational theory layer, a relationship between learners and teachers in the context of mobile behavior is established. Although the aim of the present study is to develop an mLearning service by identifying learners' requirements and evaluating it by collecting their feedback, initially the project is a curriculum-centered (Leithart, 2008) as no input from users (students) is used prior to the commencement of the first research cycle.

In research cycle one, the study design follows the theoretical postulate of behaviourism (Table 2.). Both the teacher (researcher) and the students are passive recipients with the curriculum determining the content of the pedagogical materials and the arrangement of the time frames.

The learning activities in the first cycle are driven predominantly by the researcher, the learning flow, designed in consultation with the EAS class lecturer, is shown in Figure 6.

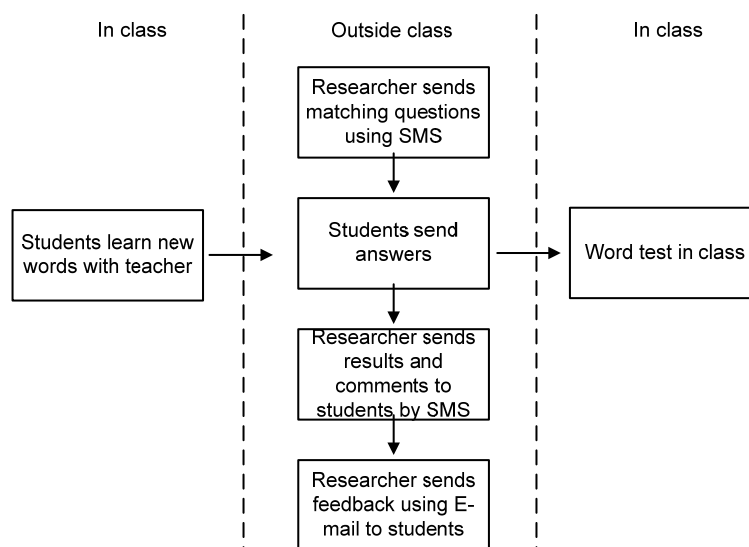


Figure 6. mLearning flow in research cycle one

As shown, students learn new vocabulary (listed in AWL¹) with the teacher in class every week. Outside class, the researcher sends students questions testing the new academic words using text messaging. Students can send their answers back to the researcher. The results and feedback are sent back to students (via SMS) immediately. The study record is sent by E-mail every night after students complete the mobile exercises. Each following week, students have a summative (Gong, Li, & Zhao, 2008) word test in class and a new group of vocabulary is taught.

The design of the matching questions is explained later in relation to the pedagogy layer. The timetable of the EAS class is shown in Table 4.

Table 4. Timetable of EAS class

	<i>Mon.</i>	<i>Tues.</i>	<i>Wed.</i>	<i>Thurs.</i>	<i>Fri.</i>	<i>Sat.</i>	<i>Sun.</i>
<i>Before</i> <i>9.00 am</i>	Students are on their way to school.				Self-study time	Weekend break	Weekend break
<i>9.00 am</i> – <i>10.00 am</i>	Other class	Word class (in classroom)	Other class	Other class			
<i>10.00 am</i> – <i>11.00 am</i>		Word class (in computer lab)					
<i>11.00 am</i> – <i>12.00 pm</i>	Lunch break						
<i>12.00 pm</i> – <i>2.00 pm</i>	Other class	Word class (in classroom)	Other class	Other class			
<i>After</i> <i>2.00 pm</i>	Self-study time						

The word class is scheduled on Tuesdays. Normally, new vocabulary is taught by the teacher in the morning from 9.00 am to 11.00 am. Students have a chance to engage in flexible learning using computers in the computer lab. In the afternoon, students have a word test to assess their word learning from the previous week. The targeted time frames for mLearning are set in students' self-study time and break time, which are highlighted in Table 4.

¹ The AWL (Academic Word List) is available from <http://www.victoria.ac.nz/lals/staff/averil-coxhead/awl/>

The pedagogy layer is concerned with the design of mLearning educational material. In research cycle one, in line with the behaviouristic approach, mLearning outside class is considered to be a complementary approach to help students familiarize themselves with the type of questions used in tests and memorize the new words studied every week.

One page of AWL including approximately 25 new academic words (please see a sample of AWL in Appendix I) is required to be learnt by students each week. Matching questions are used in summative (Gong et al., 2008) word tests in class. A sample of a word test as used in the EAS class is shown in Figure 7.

EAS ACADEMIC VOCABULARY TEST 1

Complete the sentences by selecting the BEST word from the list below.
You may need to alter the ending of some words.
Marks will be deducted for grammatical and spelling mistakes.

approach	consistent	constitute	context	define
derive	factor	distribute	create	assume
authority	function	estimate	evident	assess

1 Academic writing may be authority as the style of writing required in tertiary institutions. *desired*

2 English teachers have different approaches to the teaching of vocabulary.

3 The growth of export education in the central business district has created a number of economic benefits for the city.

Figure 7. Sample of EAS academic vocabulary test

There are 10 matching questions in each word test in class every week (only three questions are listed in the sample). The 15 possible words are listed in the box above the 10 questions. All 15 words are selected from one page of AWL taught in the previous week. Students are required to choose the best word to complete each sentence,

avoiding grammatical and spelling mistakes. They have roughly 15 minutes to finish all questions in class.

The pedagogy design for the mLearning system is consistent with the word test in class, as “Gap-fill” (Son, 2008) exercises are embedded in the learning text messages. The learning materials are derived from a database¹ containing 150 gap-fill exercises for AWL compiled using the software, Gerry's Vocabulary Teacher² (Luton, 2000). The source of the exercises is different from the one used for the word tests in class. The format of the mLearning text messages is shown in Figure 8.

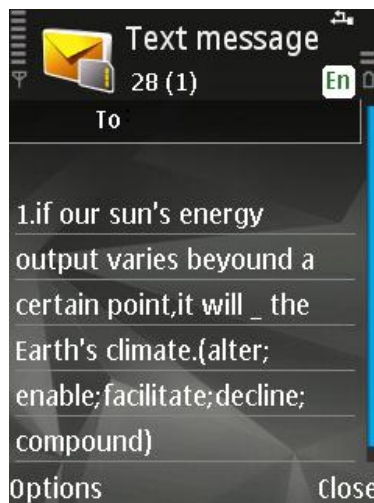


Figure 8. mLearning text message sent to students

A screenshot of the researcher’s mobile phone illustrates the format of the mLearning text message sent to students. The incomplete sentence is numbered as “1.”, and the gap in the sentence needed to be filled is marked as “_”. The possible words are listed in parentheses.

After receiving the SMS, a student reads and analyzes the question and returns their answers to the researcher using their mobile devices anywhere, anytime. The proposed format for a text message reply by students is shown in Figure 9.

¹ The database is available on <http://www.academicvocabularyexercises.com/index.htm>

² The demo of the software and product purchase information is available on <http://www.cpr4esl.com/>

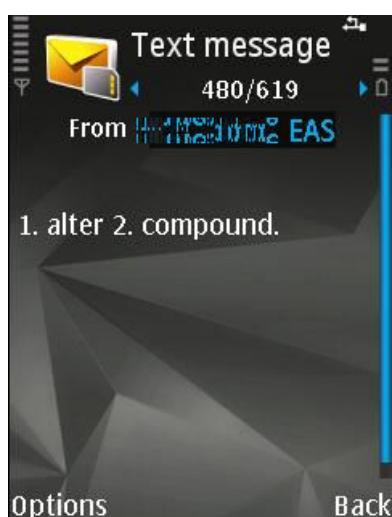


Figure 9. A proposed format for student answers in SMS

The expected format of the answer includes the corresponding question number and the selected word using correct grammar and spelling.

mLearning text messages are sent to students every day. Normally, one to three gap-fill exercises are conveyed to learners each day. The vocabulary referred to are selected randomly from AWL. By Tuesday every week, all new words from one page of AWL should have occurred in possible words lists in the text messages.

During the weekends, there is an underlying assumption that students engage in a revision of the new words, to pre-test their knowledge. In order to encourage them to conduct further review and reinforcement of new vocabulary, a formative test (Nichols, Mittelholtz, Adams & van Deusen, 2008) named “winning chocolates” is created and sent. It includes ten gap-fill exercises. To win a chocolate, a student is required to complete at least eight sentences correctly. The participants who accomplish the mission can receive two chocolate bars.

The pedagogical materials are edited and sent using a laptop with the previously mentioned Nokia PC Suite.

As shown, the research setting in all three layers is introduced for use in research cycle one. However, acknowledging the “value of uncertainty” (McNiff and Whitehead, 2002, p.5) in action research, the revised setting for cycle two will be outlined in the re-plan phase later.

In the following section, data collection methods are discussed.

3.3 Methods of Data Collection

In action research, a wide variety of data collection methods can be employed for gathering rich information. Common data collection techniques in action research, interviews and questionnaires, are used in the study presented here, as well as additional methods (Reflective journal, observation, informal conversation, students’ word test records, SMS transmission history, professional presentation and portfolio).

3.3.1 Interview

Interviews allow for sufficient qualitative data from participants about their thinking, feelings and beliefs to be gathered (Morrison, 2007). Semi-structured interviews (Noor, 2008) are adopted in the present study, with the basic questions pre-set but open-ended. After an informal conversation, interviewees may answer questions with more ease, and express their opinions more fully. The interviewer (researcher) may ask additional questions at their discretion and pursue a point of view raised by a participant.

The purpose of the interview is to inform the research, so the interviewer is expected to listen to participants’ responses carefully and attentively, and request clarification where appropriate. However, to avoid bias in responses, the interviewer should avoid sharing their personal perspectives on mLearning with interviewees.

Interview data is recorded by a digital audio recorder (or through note-taking if recording is not acceptable to an interviewee).

3.3.2 Questionnaire

A questionnaire is an appropriate approach when interviewing every participant is not possible (Arhar, Holly, & Kasten, 2001). In the present study, a questionnaire is used for students who have not enough time to be interviewed.

Three types of questions are used in the questionnaire: closed-ended questions, an attitude scale, and open-ended questions.

Closed-ended questions were designed to collect information about participants' background and the facts of their mobile technology usage. Participants choose one answer from several options.

The attitude scale questions are used to gather information about students' acceptance, views and attitudes in regard to mLearning methods. A scale from one to seven measuring degree of agreement (or disagreement) on mLearning activities is used.

Open-ended questions provide opportunities for respondents to express their overall feelings about the mLearning experience. They are positioned at the end of questionnaires.

3.3.3 Observation

“Observation is foundational to all good research” (Arhar et al., 2001, p.137). In the present study, the researcher has the opportunity to sit in the classroom and study vocabulary with the students in the EAS class every Tuesday. Therefore, it is possible for the researcher to observe “learning conversation” (van der Pol, 2009) between students and the vocabulary teacher.

In the classroom, the researcher does not sit in an unobtrusive position but is immersed in a group of students (the layout of grouped desks is shown in appendix III). Observational fieldnotes (Harnett, 2007) are written to record information about the class in a timely fashion.

3.3.4 Informal Conversation

The multiple roles of the researcher enabled him to have plenty of chances to communicate and interact with students and the lecturer in the EAS class. Informal conversations are not structured but are very powerful for dealing with uncertainty.

Informal conversations occur not only in the classroom but also anywhere the researcher meets students. It is believed that because of the shared English study background (the researcher was also an ESL student in EAS class) and the already established rapport with the lecturers in EAS class, both students and lecturers could talk freely and informally with the researcher. As conversations were expected to occur mostly before or after class, they are added to the fieldnotes.

3.3.5 Reflective Journal

The reflective journal is a powerful tool (Arhar et al., 2001) for data collection. In this study, maintaining a journal enhanced flexibility, recording reflective ideas as they emerged. Additionally, a reflective time slot was set for every Tuesday evening, for organizing data and / or writing in the journal.

The researcher's perspectives, feelings and hunches were recorded using McNiff and Whitehead's (2005) four systematic questions for developing a reflective journal:

- “What have I done?”
- “What have I learnt?”
- “What is the significance of the learning?”

- “How will the learning generate new actions?”

3.3.6 Professional Presentation

Sharing action research is a “key to critical practice” (Arhar et al., 2001, p.271). Professional presentation is able to offer the researcher an opportunity to make the work public, discuss with experts around or in the field, and listen to similar or differing opinions (Arhar et al., 2001).

During the first research cycle, the researcher presented his action research at the AUT 2008 Postgraduate Symposium on 29th August 2008 (in the end of week six). Critical questions and points of view from the audience would help the researcher reflect on his work and modify research settings. The feedback from the audience might be “a bit daunting” (Arhar et al., 2001, p.271), but useful.

3.3.7 Portfolio

A portfolio is defined by the Oxford English Dictionary as:

A receptacle or case for keeping loose sheets of paper, prints, drawings, maps, music, or the like; usually in the form of a large book-cover, and sometimes having sheets of paper fixed in it, between which specimens are placed.

A portfolio can be used for data collection in action research. According to Arhar et al. (2001), in action research, a portfolio is “a carefully selected, constructed, and narrated collection of work pertaining to a special topic” (p.21).

In this study, a portfolio was used to narrate stories which took place in the action research journey. The aim of employing a portfolio is to gain a comprehensive view from different angles. Photographs and contemporary news about short messages were collected, selected and constructed:

- Photographs of the researcher taken by people surrounding him (such as his friends) intentionally or casually are intended to record the view of people observing mobile teaching behaviours. By reviewing the impression of mLearning gathered from outside positions, the researcher may reflect on mLearning and / or teaching activities objectively.

Due to ethical concerns, participants do not appear in photos, and images of other persons would be masked.

- Contemporary news about SMS were searched for and browsed using Google® Reader¹, which updates news synchronously with the official websites of newspapers, radios or TV channels such as the New Zealand Herald and the BBC (British Broadcasting Corporation). It was assumed that reading news about short messages would help build a broad picture of SMS-based learning methods in local and worldwide contexts. Sometimes vignettes from the news were collected to illustrate mLearning issues.

3.3.8 Students' Word Test Records

In the EAS class, students would have ten word tests (from week three to week 12). There are no tests in the mid-semester break. The word test is set for approximately 12.15 pm to 12.35 pm every Tuesday, to examine the students' vocabulary learning from the previous week.

Ten questions are included in every word test. Each correct answer to a question counts as one point. Using the correct word but in an incorrect grammatical form counts for half a point.

The final grade of the ten word tests is the average grade of the ten tests. The word test grade contributes 20% to the final grade.

¹ Google® Reader is a web-based RSS (Really Simple Syndication) reader developed by Google®.

The students' test grades are recorded and documented by the vocabulary lecturer. The researcher has access to the test results history to collect data for analysis.

3.3.9 SMS Transmission History

A special sort of data, SMS transmission history, was generated and collected as short messages are the media for conveying pedagogical materials to students, and the instrument for accomplishing communication between the researcher and students outside the classroom. Capturing and storing information about SMS data exchange between the researcher and students provides some quantitative data as input to the evaluation of the mLearning system.

The SMS transmission history was recorded on the hard disk of the researcher's laptop connected to the mobile phone, as enabled by Nokia PC Suite (Figure 5). The records show sender / receiver names, time of transmission and message content in Microsoft® Excel files.

3.4 Data Analysis Technique

Although data collection is conducted prior to data analysis in the research cycles, the researcher needs to clarify how data are going to be analyzed before they have been gathered (Merriam, 1998). In this section, commonly used data analysis methods in action research are introduced, and then, a framework for reviewing and analyzing data in the present study is presented.

3.4.1 Data Analysis in Action Research

In action research, data analysis is an ongoing process throughout the phases of the research cycles, rather than something that happens only at the end of the research process (Harnett, 2007).

Most of the data collection methods outlined earlier are designed to obtain qualitative data, which is commonly gathered in action research (Larsson, 2009). Analyzing qualitative data includes organizing collected information, systematic review, searching and discovering patterns in data, and breaking data into manageable units (Best & Kahn, 2006).

Coding and categorizing collections of data plays a crucial role in data analysis. There are two approaches to developing categories: deductive and inductive (Morse & Mitcham, 2002).

The deductive method advocates building categories by academic disciplines or / and researcher's theoretical knowledge, while categories developed with the inductive method are derived from the examination of data (Magnusson & Doherty, 2008).

The present study employed both methods. At the beginning of the study, a coding system based on the two research questions, the research setting model, and academic discipline was used. As the research progressed, the data collected was examined and the categories refined inductively.

The categories created deductively are explained below, while categories built via the inductive method are presented in the data analysis sections later.

3.4.2 Data Analysis Framework

The data analysis framework is derived from the two research questions:

- (1) To what extent does mobile technology enhance learning activities and improve student learning?
- (2) What are the underlying success factors or obstacles to integrating mobile technology into learning activities?

First, the design and development of the mLearning system was conceptualized based on user-centered design principles. Carter (2007) suggests five elements to be used in the process of finding out whether “something is useful” for users: “time, place, artifact, user, and user’s cognitive framework” (p. 18). In the study, “useful” is considered an underlying factor contributing to the enhancement and improvement of students’ vocabulary learning.

The study adapts the five elements to fit three categories. The researcher would be aware of and discover any enhanced or improved learning activities relevant to these three aspects, which are:

- Surrounding factors: the time and the place of the mLearning activities are grouped into categories. For example, if mobile technology liberates student’s vocabulary learning from the classroom to anywhere, such as at bus stops, this will be determined and marked as an enhancement.
- Interface: the artifact defined in Carter’s (2007) article. In the study, interface refers to mobile phones. For example, if the keyboards of mobile phones are found to be easy to use and acceptable for conducting mLearning activities, the devices will be considered as useful optional learning tools for students’ enhanced learning.
- Cognitive framework: users’ internal thought flow when they are using the mobile phone or after using it. The expected outcome is being able to find out whether the mLearning method is able to enhance students’ ability to memorize new English words and master the use of them.

These three categories are related to the first research question, “To what extent does mobile technology enhance learning activities and improve student learning?”

Earlier, the research setting of the project was discussed along “technology”, “educational theory” and “pedagogy” lines. These three categories can be used to analyze data with regard to the second questions “What are the underlying success

factors or obstacles to integrating mobile technology into learning activities?”, in order to identify the success factors or obstacles to mLearning. Moreover, the extracted ideas would inform the modification of the research setting in the second research cycle.

The two research questions are related. The second question aims to find out the reasons for the answers to the first question. Thereby, the two groups of three categories are combined in one table to build a small-scale taxonomy of the data collected, used as a data analysis framework in the two research cycles. (Table 5)

Table 5. Data analysis framework

Usefulness factors Usefulness reasons	Surrounding factors	Interface	Cognitive framework
Pedagogy	<ul style="list-style-type: none"> - Summative and formative word test schedule; - SMS pedagogical materials delivery schedule; 	<ul style="list-style-type: none"> - The format of pedagogical materials displayed on mobile phone screen; - The responsive learning / teaching activities (such as typing words or sentences using mobile phone keyboards); 	<ul style="list-style-type: none"> - Comprehension / memorization / recollection / analysis of new English vocabulary initiated by the pedagogical materials delivered.
Educational Theory	<ul style="list-style-type: none"> - Behaviourism; 		
Technology	<ul style="list-style-type: none"> - Time and place people prefer to read / send short messages; - Events happening with reading / sending short messages; 	<ul style="list-style-type: none"> - The usability of mobile phone keyboard and screen; 	<ul style="list-style-type: none"> - Mobile phone screen control method; - Mobile phone word input method; - Word checking synchronously with word typing;

The three categories related to the first research question are named “usefulness factors” and each category occupies one column in the table. The three layers in the research setting model form the “usefulness reasons” group and are positioned in the three rows.

Each of the two layers, technology and pedagogy, are split into three cells. Because the layer of educational theory is an abstracted concept, the middle row is not split by the “useful factors” and contributes to the data analysis as a whole.

Seven pre-conceived individual data are provided as examples in Table 5. The data analysis framework is employed to review and analyze data gathered in the two research cycles. In addition, as the framework is developed by the deductive method, it has an influence on the data collection method, such as the design of the interview questions. However, as a variety of data collection methods are involved in the study, new categories may be coded or the framework may be modified in the process of the research.

3.5 An Overview of the Two Research Cycles

This study comprises two research cycles. Research activities of the first research cycle are the topic of this chapter. Based on the data analysis framework (shown in Table 5), sub-research questions are generated during this cycle and outlined in Table 6.

Table 6. Sub-research questions in research cycle one

Usefulness factors Usefulness reasons	Surrounding factor (when/where)	Interface (mobile phone)	Cognitive framework (internal thinking flow)
Pedagogy	<ul style="list-style-type: none"> - When will students (like to) conduct mLearning? - Where will students (like to) conduct mLearning? 	<ul style="list-style-type: none"> - Can the format and layout of pedagogical materials be displayed on a mobile phone screen properly? - Can the proposed learning activities (such as replying with answers to the researcher) be performed with mobile devices? 	<ul style="list-style-type: none"> - Can the delivered pedagogical materials help students remember new vocabulary and their definitions? - Do students think mLearning is useful after they finish the word test every week?
Educational Theory	<ul style="list-style-type: none"> - Is behaviourism the appropriate educational theory to use outside the classroom? 		
Technology	<ul style="list-style-type: none"> - When do students prefer to read / send short messages? - Where do students prefer to read / send short messages? 	<ul style="list-style-type: none"> - Are the contents displayed on mobile phone screen easy to read? (Issues such as the size of characters and the space between two lines). - Is the keyboard (or touch screen) of the mobile phone easy to use for inputting information? (issues such as the space between two keys and the feeling of pressing keys)? 	<ul style="list-style-type: none"> - Do students think the English word input method installed in the mobile phone is easy to use? - Do students think the operation process of receiving / sending SMS is simple or complex? (such as pressing a particular key to open one message and read it)

The sub-research questions were to be investigated in cycle one, and to go further to identify the reasons for the answers provided by the students and the extent to which the answer is “yes” or “no” (if applicable).

To address the research questions in the context of research cycle one, eight data collection techniques are selected and assigned to seeking answers to particular questions. (Table 7)

Table 7. Designated data collection methods in research cycle one

Usefulness factors Usefulness reasons	Surrounding factors	Interface	Cognitive framework
Pedagogy	<ul style="list-style-type: none"> - Reflective journal; - Interview; - Observation; - SMS transmission history; - Informal conversation; - Portfolio; 	<ul style="list-style-type: none"> - Reflective journal; - Interview; - SMS transmission history; - Informal conversation; 	<ul style="list-style-type: none"> - Reflective journal; - Interview; - Observation; - Students' word test records; - SMS transmission history; - Informal conversation; - Professional presentation;
Educational Theory	<ul style="list-style-type: none"> - Reflective journal; - Interview; - Observation; - Students' word test records; - SMS transmission history; - Informal conversation; - Portfolio; 		
Technology	<ul style="list-style-type: none"> - Reflective journal; - Interview; - Observation; - SMS transmission history; - Informal conversation; - Portfolio; 	<ul style="list-style-type: none"> - Reflective journal; - Interview; - SMS transmission history; - Informal conversation; - Professional presentation; 	<ul style="list-style-type: none"> - Reflective journal; - Interview; - SMS transmission history; - Informal conversation; - Portfolio;

As shown in Table 7, particular techniques are employed to gather information regarding different items. Interviews are used widely to investigate all aspects of the seven cells of the data analysis framework. Interviews are conducted both at the end of the research cycle one and during the cycle itself. Interviews are 15 – 20 minutes long. Three indicative interview questions are elicited from “usefulness factors” to guide conversations (Table 8). More questions will be raised by the researcher as a consequence of interviewees' individual answers with the intention of finding the reasons within the three layers (i.e. technology, educational theory and pedagogy).

Table 8. Indicative questions for interviews

Usefulness factors	Surrounding factor (when/where)	Interface (mobile phone)	Cognitive framework (internal thinking flow)
Usefulness reasons			
Pedagogy	- Where and when did you reply my SMS?	- Do you think the mobile phones are easy to use?	- Do you think short messages are useful for vocabulary learning?
Educational Theory			
Technology			

The three questions are asked to begin and guide a conversation between the researcher and the students in the interviews. Students are encouraged to “think aloud and talk aloud” (Carter, 2007, p.19), with the interviewer listening carefully. Interviewees are allowed to express their perspectives fully and freely. The reasons for the answers are pursued within the conversation flow, in order that they can be positioned into the relevant “usefulness reasons” categories.

Questionnaires were not used in research cycle one, but in cycle two in order to discover changes. The results of analyzed data in research cycle one would inform investigation issues and the question design of the questionnaires, inductively.

In the next chapters, the research findings from each cycle will be presented first, followed by an analysis. The discussion chapter provides a summary of, and reflection on, the whole project (Chapter 9).

Chapter 4: Findings in Research Cycle One

The researcher went to the EAS class on 22nd July 2008 and introduced the mLearning method to the students. Data collection commenced at this time. The researcher was very pleased to see several mobile phones were on the students' tables! "They will be my users." was a thought that came to the researcher's mind.

However, the first attempt to recruit participants in class (on 22nd July) did not meet the expected result: though students expressed or indicated their interest in mLearning, volunteers were few. Two more weeks were given for students to make their decision, and to advertise the mLearning service. 20 students joined the research project voluntarily by the end of week three.

4.1 Informal Conversation (Recruitment Phase) in Research Cycle One

The presentation of the research purpose and a brief summary of the content of the research in the front of the EAS classroom was seen as a prelude to the learning revolution at AUT Language School, as no class had integrated SMS into their educational practice before. Data collection commenced from the introduction of the mLearning to students and the recruiting of participants.

Informal conversation, which was unstructured but effective, took place after the presentation. Because the researcher had attended the AUT orientation one week before the EAS course started, some students already knew the researcher and were comfortable asking questions about SMS-based learning methods. Their questions also stimulated discussions between the researcher and students, and within the student cohort. Informal conversations were recorded in the fieldnotes.

In the following text, pseudonyms, such as Srn, will be adopted to refer to the student participants. Because the names of students, who did not eventually participate in research, were unknown to the researcher, “Student + number”, for example Student1, will be used to refer to potential participants in the recruitment phase.

Some students expressed their interest in the novel learning approach on 22nd July 2008, but most of them had no, or limited, knowledge of mLearning. The presentation was their first exposure to this type of learning support system.

Researcher: ... So, is anyone interested in my project? I think it will help your vocabulary study.

*Ada: Yes, I am **interested** (in it). But I am not very clear (about) **how** you can help me.*

Therefore, a three week period was offered to students to read the Participant Information Sheet which included a more detailed explanation about the mLearning project, and make their decision. Meanwhile, in that three week period, the researcher visited the EAS class during the lunch break to provide face-to-face assistance with their understanding of mLearning, directly answer their questions, and record volunteers’ contact information (i.e. student’s name, mobile phone number and email address).

In week two (on 29th July), some students expressed a concern with time issues.

*Shn: Sorry, Chad¹ (the researcher). I don’t think I (will) have **time** to reply to your short messages.*

Researcher: Well..., you can reply to me anytime when you have time. For example, (when you are) waiting for a bus...

Shn: But I have to work..., I also have my children who need me.... Ok, maybe I will consider it later.

Researcher: Ok, thank you.

¹ The researcher used Chad as his nickname in the EAS class.

During that week (week two), only five students volunteered to participate. Motivations for joining the project varied. Two students joined it because they were seeking assistance with word learning. They wanted to try the researcher's approach to improve their study.

Researcher: Hello guys, do you need help with your vocabulary study?

*Vns: Hi, Chad (the researcher). I think I need some **help** on (with) my (vocabulary) study, can I join you (your project) now?*

Researcher: Sure, thank you! ... And how about you? (I asked another student next to Vns)

Thd: Ok ...

One student volunteered because she wanted to help the researcher.

Vvn: So you are doing this (the) research for your (master) degree?

Researcher: Yes, exactly. MLearning is my topic ...

*Vvn: Ok, I see. I know you really need **help** as I did a similar project before. But I am not sure I will reply to you (your SMS).*

*Researcher: No worries. But I need to know **reasons** for not replying to me. Finding out the reasons is my aim.*

Vvn: Ok.

*Researcher: I will protect your **privacy**. ... Thank you very much for joining me.*

Some students participated in the research simply for the chocolates or coffee packs, which were used to encourage students to join the project.

*Lk: I really need your **coffee** as I am so sleepy now. Ok, let me join you.*

Rgn: Ok, me too ...

*Researcher: Thank you guys. Please write down your contact information here. Your **privacy** will be protected.*

On 29th July, the researcher met Shn again. She had misunderstood participation to mean “participants must reply to the researcher’s short messages”, which prompted the researcher to demonstrate the research purpose to her again.

Researcher: How are you, Shn?

Shn: Fine, Chad.

Researcher: So have you decided to join my research?

*Shn: Well, I am still afraid (that) I'll have **no time** to send short messages.*

*Researcher: Ok, I see. Well, my goal is not to make every participant use short messages. I actually want to know why people do not use or like to use mLearning technologies. So even if you don't reply to me, the **reasons** you provide will also be very useful for me.*

Shn: Ok, Chad. But please let me think about it again.

Researcher: Sure, Shn. Thank you.

Other students were concerned with financial issues.

*Shr: Hi Chad, how many (short) messages I do need to send to you? I mean if so many, it is so **costly**.*

Student1: Yeah ..., it is expensive as I don't like to spend money on my mobile phone.

Researcher: No worries. I will pay for it, because I will get funds from school.

Efforts to clarify the research purpose and advertise mLearning among EAS students received positive and satisfactory results. In the word class on 5th August (week three), 15 EAS students volunteered to join the research. Added to the five students who joined in week two, 20 volunteers in total joined as participants in the mLearning project. Only seven students in the class indicated they were not interested. The high percentage of participants (more than 74.0%) and the relatively large size of the sample boosted the researcher's confidence that valid research results could be obtained (Wang, Novak & Shen, 2008).

The pseudonyms of the 20 participants are listed below.

Table 9. Pseudonyms of the 20 participants

Number	Student's pseudonym	Joining week	Number	Student's pseudonym	Joining week
01	Vns	Week two	11	Slh	Week three
02	Thd	Week two	12	Ld	Week three
03	Rgn	Week two	13	Shn	Week three
04	Lk	Week two	14	Shr	Week three
05	Vvn	Week two	15	Sd	Week three
06	Mra	Week three	16	Ad	Week three
07	Dy	Week three	17	Kn	Week three
08	Lcy	Week three	18	Jy	Week three
09	Ada	Week three	19	Mnh	Week three
10	Dvd	Week three	20	Jm	Week three

As shown in Table 9, with an improved understanding of mLearning and the goals of the research, 20 volunteers would use SMS-based vocabulary learning methods and provide feedback on their experience.

The research findings following the participant recruitment phase will be presented in Sections 4.2 to 4.8, classified by the data collection method used.

4.2 Observation in Research Cycle One

From week four onwards, the researcher attended word class every Tuesday from 9.00 am to 2.00 pm (with a lunch break from 11.am to 12.00pm). In the EAS class, the researcher sat with the participants. Learning conversations between students and the lecturer were recorded in the fieldnotes.

The students started to have summative word tests in class from week three. However, they were still not familiar with the structure of the vocabulary course. On the morning of Tuesday in week four (12th August), a number of students had forgotten to conduct revision on the AWL taught the previous week.

Lecturer: we will have a word test this afternoon, in regard to 1b (the number of AWL). So is everyone ready?

Kn: Sorry teacher ..., I forgot it ...

The lecturer: Ok, you still have some time. So does anyone have questions about these words? ...

The students' feelings about the word tests were also sought by the lecturer. After the word test in week five, the difficulty of it was investigated by the teacher.

Lecturer: Do you think it (the word test just finished) was hard, easy, or ...?

Dy: I think (it is) better than the last time.

Sd: I need more time (to think about the questions in the test).

Jy: Should it be “assistance” or “assistant” ... (in) the last question?

Lecturer: Ok, let's look at the difference between them (assistance and assistant).

In week 6, after the lecturer distributed the marked test papers, the problems arising from the student's vocabulary study were identified by the learners themselves. Grammatical mistakes, such as plural forms and tense, occurred frequently among the students' word tests.

*Lk: aha...! I forgot the **plural** (form)...*

*Jm: Why does it need “- **ing**”?*

In addition, students often inquired about the distinction between different words which have similar meanings. For example, in week six:

*Vns: Excuse me, what is the **difference** between “primary” and “previous”?*

Lecturer: Ok, primary means ...

The feedback gathered from observation informed the modification of the pedagogical design for the mLearning activities.

4.3 Interviews in Research Cycle One

Interviews played a pivotal role in research cycle one as they provided an opportunity for the researcher to gain formal first-order requirements of users (learners) and systemic baseline data, which was compared with data collected in later cycles.

Interviews were employed with a twofold purpose: firstly, to investigate the research questions; second, to facilitate students' awareness of the new learning methods, assist them with their reflection on the mLearning experience, and help them personalize the mLearning service in order to gain more benefit from it.

The interviewees were invited to take part from week five to week seven. The interview timetable is shown in Table 10.

Table 10. Interview timetable

Number	Week	Time	Date	Interviewee
01	Week Five	2.15pm – 2.35pm	20 th August	Ada and Shn
02	Week Five	2.40pm – 3.00pm	20 th August	Mra and Shr
03	Week Five	2.10pm – 2.25pm	21 st August	Rgn
04	Week Five	3.10pm – 3.25pm	21 st August	Lcy
05	Week Six	11.30am – 11.50am	26 th August	Mnh
06	Week Six	2.15pm – 2.30pm	26 th August	Thd
07	Week Six	2.15pm – 2.35pm	27 th August	Jy
08	Week Six	4.00pm – 4.20pm	27 th August	Dy
09	Week Six	2.15pm – 2.35pm	28 th August	Slh, Dvd and Sd
10	Week Seven	2.15pm – 2.35pm	2 nd September	Lk and Ld
11	Week Seven	2.40pm – 3.00pm	2 nd September	Vns
12	Week Seven	2.15pm – 2.35pm	3 rd September	Ad and Kn
13	Week Seven	10.00 am – 10.20 am	5 th September	Jm
14	Week Seven	2.00 pm – 2.20 pm	5 th September	Vvn

The interviews took place over three weeks. Both individual and group interviews were conducted. Three indicative interview questions (refer Table 8) were employed to pursue answers to the research questions.

The conversations between interviewer and interviewees commenced with informal greetings. The findings gained in participant recruitment suggested mLearning was a novel concept for most students. Therefore, the researcher intended gain entry to interviewees' thoughts about their mLearning activities and related beliefs by asking easy questions in the context of common mobile technology experience, such as "Do you like to use mobile phones (SMS)?" In addition, one more general question, "Do you like to use short messages to (help) study vocabulary?", was asked before asking the three structured questions (refer Table 8), which are:

- (1) Where and when did you reply to my SMS?
- (2) Do you think mobile phones are easy to use?
- (3) Do you think short messages were useful for vocabulary learning?

The reasons for their answers to these three questions were also sought.

From week four the researcher began to send SMS questions to participants. The students engaged in analysing the questions, replying with their answers and discussing them with the researcher via SMS with a lively interest.

A word game named "winning chocolates" was created. In the weekend, ten SMS questions were delivered to the 20 students. The participants who provided at least eight right answers in two days would receive two chocolates as a reward. Four students were successful and received the chocolates with pleasure.

The first round of interviews took place in week five. Participants' feelings about their experience with mLearning were collected. (Tables 11 to 15)

Table 11. Responses to general question one in week five

Week Five	General question 1: Do you like to use mobile phones (SMS)?
Interviewee	Responses to the question
Ada	Yes, and I can use it (read and send messages) very fast.
Shn	I don't use SMS very often.
Mra	No, I do not use SMS very often.
Shr	Yes, I am good at using SMS.
Rgn	Yes, very much. I've already got TXT2000 ¹
Lcy	Yes, I am interested in using SMS. But it is new for me.

Table 12. Responses to general questions two in week five

Week Five	General question 2: Do you like to use short messages to (help) study vocabulary?
Interviewee	Responses to the question
Ada	Yes, I like it.
Shn	Yes, I always reply to you.
Mra	Yes, I use it sometimes.
Shr	Yes, especially the (vocabulary) games you sent me this weekend. I won it!
Rgn	Well, I like it, but did not reply you much.
Lcy	Yes, I like it.

¹ A plan provided by Vodafone NZ, which is ten NZD for 2000 short messages per month. Information about it is available on www.vodafone.co.nz

Table 13. Responses to structured questions one in week five

Week Five	Structured question 1: Where and when did you reply to my SMS?
Interviewee	Responses to the question
Ada	<ul style="list-style-type: none"> – I often replied to your messages in my car, when I was waiting for my son outside his school. So I would like to receive SMS questions at around 3pm. – But I will never use mobile phone when I am driving. – I like to have more exercises (SMS questions) in weekends. About five questions. Because I have more time at home.
Shn	<ul style="list-style-type: none"> – I have a son. I need to pick him up everyday when he has finished school. So I replied to you when I was waiting for him in my car. Sometimes I replied to you at home, when I was doing revision. – I want to reply to you immediately if I have time.
Mra	I'd like to do some practice on vocabulary in the weekends, when I was doing revision. So basically I replied to you when I was at home . Or sometimes at my friends' houses.
Shr	I replied to you at home.
Rgn	<ul style="list-style-type: none"> – Last time I replied to you was when I was on the bus. I like to send messages on bus. I spend a lot of time on the bus because my home is quite far from school. – I like to reply to your messages when I receive them. I do not like to check back on old messages. So if you send me questions when I am working, probably I will forget them and leave them.
Lcy	Actually I did not reply to your messages. Maybe once. I think I will reply to you more when I know more about mobile phones .

Table 14. Responses to structured question two in week five

Week Five	Structured question 2: Do you think mobile phones are easy to use?
Interviewee	Responses to the question
Ada	<ul style="list-style-type: none"> – Yes, it is easy. I can type words very fast. I like to receive questions one by one, not in one message together. – I haven't tried MP3. Maybe it is good.
Shn	<ul style="list-style-type: none"> – Yes, it is not hard to use. I can type words using the mobile phone (keyboard). But not fast. – Please do not include all questions in one message. My phone could not display them properly. – I don't use email. So do not send me questions using email.
Mra	<ul style="list-style-type: none"> – Yes, it is OK. I prefer to receive questions in one message. So I could send my answers together. I hate to send only one word in one message. (Sending many messages) It's a waste of money. – I don't like to use email. I don't use it very often.
Shr	<ul style="list-style-type: none"> – Yes, true. I also like to receive questions together (in one message). – Email is OK. I check it sometimes.
Rgn	Yes, I can do it very fast (input English words), even Chinese , I can type it fast.
Lcy	No, not now. But I like my new mobile phone. I think I will be better later.

Table 15. Responses to structured question three in week five

Week Five	Structured question 3: Do you think short messages were useful for vocabulary learning?
Interviewee	Responses to the question
Ada	Yes, it is good. I can know which words I do know. So I can focus on them when I do revision.
Shn	<ul style="list-style-type: none"> – I think it is helpful. I saw some words you sent me in the test. So I knew I chose the right words (in the test) as I had practised them. – Also, on Friday, your messages reminded me to do revision. I always forget that I need to do revision on new words after I've had classes on Wednesday and Thursday. – SMS questions are quite good as the format (of them) is the same as (questions in) the tests. – After I replied to your questions, I often read them again at home when I did revision.
Mra	Yes, I like to use your questions to test myself after I did revision, because it (SMS question) is quite like the questions in the tests. But please make (SMS) questions harder. I mean I want to practise grammar using it.
Shr	Your messages reminded me to do revision. I use them (SMS questions) when I do revision at home. It helped me check out which words I still did not know how to use .
Rgn	They (SMS questions) always made me remember the word test is coming. So I did some revision when I read your message.
Lcy	Maybe useful. I have not actually used it.

Up to week six, most participants had experienced on-air interactions with the researcher. However, a number of students kept silent and did not reply to the SMS questions very often. It was believed that finding the reasons for this would uncover obstacles to integrating mobile technology into learning activities. Tables 16 to 20 present data collected from the interviews in week six.

Table 16. Responses to general question one in week six

Week Six	General question 1: Do you like to use mobile phones (SMS)?
Interviewee	Responses to the question
Mnh	I don't use it (SMS) so much.
Thd	Sometimes, I send messages to my friends.
Jy	I do not use short messages very much.
Dy	No, I don't like to use mobile phones as I don't think it is healthy .
Slh	Yes.
Dvd	Yeah, I use SMS everyday.
Sd	Yes, I use SMS.

Table 17. Responses to general questions two in week six

Week Six	General question 2: Do you like to use short messages to (help) study vocabulary?
Interviewee	Responses to the question
Mnh	I like your (SMS) questions.
Thd	Actually no. I like to study my way .
Jy	Yes, I like your SMS questions very much.
Dy	No, I do not think it (SMS questions) is useful.
Slh	Not really. I haven't used it.
Dvd	No, not that useful.
Sd	Sometimes, I like that game . Winning chocolates.

Table 18. Responses to structured question one in week six

Week Six	Structured question 1: Where and when did you reply to my SMS?
Interviewee	Responses to the question
Mnh	<ul style="list-style-type: none"> – I replied you when I was at home. – I take the bus to go to school. But I do not like to read messages on the bus.
Thd	I haven't replied to you. Sorry.
Jy	<ul style="list-style-type: none"> – On the bus. I take the bus to school and to come back home. Sometime I replied to you at home as I did not hear your message. – I think sending five questions each week is good.
Dy	I just replied to you one time, in the beginning. That was at home. I do not take my mobile phone along with me as I think mobile phones send radiation , which is not healthy for me.
Slh	Sorry I did not reply to your messages.
Dvd	<ul style="list-style-type: none"> – Me too. (did not reply SMS questions). – But I take my phone along with me and send messages whenever I want.
Sd	At home . Last time I replied to you was when I was bored at home.

Table 19. Responses to structured question two in week six

Week Six	Structured question 2: Do you think mobile phones are easy to use?
Interviewee	Responses to the question
Mnh	No. Most of the time I use mobile phone to call someone. SMS is not that easy for me.
Thd	Yes, mobile phones are ok .
Jy	<ul style="list-style-type: none"> – I practised a lot when I replied to your messages. My skills (on typing messages) improved (when I was doing mLearning). – I want to receive feedback immediately after I sent the answers. I wanted to know if they are right or wrong, and telling me the reasons is good. – The screen of my mobile phone is too small and the keyboard is hard to use. I want to buy a new one (mobile phone). – I want you to send about three questions with five possible words in one message. It is more like the tests.
Dy	<ul style="list-style-type: none"> – Usually I don't use a mobile phone to send messages. So I am not good at it. The keyboard is so small. Reading messages outside gave me a headache. – I like email. When I study using a computer, I keep checking my emails. – Audio files are not good. I am not sure, (I) haven't tried it.
Slh	Yes, it is ok.
Dvd	Yes, I have got used to use SMS.
Sd	Not hard to use.

Table 20. Responses to structured question three in week six

Week Six	Structured question 3: Do you think short messages were useful for vocabulary learning?
Interviewee	Responses to the question
Mnh	Though I did not reply to your messages very often, I like your (SMS) questions. It could warm me up .
Thd	No. Maybe later I will try to reply to you. Most of the time, I have my own plan for revision. So I do not need it (SMS questions).
Jy	<ul style="list-style-type: none"> – Sometimes I received and answered your SMS questions when I have not done any revision. So I guessed the answers. But it still helped me to know how to use new words as you explained why it (my answer) was wrong to me. – I checked dictionary when I met new words in your questions at home. I also checked your messages again when I did revision at home. – Also, your messages encouraged me to do revision. When I did revision on Monday evening, I already knew which words I knew and which words I have to review again. – When I was at home, I like to write your questions on one paper, and then choose my answers and send them to you. I cannot think (about) the questions and type my answers at the same time, it's so hard. – Sometimes the questions in your messages were too easy, which I think is not helpful. If I can meet similar problems in your questions as the ones in the tests, that will be helpful. For example, two words which have similar meanings. – The game you sent me was quite good. I like it. I busily replied to you.
Dy	<ul style="list-style-type: none"> – I don't think it is useful. I have done revision with the same questions online. I know the website you use to make the questions. So I don't need it at all. Actually I have done preview on all the vocabulary on the AWL now. I like to do things in advance. – The first word test in class was quite hard as I haven't done similar questions before. But now it is ok. – Sometimes I want someone to check the sentences I've made using new vocabulary. So if I can send the sentences using SMS, then get feedback, it would be good.
Slh	Maybe good. But I do not use it. I think reading textbooks is more useful.
Dvd	No. I have not much time to do revision every week.
Sd	The game was good. I learnt new words when I was playing it.

At the end of week six, the excessive number of messages sent by the researcher caused inconvenience for some students. In the following interviews, the issue of “not too many questions in one day” was raised by the interviewees. The interviewees’ answers to interview questions in week seven are shown in Tables 21 to 25.

Table 21. Responses to general question one in week seven

Week Seven	General question 1: Do you like to use mobile phones (SMS)?
Interviewee	Responses to the question
Lk	Yes, I use it to chat with my friends.
Ld	Yes, I use short messages very often.
Vns	Yes, I like it very much. I have got used to (use) SMS
Ad	Yes, very much.
Kn	Yes, everyday.
Jm	No, I do not use SMS much. Sometimes I reply to my friends' messages.
Vvn	Yes, I like to use short messages to chat with friends.

Table 22. Responses to general question two in week seven

Week Seven	General question 2: Do you like to use short messages to (help) study vocabulary?
Interviewee	Responses to the question
Lk	Yes, it is interesting. But I did not reply to all your questions. Sorry.
Ld	Sometimes it was interesting.
Vns	Yeah, it is a good idea. I like it.
Ad	No.
Kn	Not much.
Jm	I don't use it (SMS question) much.
Vvn	Ah...it (mLearning) is interesting . But I did not use it much.

Table 23. Responses to structured question one in week seven

Week Seven	Structured question 1: Where and when did you reply to my SMS?
Interviewee	Responses to the question
Lk	<ul style="list-style-type: none"> – I check my mobile phone inbox on the bus. So normally on the bus. Sometimes I was so busy that I couldn't reply quickly. Sorry. – Please do not send me messages when I am in class. Send them in the morning or evening when I have time.
Ld	<ul style="list-style-type: none"> – I am good at sending messages, even when I am walking I can read messages and reply to them. – But I did not reply to you very often. Most of the time I was busy chatting with my friends using SMS. – I like to answer your SMS questions when I am doing revision at home. Especially playing the word games. I won it last time!
Vns	<ul style="list-style-type: none"> – I usually replied to you at home, when I was doing revision on vocabulary. But I also sent short messages to my friends outside (not including replying to SMS questions). For example, in my car or in my break at work. – Normally I want to reply to you as soon as I receive the questions. But sometimes I have to work, and I have my child. – I want to receive SMS questions between 9am and 6pm. Please do not send so many questions in one day, two is enough. I cannot reply to them. And ten questions per week is enough.
Ad	Sorry I did not reply to you though I took my mobile phone along with me.
Kn	I just read your messages. But I did not reply to them.
Jm	<ul style="list-style-type: none"> – Most of the time I read your questions on the bus. I have not much time to reply to you as I was very busy with driving or my work. – If I can receive your questions in the morning I can find some time to reply to you later.
Vvn	<ul style="list-style-type: none"> – I can send SMS anywhere. But I must be sitting or standing, not walking, when I send messages. I cannot send messages on the bus as it causes headaches for me. – Most of the time I could not reply to you as I am busy. Even though I did not have much time to do revision (on new words). I do not do revision until Tuesday morning. Only some hours to do it. – I do not like to check old messages and reply to them. Usually I like to reply to them as soon as I read them.

Table 24. Responses to structured question two in week seven

Week Seven	Structured question 2: Do you think mobile phones are easy to use?
Interviewee	Responses to the question
Lk	Yes, it is ok for me to send messages. But do not send me so many questions in one day. It is impossible to reply to them. I have no patience to read so many messages. One or two questions in one day suits me.
Ld	<ul style="list-style-type: none"> – Yes, (SMS is) very easy to use. – But sorry I did not answer your SMS questions sometimes as I could not concentrate on study. I want to relax when I am not studying.
Vns	<ul style="list-style-type: none"> – Yes, I have got used to SMS. Your messages were not difficult to read. But please send me only one question in one message. The keyboard of my mobile phone is comfortable. But if so many questions in one message, I cannot remember them. So I have to switch between reading and typing. Sometimes I have to write questions on a paper then reply to you. Not that convenient. – I think it is better than email. I don't check my email everyday.
Ad	Yes, very easy .
Kn	Yes, easy .
Jm	<ul style="list-style-type: none"> – It is ok to read messages. But please do not send me so many questions in one message at the same time. It annoyed me because the message reminder often made a noise. (His mobile phone received long messages in several divided short messages.) – I like to read textbooks to do revision even on the bus. – I don't think I can listen to MP3 and do other things at the same time.
Vvn	<ul style="list-style-type: none"> – I don't like to type words with my mobile phone keyboard because the keys are too small. But writing English is easier than writing Chinese (with a phone keyboard) because the English input method is easier. – Reading messages is easy for me. No problems. – I don't like to receive many questions at one time. I want to receive questions one by one so I have time to think about them. – I like to receive one question in one message. It is easy to read. – I check email often. But I do not like to reply to questions using email because I think you will not tell me (whether they are) right or wrong immediately.

Table 25. Responses to structured question three in week seven

Week Seven	Structured question 3: Do you think short messages were useful for vocabulary learning?
Interviewee	Responses to the question
Lk	Yeah, your questions are same as (the ones in) the tests. But most of the time, I did revision at home with the textbook .
Ld	Yes, it is interesting. Last time when I won the game I was confident of doing the test in class.
Vns	<ul style="list-style-type: none"> – Yes, it is useful for my word learning. I always forgot the word tests as I have my family and so many things need me. I always start my revision on new words when I receive your message questions. Otherwise, I think I will leave them (revisions on new words) until Monday evening. – I like to receive one more question after I answer the old one. So I can think one by one. So many questions together makes me busy clicking buttons on keyboard to read them. I have no time to think (about answers to SMS questions). – At home, I checked my dictionary to find the answers to your questions. Also I think textbook is necessary. I cannot study only with short messages. I also want to receive the meanings of words, which confused me when I answered the SMS questions.
Ad	Your SMS questions were too easy . I could give you the answers even if I did not know the possible words!
Kn	I did not reply to you. I did not do much revision. So I did not know the answers to your SMS questions.
Jm	<ul style="list-style-type: none"> – I like to use books to do revision. The game you sent me was quite interesting. – But when I had time I read your questions and it made me know I didn't know how to use them (new words). – I like to receive the meanings of words. Because if I don't know the new words in your questions, I will leave it and it will be not useful. But for meanings I can read them and remember the words. Also, example sentences are good.
Vvn	<ul style="list-style-type: none"> – Most of the time, I just read the SMS questions you sent me. I did not like to reply to them. But it reminded me that I have to do some revision on new vocabulary. I read the optional words in your questions, asked myself if I know these words. – I think if you send me the meanings of new words it is more useful for me as I can read them when I am outside. – I like to listen to MP3. If mLearning uses MP3, I think it will be helpful for me as I can listen to it and do other things, for example, walking.

In the first research cycle, all participants were involved in interviews in the context of events occurring in the mLearning process. It is believed that the face to face communication with every participant enabled the researcher to gain a comprehensive picture of the mobile learners' knowledge, thinking and opinions on mLearning.

4.4 Reflective Journal in Research Cycle One

The first several pages of the researcher's reflective journal were all about the confusion, "why were most students interested in the innovative learning method, but did not desire to or refused to join the project (in week one)?"

The reflection on this question promoted the researcher to remember one of the research objectives: to investigate success factors and / or obstacles to integrating mobile technology into learning activities, not to force participants to implement particular mobile technologies, such as SMS. In other words, even if no participants answered the SMS questions or replied to the short messages, the reasons unearthed for this situation would still be valuable. This concept also had an influence on the explanation of the research purpose and contents to the students in the participant recruitment phase (in week one and week two): Replying to the researcher's SMS questions is actively encouraged, but not an obligation.

Discovering and clearing up participants' potential misunderstanding about the proposed research received positive results. Most students in the EAS class volunteered to take part in the research.

However, the relatively large number of participants also led to a heavy workload for the researcher. Although the Nokia PC Suite facilitated the process of delivering SMS questions to the students, it restricted mobile teaching activities to home. Moreover, the software could not process data transmission properly from week five. Till the researcher updated the version of Nokia PC Suite on the official website and solved the problem in week seven, the researcher had to send messages using the mobile phone keyboard.

This incident also provided the researcher with a chance to experience typing messages with a mobile phone keyboard, which was the method most students used to operate

their mobile devices. A reflection on the process of sending messages is illustrated in Figure 10.

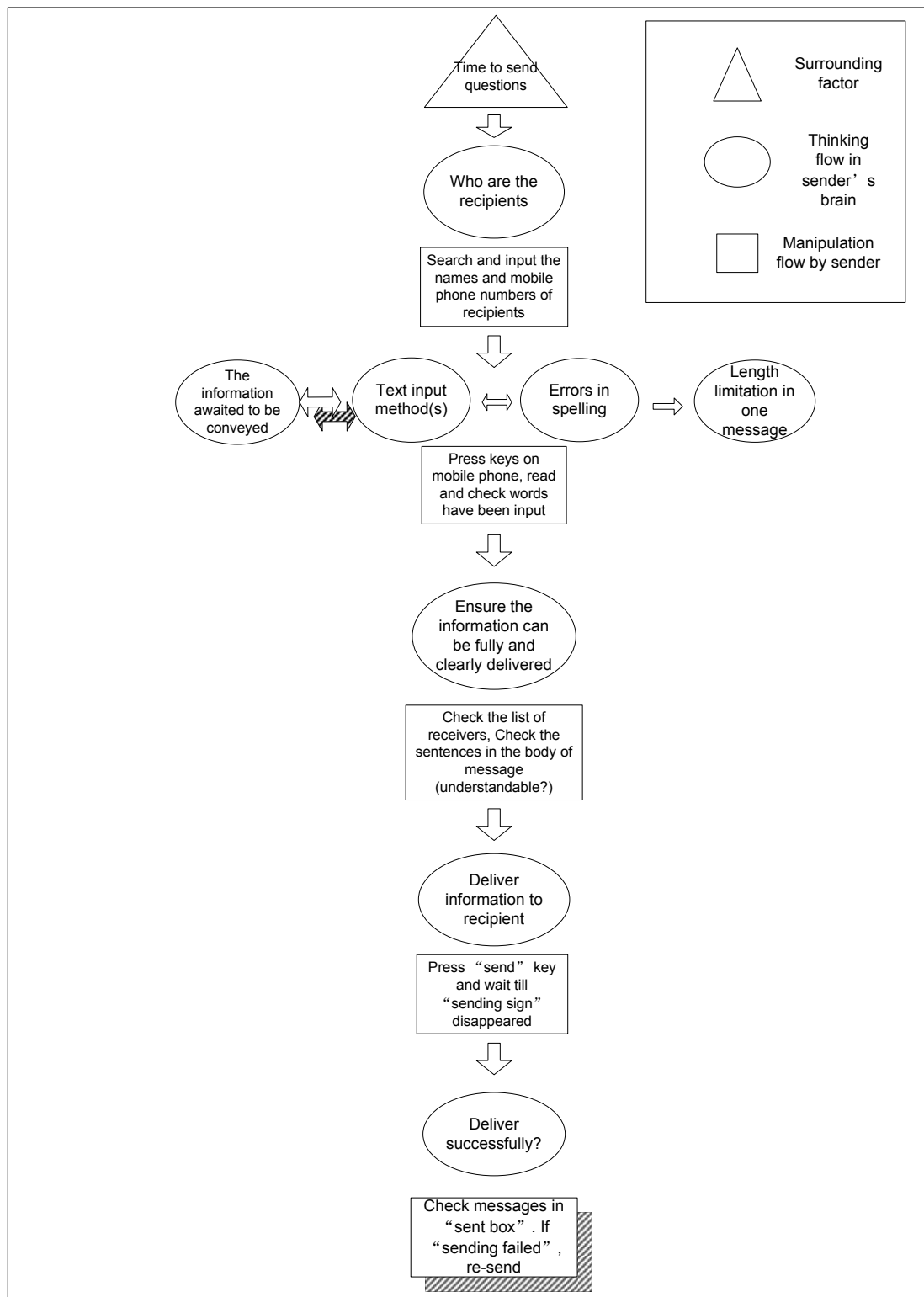


Figure 10. The process of sending messages using a mobile keyboard by the researcher

There are two parts highlighted with shadows in Figure 10. First, when the researcher was typing sentences, he was busy shifting his mind between the meaning the researcher wanted to express and the input methods which controlled the finger movements. This process consumed much energy and sometimes the researcher lost his train of thought and had to stop to check if the sentence made sense. Second, the performance of the researcher's mobile device was not stable. Group sending failed occasionally causing the researcher to check the "sent box" to cross check if the messages had been conveyed successfully. This step also took time and energy. The solutions to these two problems were sought and the updated approaches will be outlined in chapter 6 (revised plan for research cycle two).

4.5 Professional Presentation in Research Cycle One

On 29th August in week six, the AUT 2008 Postgraduate Symposium provided the researcher an excellent opportunity to present the research to other experts from a wide range of fields including the educational and business areas. Two questions were raised by the audience after the presentation.

- First, how do you (the researcher) judge whether the improvement (if any) is due to the adoption of mLearning methods?
- Second, can the school bear the cost of short messages?

The first question would drive the researcher to find evidence to prove the SMS-based learning method is effective. The learners' feedback gained in the interviews indicated my SMS questions were useful to most participants.

The budget for sending messages by the researcher was 60 NZD for one semester (receiving messages is free in New Zealand). This amount was acceptable to the enquirer, who is a professor at the School of Languages at AUT.

4.6 SMS Transmission History in Research Cycle One

Though qualitative data is mainly used in the present action research, quantitative data also contributes to illustrate certain situations in mLearning. The SMS transmission history was stored on the hard disk of the researcher's computer. Two types of information were captured: the number of short messages received by the researcher and the length of time the researcher spent waiting for the participants' responses.

First, the number of short messages sent by participants was counted and shown in Figure 11.

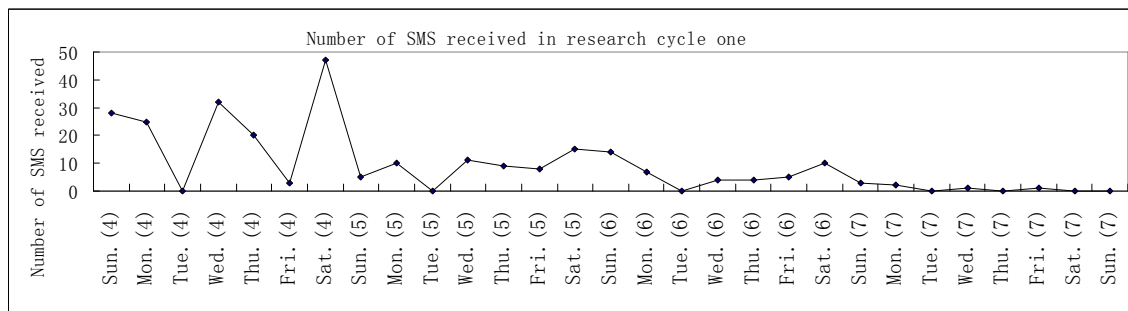


Figure 11. Number of short messages received in research cycle one

As shown in Figure 11, the number of response by participants declined from about 40 in week four to less than five in week seven (the numbers in brackets stand for week number). The relatively high number of messages received indicates that students participated in mLearning with lively interest at the beginning. In the weekend of week four especially, the game “winning chocolates” stimulated their engagement in on-air interaction with the researcher.

The number of received SMS remained at about 15 every day in week five and week six. Every Saturday students spent more time on revision and replying to SMS questions. Every Tuesday, word tests were administered and no pedagogical material was delivered to students with SMS.

In week seven, participants rarely sent SMS to the researcher. A possible reason was that there were to be no word tests in the following two weeks as the mid-semester break was coming. More detailed underlying factors for this situation are pursued in the next chapter.

Second, the average waiting time¹ for participants' responses (when they occurred) was calculated, and is illustrated in Figure 12.

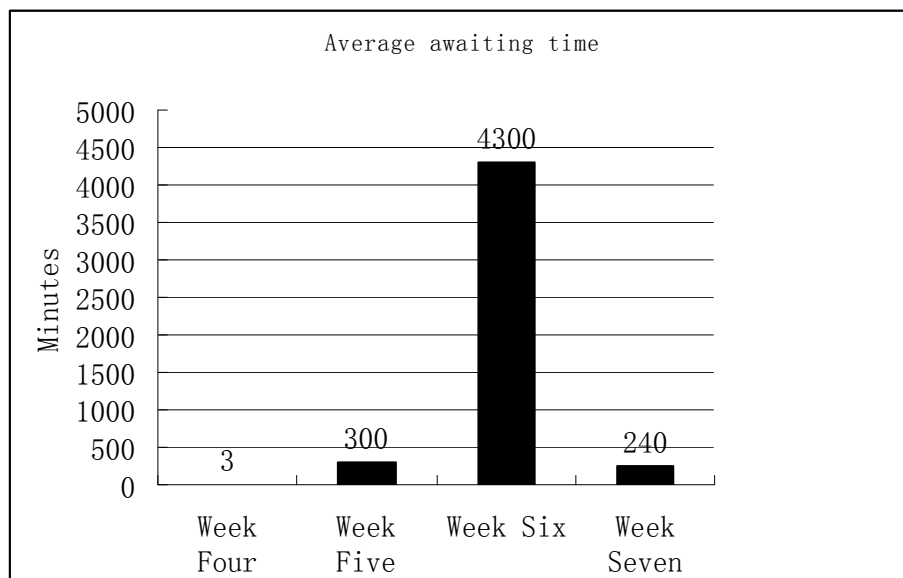


Figure 12. Average awaiting time for participants' responses

As shown in Figure 12, most responders replied to the SMS questions as soon as they received them in week four. From week five, participants who planned to answer the questions preferred to choose a suitable time for themselves to send SMS. For example, Ada kept all SMS questions on her mobile phone and sent all the answers in the weekends. In week seven, however, due to few messages being received, a result of 240 minutes derived from a small sample may not be representative.

The extended awaiting time suggests students started to personalize mLearning methods after they were more familiar with it. They began to organize their time on mLearning

¹ The average waiting time is equal to the total waiting time divided by the number of messages received by the researcher.

activities rather than simply being driven by the researcher. This change was positive and encouraged in subsequent research cycles as it is consistent with the research design concept: Student-centred design.

4.7 Students' Word Test Records in Research Cycle One

Summative word tests were administered in the EAS class from academic week three. Students' test results were able to explicitly present their study quality. The average grade of the five word tests was calculated and is shown in Figure 13.

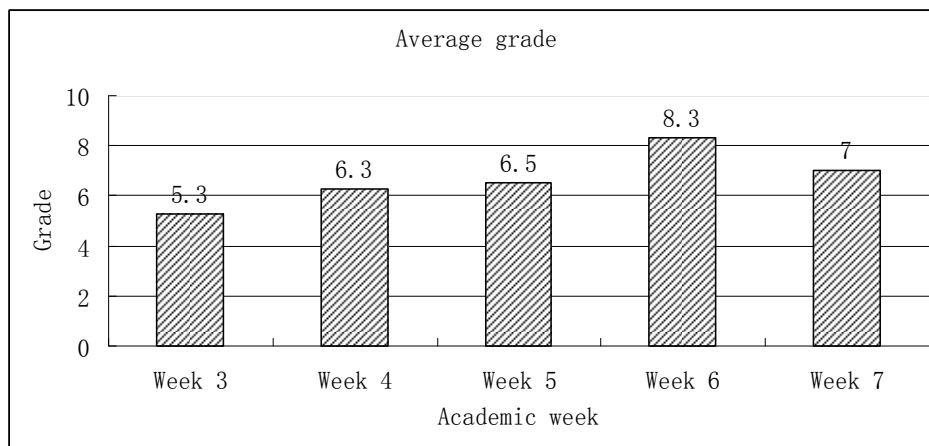


Figure 13. Participants' average grade of word tests in research cycle one

As illustrated, a trend of increased performance was observed in the 20 participants' word tests results for four weeks (from week three to week six), which suggests that they improved their vocabulary learning. However, the average grade decreased from 8.3 to 7 in the last two weeks before the mid-semester break (between week six and week seven).

To some extent, the change in the tests results is parallel with the change in students' mLearning performance. As shown in Figure 11, the density of short message activity was relatively high in week four, which may have enhanced participants' word revision and contributed to the more than one point increase in the average grade (shown in Figure 13). The number of interactions between the students and the researcher via SMS

was stable in weeks five and six. The regular mobile pedagogy maintained by the researcher and adjusted learning activities conducted by students were followed by a relevant remarkable improvement in word test results: a nearly two point increase in the average grade in week six. Meanwhile, a lower percentage of engagement in replying to the SMS questions happened at the same time as a decreased average grade in week seven.

4.8 Portfolio in Research Cycle One

Two significant photographs were selected and included in the researcher's portfolio in research cycle one. One picture was taken by the researcher's friend while we enjoyed a trip to Waiheke Island near Auckland, New Zealand. This photo is shown in Figure 14.



Figure 14. The researcher on Waiheke Island

As shown in Figure 14, the researcher (in the middle, holding a mobile phone) was busy sending pedagogical material even while his friends were trying to chat with him. Two issues are revealed in this photo:

First, in order to achieve students' learning anywhere, anytime the researcher had to teach synchronously. Although the researcher maintained the mLearning service with great commitment even during the holidays, time consumption will be a challenge in mLearning deployment.

Second, the researcher was so concentrated on typing short messages that he ignored the people surrounding him. The high time and commitment requirement may prevent SMS-based learning methods from being anywhere, anytime.

A serious accident alerted people to the safe use of SMS. The scene of a train crash is shown in Figure 15.



Figure 15. The scene of a train crash (Rubin, Simmons & Landsberg, 2008)

The crash shown in Figure 15, was caused by the train driver's sending short messages while he was working. The event cautions SMS consumers, including mLearning users, against operating mobile devices in unsafe situations.

Chapter 5: Data Analysis in Research Cycle One

In this chapter, a user classification model developed inductively will first be presented. Then the data collected in cycle one will be analyzed in the light of the data analysis framework (refer Table 5). A data analysis technique called “binary tree” (Li, Zhao & Zhu, 2008), will also be introduced and used for visual data analysis.

5.1 User Classification in Research Cycle One

The analysis of research findings in research cycle one made it possible to derive two general and explicit criteria to categorize participants:

- First, the analysis of data collected from interviews suggests that though all participants owned mobile phones, not all of them liked to use SMS or had challenges in using it due to a lack of technological experience. Therefore, students were classified into “Use SMS often” and “Use SMS occasionally”.
- Second, the analysis of data gathered from the SMS transmission history indicates that there was a variety amongst the 20 volunteers’ mLearning performance. Some students engaged actively in communication with the researcher while others stayed quiet most of the time. “Engaged in SMS-based learning actively” and “Quiet mLearning user” were used to cross-classify learners.

A two-dimension user classification model is presented in Figure 16.

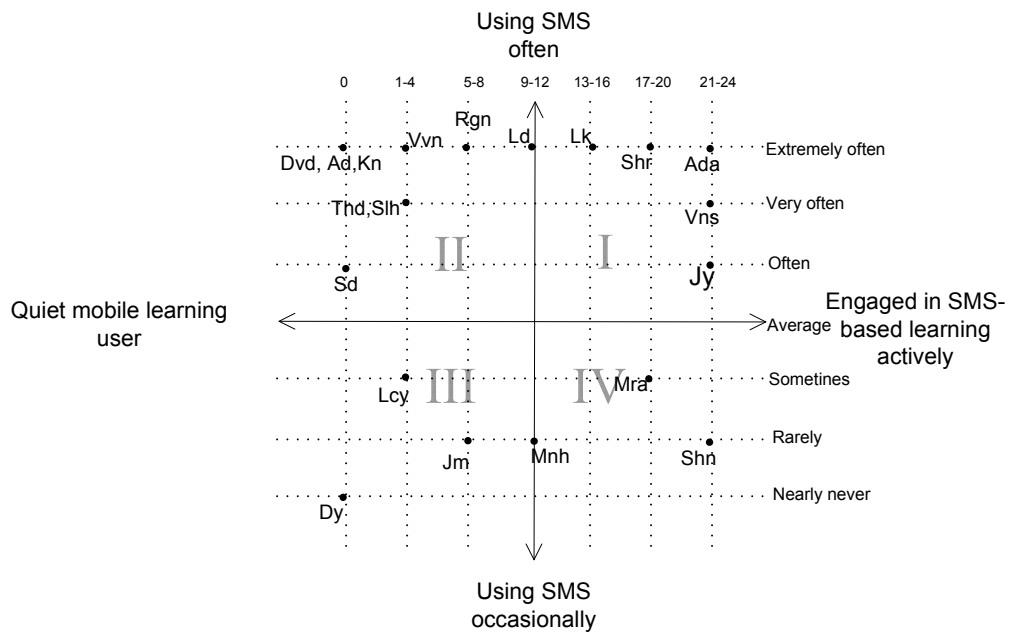


Figure 16. User classification model

As shown in Figure 16, the two criteria are positioned on vertical and horizontal lines. The twenty participants are situated in the context of the categories. The positions are determined comparatively through the researcher's personal analysis of data collected from interviews and the SMS transmission history.

On the vertical line, participants' answers to the interview question "do you like to use mobile phone (SMS)", and their related answers (if any) to other questions in the interviews, were analyzed qualitatively to judge how often they use short messages (i.e. extremely often, very often, etc.). On the horizontal line, quantitative data (i.e. the number of messages sent by the participants) was used to determine the participants' positions (i.e. 21-24, 17-20, etc.).

All participants are shown in Figure 16. The extreme cases (students positioned at the very corners of the quadrants I, II, III and IV) can be used to identify the characteristics of the four groups the participants fall into.

- (1) In the top right corner, Ada is an example of a student who is an experienced SMS user and keen to apply her technological skills to expanding her learning opportunities.
- (2) In the bottom right corner, Shn has a high interest in trying novel learning methods and achieved effective outcomes, and is able to overcome a lack of mobile technology usage experience.
- (3) The three students in the top left corner “like using short messages” but did not seem to “like using an SMS-based learning method”. The reasons may include students’ entrenched learning habits (such as preferring a textbook). A more detailed analysis of underlying factors is provided in the following sections.
- (4) Rejecting mobile devices was an element which led to abandoning the adoption of an SMS-based learning method. For example, Dy stopped reading or sending messages because she believed mobile signal radiation was unhealthy for the human body.

In this study, a high level of engagement in mLearning activities is assumed to be an indication of “success”. Therefore, the researcher would encourage and facilitate students to move from the left side of the vertical line to its right. The factors underlying the situation shown in Figure 16 will be analyzed in this chapter. The results would inform the modification of research settings for research cycle two.

5.2 Coded Names of Items in Data Analysis Framework

The data analysis framework (Table 5) used for reviewing the research findings is shown again in Table 26, where each category is assigned a code to be used in the following text. The items in the data analysis framework are given the initials of their two relevant categories. The code names are used in the titles of the sections.

Table 26. Coded names of items in data analysis framework

Usefulness factors Usefulness reasons	Surrounding factors (when/where)	Interface (mobile phone)	Cognitive framework (internal thinking flow)
Pedagogy	SF P	I P	CF P
Educational Theory	SF ET		
Technology	SF T	I T	CF T

5.3 Data Analysis in Category SF|T in Research Cycle One

Being able to contact people without being limited by location is an advantage of using a mobile phone. However, a number of students only utilized short messages in an indoor environment. The reasons include the process of operating a mobile device and the user's personal preferences or / and skills.

Most students preferred to read and send short messages while not moving. Although people could stop in their tracks to reply to messages, most of the time they chose to situate themselves in a stable environment, such as a classroom, cafeteria, their home, their friends' house, or restaurant. One reason is that performing SMS activities on mobile devices requires a high level of concentration (Viswanathan, 2009). While reading messages or typing words using a mobile phone keyboard, users need to pay full attention to their mobile phones and other activities are paused for a moment. Another reason is safety. To avoid accidents such as the one illustrated in Figure 15 SMS users choose indoor environments.

By way of compromise, people chose to use SMS in cars and on buses. Some students used SMS when they rested or were at a relative rest. For example, Rgn chatted with his friends via SMS on the bus on his way home. However, some did not feel comfortable reading sentences on a moving bus as it caused headaches. Others browsed short messages in their cars as they waited for people as a way of saving time.

Some experienced SMS users would send messages while they were walking. Their technological skills would enable them to switch their focus between their environment and the operation of their mobile phone.

A number of students had no time to use short messages though they took their mobile phone along with them. One major reason was they were busy with working. They could only check their in-box in their breaks if they were at their workplace. Household chores also shortened students' available online time. For example, Vns usually replied to the researcher's messages after 9 pm.

Health reasons rarely stopped people using SMS but did so completely. The concern about signal radiation led to the impossibility of implementing mLearning.

Interestingly, the cost of sending short messages was acceptable for most students and did not limit SMS usage.

To some extent, the places where students could use SMS and the time when they were available to read and send messages shaped participants' mLearning behaviour and re-defined "anytime and anywhere" in the context of learners' situations. Most students' habits and preferences in regard to SMS usage contributed to the extent of their accomplishment of reading and replying to the SMS questions. The analysis of where and when students conducted mLearning and replied to the researcher's questions is presented in section 5.7.

5.4 Data Analysis in Category I/T in Research Cycle One

All SMS users involved in the study suggested reading short messages was easier than typing words and sending messages. In addition, only one participant (Jy) complained that the screens of mobile phones were too small to display information.

However, compared with the keyboards of computers, the usability of mobile phone keyboards was not perceived as good due to the small size of the keys and the compact layout. An unsatisfactory experience entering text reduced the chances of some students replying to the messages. Fortunately, most users (e.g. Lcy) would like to practice their typing skills on their own mobile device because SMS was a popular tool with which their friends contacted them.

The challenges of operating a mobile phone keyboard did not reduce participants' enthusiasm for mLearning. The students who are positioned under the horizontal line in Figure 16 (i.e. relatively new to the use of SMS) expressed or indicated that replying to SMS questions also provided them with a chance to improve their technological skills in sending messages.

5.5 Data Analysis in Category CF|T in Research Cycle One

For most participants, keying in English words was simpler and easier than doing so in their first language. This was an innate advantage of communication in English using short messages. However, SMS users still needed to switch their thinking between the information they planned to convey and the input method, which controlled their finger movements. As an SMS user, whose technological skill was at a middle level, the researcher really experienced short-term thinking congestion when he was sending messages to students using his mobile phone.

5.6 Data Analysis in Category SF|ET in Research Cycle One

The initial mLearning method design was primarily driven by the researcher. The educational activities via SMS were designed as a continuation of classroom teaching, with behaviourism as the underpinning theory of the first cycle.

However, the study also attempts to employ a user-centered design approach to the development of mLearning service. As an increasing amount of information about

students' feelings, requirements and performance was gained along with the progress of the action research process, the development of mLearning, organizing the learning activities and constructing pedagogical materials, started to shift away from the researcher to the students. Learners whose needs determined the focus were encouraged to personalize mLearning.

The binary tree shown in Figure 17 visualizes the relationship outside the classroom between the researcher (as an assistant lecturer) and the students as it developed in an hour of mLearning activity.

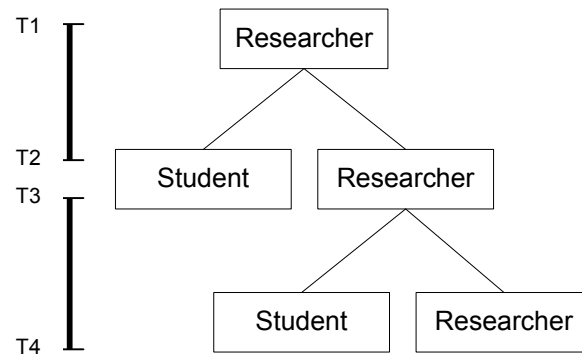


Figure 17. Learning conversation via SMS in research cycle one

The rectangles labeled “Researcher” and “Student”, represent the short messages sent by the researcher and students respectively. The sending sequence is from top to bottom and from left to right. The tree develops along a timeline, marking the time when the SMS was sent. Figure 18 illustrates a real-life learning conversation.

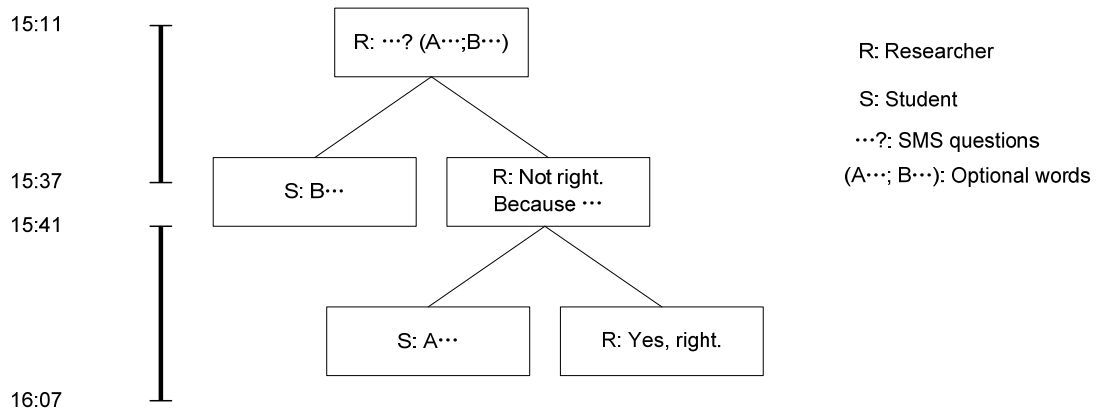


Figure 18. An example of a learning conversation via SMS

First, the researcher distributes SMS questions to students. Conversation starts when the student replies with the answer B to the researcher. The researcher provides feedback including explanations of wrong choices. Finally, the student sends the correct answer, which is confirmed by the researcher.

Some educational issues can be elicited from the binary tree, as shown in Figure 19:

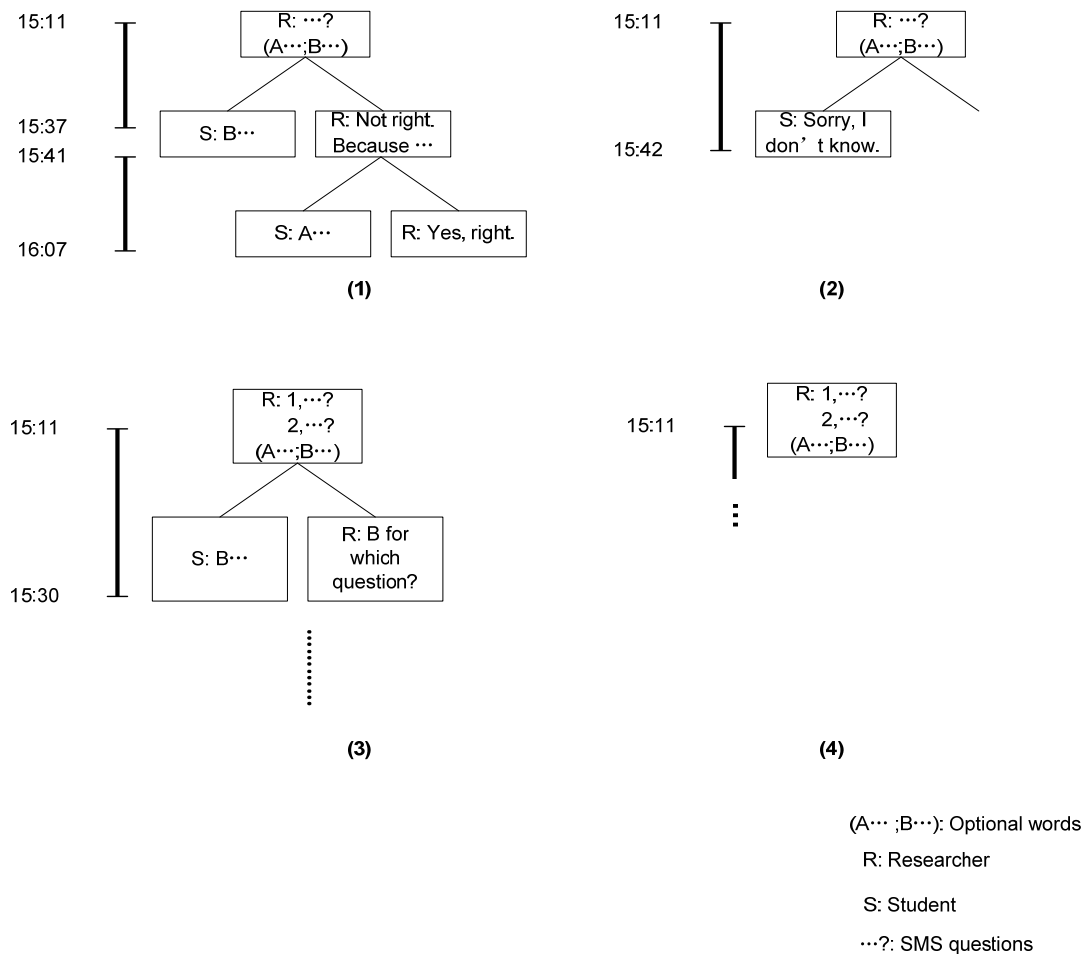


Figure 19. Educational issues illustrated with binary trees

- (1) As the learning conversation via SMS in research cycle one was underpinned by behaviourism, the topic of the discussion between the researcher and students was raised by the researcher. All subsequent content was relative to the topic. New topics were not encouraged.
- (2) Learning outside the classroom is different from study in the classroom. In the word class, new vocabulary was taught to all students at the same time. The extent to which students mastered the knowledge was relatively similar. However, the students' processes of review of the new words were asynchronous. As a result, the same SMS questions sent to all participants might be not applicable to some of them. This situation is shown in picture (2) in Figure 19.
- (3) More than one SMS question was sent to participants in one day. Their responses occurred at different times. It was difficult for the researcher to figure out the

corresponding questions if the answers were not numbered. The situation presented in the picture (3) suggests that remote communication requires identification tags, such as question numbers, to assist clarity.

- (4) Another challenging situation is illustrated in picture (4) in Figure 19. No responses to the topics initiated by the researcher occurred. In this situation, classroom teaching is proved to be more flexible in solving this problem. The teacher is able to explain the questions in more detail, or ask easier or related questions to bridge the gap between learners' current knowledge level and the required level. On-air teaching lacked the capability of dealing with this situation.

Problems (2) and (3), were reduced or solved in research cycle one. For problem (2), participants personalized mLearning by adjusting their replying time, which is illustrated in Figure 20.

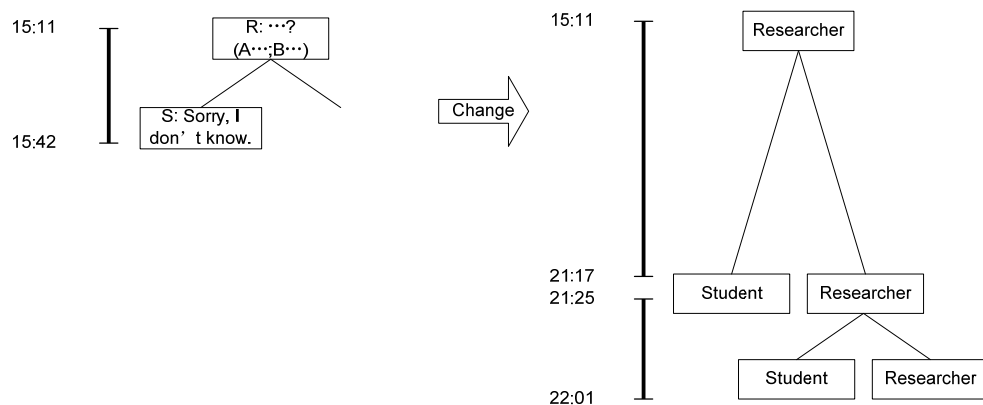


Figure 20. Personalized mLearning in research cycle one

Participants considered answering SMS questions when they were ready. The waiting time for students' responses was expanded. This change allowed mLearning to be more flexible and effective for students.

The researcher solved problem (3) by reducing the number of questions sent within a short-term period and asking participants to number their answers.

The solutions to problem (1) and (4) are sought in research cycle two.

5.7 Data Analysis in Category SF|P in Research Cycle One

In this section, time and place will be discussed in the context of pedagogy.

In this study, “learning time” is measured by the learning time-frame index, and the amount of learning time.

First, learning time-frames are indexed with regard to student’s vocabulary study allotment within one day or one week. For example, a student might do revision on new words regularly from Tuesday to the following Monday, or he or she may review the word list one day before the word test. In this case, the learning time-frame index is seven and one respectively.

Second, the amount of learning time is the length of time students spent in every time-frame. For example, if a student revised her (his) English words from 8 pm to 10 pm on Monday evening, the amount of learning time will be two hours.

In research cycle one, participants’ weekly amount of learning time expanded as the index of the learning time-frame increased both for the students who engaged in responding to SMS questions actively, and quiet users who only read the researcher’s short messages. In week four, when students experienced mLearning for the first time, their study enthusiasm was stimulated by their curiosity. A high percentage of participants engaged in replying to the SMS questions immediately.

As students’ familiarity with mLearning increased, some participants adjusted their mLearning periods and situated them in fixed time-frames, which were complementary to their normal study. For example, when students were waiting for people in their cars, sitting on buses or at parties at friends’ houses, they could casually review vocabulary using their mobile phones.

On the other hand, reading SMS questions also reminded and encouraged students to revise for word tests using a stable learning instrument, such as paper, pen and a desktop computer, at school or at home. Therefore, more time-frames for vocabulary learning were organized by students themselves in their study schedules every week. In addition, learning with mobile devices also penetrated into students' regular study at home or school: some participants conducted revision using short messages when they were browsing AWLs in their textbooks.

5.8 Data Analysis in Category I|P in Research Cycle One

From the point of view of interface, mobile phones are quite different from traditional tools such as paper and pen. Even compared with laptops or desktop computers, the keyboards and screens of mobile devices are constrictive. These differences contributed to the design of pedagogical materials for mLearning.

First, the number of characters, including spaces and punctuation, is limited to 160 for one short message. Although the researcher could create a longer message, most students would receive it as several divided messages with no more than 160 characters each. For example, a message with 180 character would be received as one message containing 160 characters and one with 20 characters.

This situation reduced the coherence of sentences in SMS questions and had a negative effect on student's comprehension of sentences. Therefore, the number of questions had to be limited to one or two in one message. Subsequently, the total number of messages sent by the researcher increased.

The increased number of messages the researcher sent to every participant lead to another problem: the lack of consistency in on-air learning conversation. Sometimes the researcher was confused about which question a student's answer corresponded to. To solve this problem, a standardized question and answer format was required.

The layout of the phone keyboard and the relatively small size of the buttons led to the idea of simplifying the content of students' answers. However, if students only needed to input the label of the options, such as a. or b., English grammatical issues would be ignored by the respondent, which was inconsistent with the curriculum requirements for the students' English word study; while full sentences were not necessary, the correct word with the correct spelling and grammatical form were needed in the SMS reply.

As it turned out, nearly all students were satisfied with the size of the screen. The reason may be that the length of the mLearning messages was acceptable to students as they were not required to focus on the mobile screen for a long time. mLearning did not seem to cause tiredness and was not uncomfortable for participants' eyes.

5.9 Data Analysis in Category CF|P in Research Cycle One

The initially proposed mLearning activities included: the learners analyzing SMS questions, providing answers to the researcher and subsequent learning conversations via SMS between students and the researcher. However, as the research progressed, mLearning was re-defined by the users and learning activities were adjusted and expanded to a changed format. Participants' mLearning activities in research cycle one included:

- Some students only browsed the received SMS questions without sending back answers. Pedagogical short messages were used as dynamic alert schedulers and / or exam tips. The questions sent to students reminded them to do revisions on new words as the tests were coming. In addition, because of the curriculum organisation and content, and also because the type of questions in the word tests were unfamiliar to the students in the first weeks, SMS questions provided them with a chance to preview the instructions and format of questions in the tests, which contributed to them gaining more time to analyze incomplete sentences, answer the questions and check the filled words.

- By replying to the researcher's short messages, participants also engaged in analyzing SMS questions, recalling the meaning of the words and practicing the new words by using them in context.
- SMS questions in the game "winning chocolates" also played a role as formative assessment for evaluating students' word study every week. Participants could "warm up" and test themselves before the summative word tests in class were administered.
- SMS questions stored in participants' mobile phones were also adopted as study materials for their regular study at home. Students combined traditional methods with short messages. SMS provided more opportunities for them to interact with the researcher and gain assistance in learning outside school. Immediate and effective feedback from the researcher was able to enhance the quality of their study.

On the other hand, the number of SMS questions should be limited to an acceptable number for students. An overload of work requested by mLearning had a negative effect on participants' thinking. Too many questions in one day caused them to feel tired and annoyed, which led to a lack of study outcomes from mLearning.

Chapter 6: Revised Plan for Research Cycle Two

The outcomes from the analysis of research cycle one suggested modifications for the next research cycle. Changes in each layer of the research setting model (refer Figure 4) will first be presented. Data collection and analysis methods, and new research questions will also be introduced in this chapter.

6.1 Changes to the Technology Layer

In research cycle two, the researcher made modifications to the sending and receiving of SMS to make it more stable and flexible.

First, the researcher downloaded updated mobile phone software¹ from Nokia's official website and installed it on his Nokia N82 phone. The Nokia Company had debugged the software to guarantee successful SMS group sending.

Second, to make the process of inputting information more flexible, a wireless keyboard, the Apple Wireless keyboard, was purchased and paired with the Nokia N82 mobile phone.



Figure 21. Nokia N82 paired with Apple Wireless keyboard

In Figure 21, an A4 sheet of paper and a 50 cent coin are put under and beside the keyboard as reference objects to illustrate the size difference. The wireless keyboard could be connected to a Bluetooth enabled mobile phone. With the wireless keyboard, the researcher could operate the mobile phone and achieve all functions available on a normal mobile phone keyboard.

¹ The software is available on www.nokia.co.nz

Although the Nokia Company also produced the Nokia Wireless Keyboard SU-8W (please see Appendix IV), the Apple Wireless Keyboard was more suitable for mLearning. The reason being: the Nokia SU-8W has a two-piece fold-out design without a lock. The two parts of the keyboard are still moveable when it was open and in use. This limits the use of the Nokia SU-8W to flat surfaces only.

The Apple Wireless Keyboard was small enough to be put into the researcher's bag, and so he could take the wireless keyboard along with him and utilize it to perform on-air communication with participants.

6.2 Changes to the Educational Theory Layer

Due to an abundance of information collected in research cycle one, the research design could then move from curriculum-centered design to student-centered design (Brandes & Ginnis, 1996). Thereby, constructivism would replace behaviourism as the underlying educational theory in research cycle two. The modified mLearning design is illustrated in Figure 22.

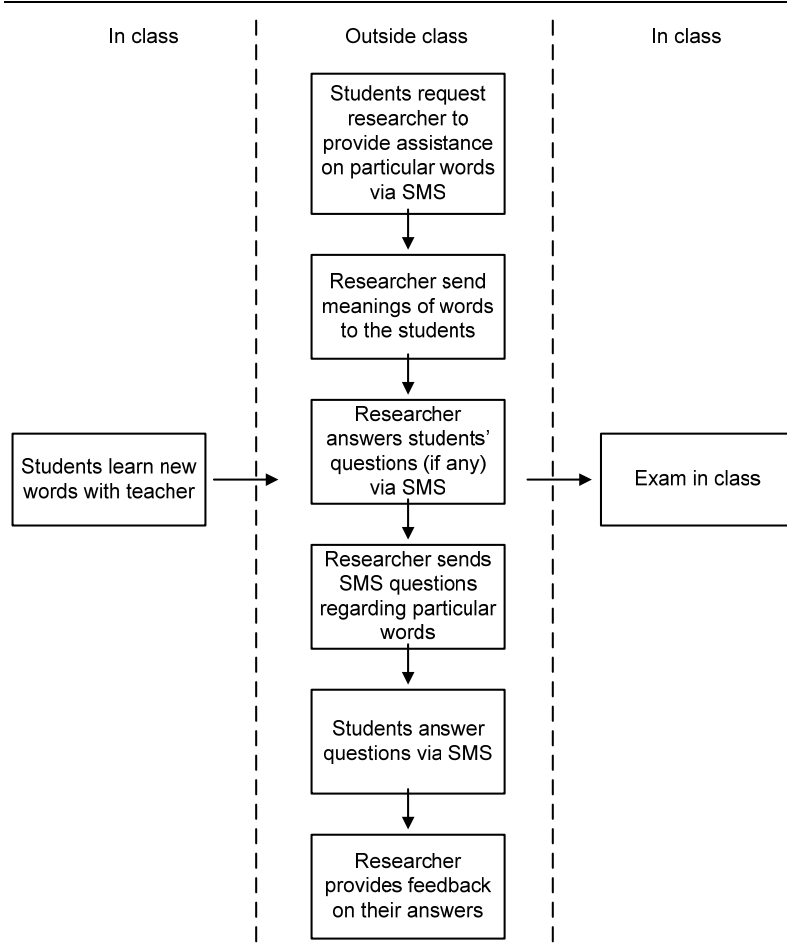


Figure 22. mLearning process in research cycle two

As shown above, study outside the classroom would be initiated by learners, rather than the researcher. All subsequent learning activities are related to students' concerns with particular words. Meanings of the words would be sent to assist students' understanding. No reply to the SMS was requested from students when they were reading the meanings. SMS questions would then be conveyed to evaluate students' understanding of the specified words. After students' replied with the answers, feedback would be provided by the researcher via SMS.

Applying a constructivist approach to the learning process in cycle two gave students the opportunity to raise their own learning issues and gain effective help words of concern to them. The benefits employing constructivism in mLearning will be discussed in chapter eight.

6.3 Changes to the Pedagogy Layer

The pedagogical design for mLearning was changed to meet student's requirements as highlighted in research cycle one, and to be parallel with the modified learning process as shown in Figure 22. The changes included:

6.3.1 Explanation of Words

Explanation of words: as illustrated in Figure 22, the researcher would be required to provide explanations of specified words. An English to English dictionary, (Collins COBUILD Dictionary¹), was used as a teaching resource. The dictionary was recommended by EAS lecturers and available in the EAS class for students to check words.

The researcher would edit the meaning of the word in the SMS and send it to students. The interface of the SMS is shown in Figure 23.

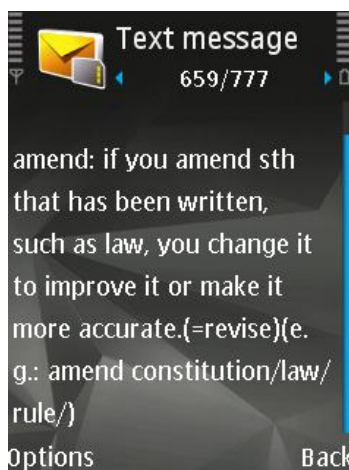


Figure 23. The meaning of a word in SMS

As can be seen in Figure 23, as the number of characters in one message was limited, so abbreviations needed to be used.

¹ Information about this dictionary is available on the official website: <http://www.collinslanguage.com>

6.3.2 Standardization of the Display Format

To enhance the consistency of the SMS learning conversation, the format of the SMS questions and answers was standardized in research cycle two. (Figure 24.)



Figure 24. Standardized format of SMS for research cycle two

As shown in the left hand picture, only one question would be included in each message. The question was numbered. To encourage students to input a word rather than a number, the possible words in the brackets following the questions were not numbered. The answers were required to be labeled with the corresponding question number (right hand picture). Students were allowed to send answers to more than one question in each message.

6.3.3 New Resources for SMS Questions

To enrich the resources, new academic materials related to AWL were searched for online. Martin McMorrow (Massey University New Zealand) published gap-fill exercises for AWL learning online¹. These materials were included in the learning resources for creating SMS questions.

¹ Online materials are available on <http://www.academicenglishgenerator.com/>

6.4 Data Collection Techniques in Research Cycle Two

In research cycle two, a questionnaire was used in place of interviews. Compared to research cycle one, more summative assessments of students' other courses, such as listening and writing, would occur after the mid-semester break. The researcher assumed that most students would be busy with their revision for these exams. Therefore, a time –consuming method (interview) would be not suitable, and a questionnaire was employed. The rest of the data collection methods are similar to the ones used in the previous research cycle. The techniques used are shown in Table 27.

Table 27. Data collection techniques used in research cycle two

Usefulness factors Usefulness reasons	Surrounding factor (when/where)	Interface (mobile phone)	Cognitive framework (internal thinking flow)
Pedagogy	<ul style="list-style-type: none"> - Reflective journal; - Questionnaire; - Observation; - SMS transmission history; - Informal conversation; - Portfolio; 	<ul style="list-style-type: none"> - Reflective journal; - Questionnaire; - SMS transmission history; - Informal conversation; 	<ul style="list-style-type: none"> - Reflective journal; - Questionnaire; - Observation; - Students' word test records; - SMS transmission history; - Informal conversation; - Professional presentation (Field Seminar);
Educational Theory	<ul style="list-style-type: none"> - Reflective journal; - Questionnaire; - Observation; - Students' word test records; - SMS transmission history; - Informal conversation; - Portfolio; 		
Technology	<ul style="list-style-type: none"> - Reflective journal; - Questionnaire; - Observation; - SMS transmission history; - Informal conversation; - Portfolio; - Professional presentation (Field seminar); 	<ul style="list-style-type: none"> - Reflective journal; - Questionnaire; - SMS transmission history; - Informal conversation; - Professional presentation (Field seminar); 	<ul style="list-style-type: none"> - Reflective journal; - Questionnaire; - SMS transmission history; - Informal conversation; - Portfolio;

Eight data collection techniques were employed in research cycle two. It should be noted that the professional presentation in this cycle is different from the one in the previous cycle. The researcher was to attend an academic seminar in the mLearning field during the early weeks of research cycle two. Two experts, Nathan Kerr and Robert Douglas, were to provide a presentation and discuss emerging issues in mLearning with their audience. The researcher would discover valuable viewpoints in the seminar, which would contribute to the research.

6.5 Data Analysis Methods in Research Cycle Two

The data analysis framework (Table 5) was to be employed again in research cycle two. In addition, the user classification model (Figure 16) was to be used to identify changes (or a lack of changes) among mLearning users. The reasons for any changes would also be sought.

6.6 Research Questions in Research Cycle Two

The two initial research questions would continue to guide research activities in cycle two. The sub-questions were updated after analysis of the data in cycle one. The sub-questions from cycle one (Table 6) and the new sub-questions in cycle two (highlighted in Table 28) are shown below.

Table 28. Research questions in research cycle two

Usefulness factors Usefulness reasons	Surrounding factors (when/where)	Interface (mobile phone)	Cognitive framework (internal thinking flow)
Pedagogy	Cycle 1: - When will students (like to) conduct mLearning? - Where will students (like to) conduct mLearning?	Cycle 1:- Can the format and layout of pedagogical materials be displayed on a mobile phone screen properly? - Can the proposed learning activities (such as replying with answers to the researcher) be performed with mobile devices?	Cycle 1:- Can the delivered pedagogical materials help students remember new vocabulary and their definitions? - Do students think mLearning is useful after they finish the word test every week?

	Cycle 2: - Will the place and time where and when students conduct mLearning be expanded?	Cycle 2: - Will the layout of the word meanings in SMS be understandable and useful for students? - Will the standardized SMS format facilitate on-air communication between the researcher and students?	Cycle 2: - Will the meanings of words and the related SMS questions sent by the researcher be effective in helping students memorize and comprehend new vocabulary?
Educational Theory	Cycle 1: -Is behaviorism an appropriate educational theory to use outside the classroom?		
	Cycle 2: - Is the alternative educational theory, constructivism, more appropriate for mLearning? - Will the modified mLearning process (shown in Figure 22 underpin more effective word study for students?		
Technology	Cycle 1: - When do students prefer to read / send short messages? - Where do students prefer to read / send short messages?	Cycle 1: -Are the contents displayed on the mobile phone screen easy to read? (Issues such as the size of characters and the space between two lines). - Is the keyboard (or touch screen) of the mobile phone easy to use for inputting information? (issues such as the space between two keys and the feeling of pressing the keys)?	Cycle 1: - Do students think the English word input method installed in the mobile phone is easy to use? - Do students think the operating process for receiving / sending SMS is simple or complex? (such as pressing a particular key to open one message and read it)
	Cycle 2: - Are there any changes to the place and time, where and when participants use SMS?	Cycle 2: - Are there any improvements in SMS users' technological skills?	Cycle 2: - Will the modified mLearning process (shown in Figure 22) simplify or complicate the mobile device operation flow for students?

The new research questions aimed to discover any changes in participant behaviour as compared with the baseline data gained in the previous research cycle.

In addition, possible changes in participants' positions in the user classification model (refer Figure 16) also raised four new research sub questions:

- If participants benefit from the adoption of the mLearning method, what are the benefits and who are the participants who benefit?
- Will the modified research settings encourage more participants to engage in the learning activities?
- What are the factors determining the adoption of mLearning by students?
- What are the factors facilitating the change of student behavior in mLearning?

These four questions make it possible to “zoom in” on the two research questions (Figure 2) at a participant level. Responses to these four questions would provide answers to the two initial research questions. The possible *benefits* stated initially were *enhancements* and *improvements*. Students' *engagement* in the proposed mLearning activities was used to measure the *success* of integrating mobile technology into learning activity. Therefore, the *factors* underlying learners' engagement in mLearning would contribute to the *success* of the integration of mobile technology into learning activities.

Chapter 7: Findings in Research Cycle Two

After modifying the research plan, the second research cycle commenced from the second week of the mid-semester break (Figure 3). The action phase would last five weeks followed by one reflection week.

One participant, Slh, quit the research when they withdrew from the course. One new student, Rb, volunteered to join the project. Therefore, the total number of participants stayed at 20.

In this section, the research findings from cycle two will be presented based on the data collection technique used.

7.1 Informal Conversation

Students' familiarity with the researcher increased, and the researcher was invited to their self-study space in the library during the break weeks. More informal conversations occurred, and some of the issues facing students were revealed.

SMS questions sending paused in week seven and the first mid-semester break week. Students expressed their requirements of mLearning and concerns about not receiving short messages from the researcher.

Shn: Hi Chad, are you OK these days? Why didn't I receive anything from you?

Researcher: Thank you Shn, I am fine. Because I am trying to modify our mLearning method, no SMS questions these days. It will re-started soon.

Ada: OK, I was waiting for your messages as well. Hope you can send them soon.

Vvn: Hi Chad, sorry I did not reply to you much. But I still like it (SMS questions). Please keep sending me them I will try to reply to you.

Researcher: Sure, Vvn. Actually no participants have received my messages these days as I am revising them. New questions are coming soon...

The new participant, Rb, desired a learning assistant as the student had trouble with vocabulary study.

Rb: Hello, can I still join you now? I just got my mobile phone. But I don't have email.

Researcher: Don't worry. Just leave you mobile phone number with me, I will start to send you my questions.

The student also indicated that the mLearning method was helpful and useful.

Rb: Hi, Chad, thank you very much for what you have done. Can I keep contacting you after this course?

Researcher: Sure, Rb, I am very happy to help you.

7.2 Observation

The observations occurred in the EAS classroom. Student did not ask for general information, such as when are the word tests, because at this point they were familiar with course organisation and the style of the tests.

Most students raised questions about understanding specific words and distinguishing between two words. For example:

Dy: What is the difference between "amend" and "alter"?

Lecturer: you amend something written ... For example: amend law ...

In the latter weeks of research cycle two, students' learning was more flexible. Some students spent more time on revision for other coming exams, such as listening tests. The number of students attending the word class dropped.

7.3 Professional Presentation (Field Seminar)

In the early weeks of the second research cycle, the researcher was invited by his primary supervisor (Petrova) to an academic seminar in the field of mLearning. Two experts, Nathan Kerr¹ and Robert Douglas², presented their mLearning project using cell phones.

Two issues raised by the presenters stimulated the researcher to consider the factors underlying the usage of mLearning.

First, ownership played an essential role in popularizing mLearning among students (Olney & Lefoe, 2007).

Nathan Kerr and Robert Douglas pointed out that the low percentage of ownership of some mobile technologies, such as PDAs, limited the deployment of mLearning based on them. The presenters also indicated that users' backgrounds also contributed to the preference for mLearning.

*Kerr: "The greatest interest in using mobile phones for improving skills, and learning was expressed by **girls**, 16-19 year olds..."*

This result showed that females may be more willing to implement mLearning methods than males.

7.4 Reflective Journal

The modifications of the mobile phone software and the input method were very effective. The two problems shown in Figure 10 were solved. First, all short messages could be sent to a group successfully. Second, the wireless keyboard enabled the researcher to type words and sentences as comfortably as on a full-size keyboard

¹ Nathan Kerr: 2008 Microsoft Innovative Teacher Scholar (email: nathankerr007@gmail.com)

² Robert Douglas: Director of ICT at Howick College (email: r.douglas@orcon.net.nz)

(Figure 21). However, the revised mLearning process increased the researcher's workload. As the requirements for learning assistance varied among students, the researcher had to spend more time on searching related information about the AWL and editing learning materials. Sometimes, the researcher's responses to students' inquiries for word learning help were delayed.

7.5 Portfolio

Three photographs were collected to illustrate mLearning issues in research cycle two. First, the flexibility of the wireless keyboard adopted by the researcher is illustrated in Figure 25. The Apple Wireless Keyboard enhanced the researcher's mobile phone by facilitating the process of inputting the messages. Because the input method was simplified, the researcher could focus on thinking about the information needing to be conveyed to the students without interference.

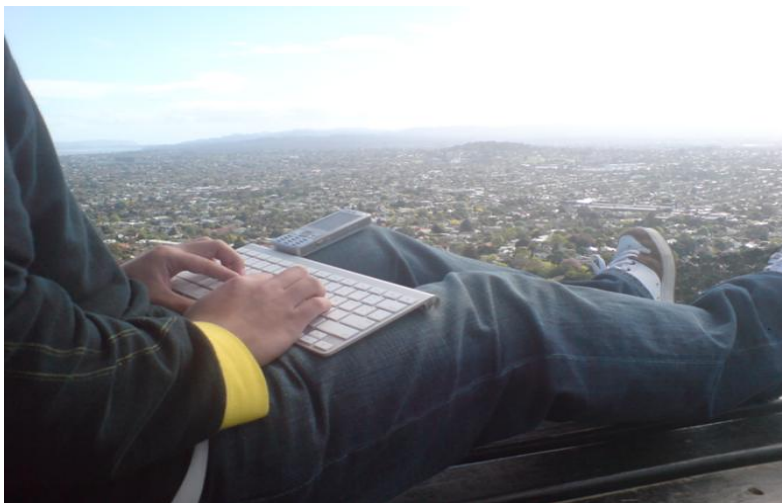


Figure 25. Inputting words with the wireless keyboard outside

Second, the available range of locations at which the researcher could send and receive SMS was expanded to nearly anywhere due to the adoption of the wireless keyboard in research cycle two. The flexibility of mobile teaching, enhanced in research cycle two, ensured the students' mLearning process was smooth.

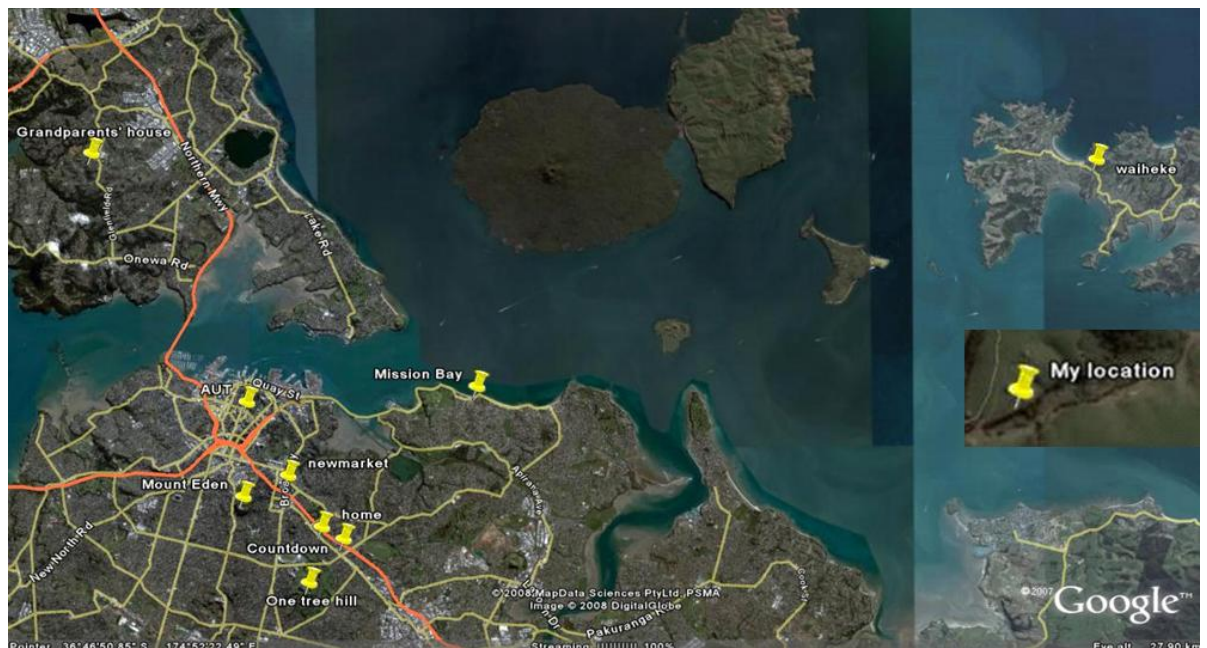


Figure 26. The researcher's locations during research cycle two

The locations where the researcher conducted mobile teaching are marked on a map produced by Google® Earth shown in Figure 26. The points marked with yellow labels illustrate the locations where the researcher was situated when he conducted mobile teaching. In research cycle one the places were limited to the researcher's home and school.

Third, a news report in The Guardian newspaper in the United Kingdom suggested a solution to the risk of operating mobile phone shown in Figure 15. The software, named Textecution¹, embedded in a mobile phone would disable SMS capability when the user's moving speed was more than ten miles per hour (Smith & Davies, 2009). It prevented SMS users from sending short messages when they were driving.

7.6 Questionnaire

A questionnaire was used place of an interview in research cycle two. Hard copies of the questionnaire were distributed to all 20 participants in week 11. Eighteen questionnaires in total were completed and returned.

¹ The information about the software is available on <http://www.textecution.com/>

Two goals guided the design of the questionnaire: First, to find out about changes in students' mLearning activities compared with research cycle one; second, to discover the reasons for the changes (or for a lack of change).

The questions in the questionnaire were grouped into twelve categories, as informed by the research results from research cycle one and by the already gained research findings in research cycle two. Below is a summary of the responses in each category.

Table 29. Summary of the responses in questionnaires

Category	Summary of the responses
A: About you.	The background information of participants included their first language, age, gender. There were eight males and twelve females. Four students were over 30 year old while all the others were under 30. English was their second language.
B: General mobile phone experience (Participants' mobile phone use).	Compared to research cycle one, most students did not change their mobile phone habits. Only one student, Shn, enhanced her mobile technological skills after experienced mLearning.
C: EAS academic vocabulary test.	Compared with research cycle one, all students felt that they were more competent at the word tests every Tuesday. 80% of the participants attributed the change to reading the everyday SMS questions.
D: Motivation and stimulation.	Nearly all participants denied that chocolates or other rewards were the motivation for engaging in mLearning. All volunteers joined the research because of their curiosity and interest. The participants kept using mobile learning, stating that it was useful to them. In addition, five people increased their interaction with the researcher via SMS after the research settings were modified in research cycle two.
E: The organization of the mLearning programme.	All participants stated that the amended mLearning process was better in the second cycle. The new mLearning design satisfied and benefited them.
F: The workload of the mLearning programme.	In contrast to cycle one, learners themselves are able to control the workload. Work overload did not occur in research cycle two.
G: The use of mobile phones for learning purposes.	Students' mLearning activities were more pronounced in cycle two. They could read or send messages with ease, rather than only receiving questions passively.

H: Learning activity enhancement and learning outcome improvement.	Most participants stated that their learning activities were enhanced because learning with a mobile phone was flexible.
I: Communication with the researcher.	Some students complained that the researcher's response time was too long in research cycle two.
J: Internet usage for learning purpose.	For the participants, there was no difference between using Email in research cycle one and not using Email in research cycle two.
K: Usage of mobile devices for learning purposes in the future.	50% of participants would like to try new mobile technologies, such as PDAs or MP3 in the future. Most students, who had no interest in other mobile technologies, did not own such devices.
L: Overall experience.	Most students expressed satisfaction with mLearning and thought it was useful. The only complaint was the very large number of SMS questions sent at the end of research cycle one. Fortunately, this situation did not reoccur in research cycle two.

7.7 SMS Transmission History in Research Cycle Two

The researcher stored a copy of the backup of the SMS transmission history. The number of SMS sent by participants is illustrated in Figure 27.

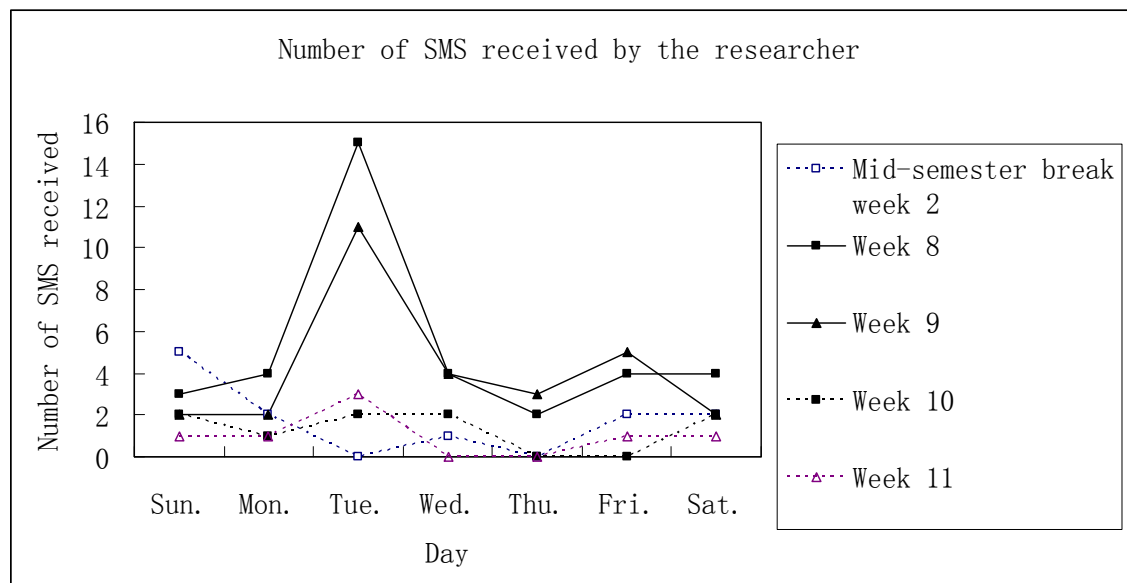


Figure 27. Number of SMS received by the researcher in research cycle two

As shown, students rarely sent short messages to the researcher during the mid-semester break. The peak of message sending appeared to be Tuesday, which was different from the peaks in research cycle one (weekends). From week ten onwards, the number of SMS sent by students reduced substantially.

Due to the increased workload for the researcher, the response time was longer than in research cycle one. A typical message illustrating this situation is shown in Figure 28.

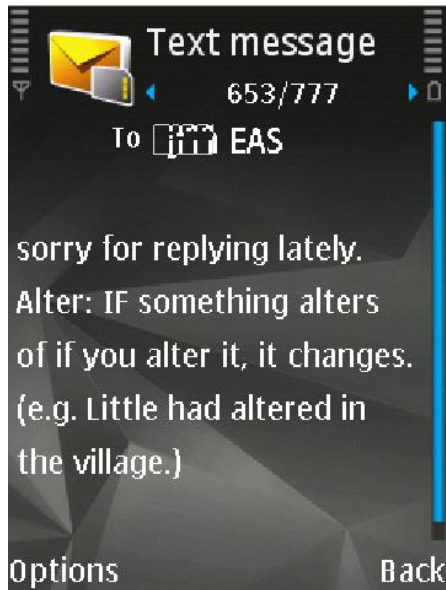


Figure 28. A delayed response from the researcher

7.8 Student's Word Test Record

The students' word tests results were collected and the average grade in each week was calculated.

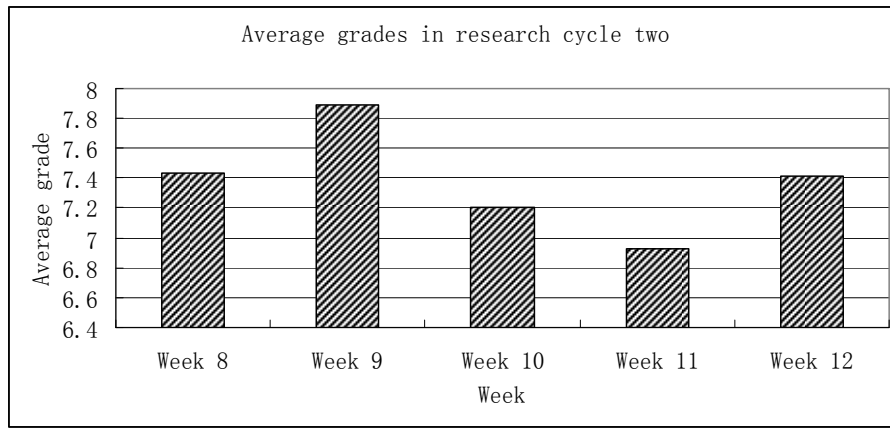


Figure 29. Average grades of students' word tests in research cycle two

As shown, students' word test results in week eight and week nine were better than the ones in the following two weeks, which is consistent with the participants' engagement shown in Figure 27. In week 12, four participants were absent from the word test, which may have contributed to the reversal of the trend.

Chapter 8: Data Analysis in Research Cycle Two

In this chapter, the research findings will be analysed against the data analysis framework (Table 5). A user classification model will be used to visualize the changes observed.

8.1 Category SF|T

For the students, the place and time, (where and when they preferred to use SMS) did not change. However, as the researcher adopted a peripheral device to enhance the use of the mobile phone, more locations became suitable for his work. This made mLearning a flexible process. This advantage facilitated dealing with students' varying learning requirements.

8.2 Category I|T

There was no change in students' mobile phone interface. For the researcher, the wireless keyboard enabled the word typing experience to be more comfortable. The wireless keyboard was light and small enough to be carried in the researcher's bag.

8.3 Category CF|T

In cycle two students were not required to input any words after they had read the meaning of specific words. This simplified method allowed the students to focus on understanding the meaning of the words and memorizing them. For the researcher, the comfortable word typing experience contributed to efficient teaching practice and enabled him to fully focus on expressing his thinking or opinions, rather than being impeded by tedious word input using the mobile phone keyboard. The improvement reduced the time spent sending SMS to students, and improved the flow of the learning conversation via SMS.

8.4 Category SF|ET

The modified mLearning process based on the constructivistic approach solves the problems illustrated by sections (1) and (4) in Figure 19. The process of mLearning in research cycle two is illustrated in Figure 30.

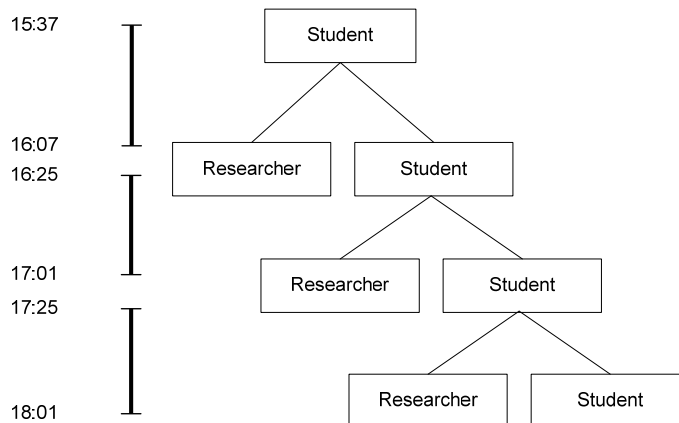


Figure 30. mLearning process in research cycle two (the times are examples)

As shown, the conversations are initiated by the students. The assistance from the researcher is based on learner's requirements. Thus, students were encouraged to identify their own needs in regard to learning and the revision via SMS was synchronised with their own study schedules. The learning time was also chosen by participants themselves. This greatly enhanced the coherence of the conversations.

8.5 Category SF|P

For the students, reading the meaning of the words on a mobile phone screen required less concentration than sending messages. Therefore, the place and the time (where and when) students engaged in mLearning were extended.

8.6 Category I|P

The standardized format of messages simplified reading SMS questions and sending answers. However, the limited number of characters in one message complicated the process as editing of the explanations of the words was required. In addition, students sometimes had to check the textbook to verify the spelling of the words they would send to the researcher. This would require AWLs stored in their mobile phones to overcome the inconvenience of carrying a paper copy.

8.7 Category CF|P

Students' learning with mobile phones was more active compared with research cycle one. All learning materials and assistance received from the researcher were relevant to their study requirements. The relevance of learning materials promoted students' engagement in mLearning. Solving students' learning issues contributed to a more effective and useful learning experience using mobile devices.

8.8 Changes in Participants' Positions in the User Classification Model

Participants' positions in the user classification model changed in research cycle two. (Figure 31)

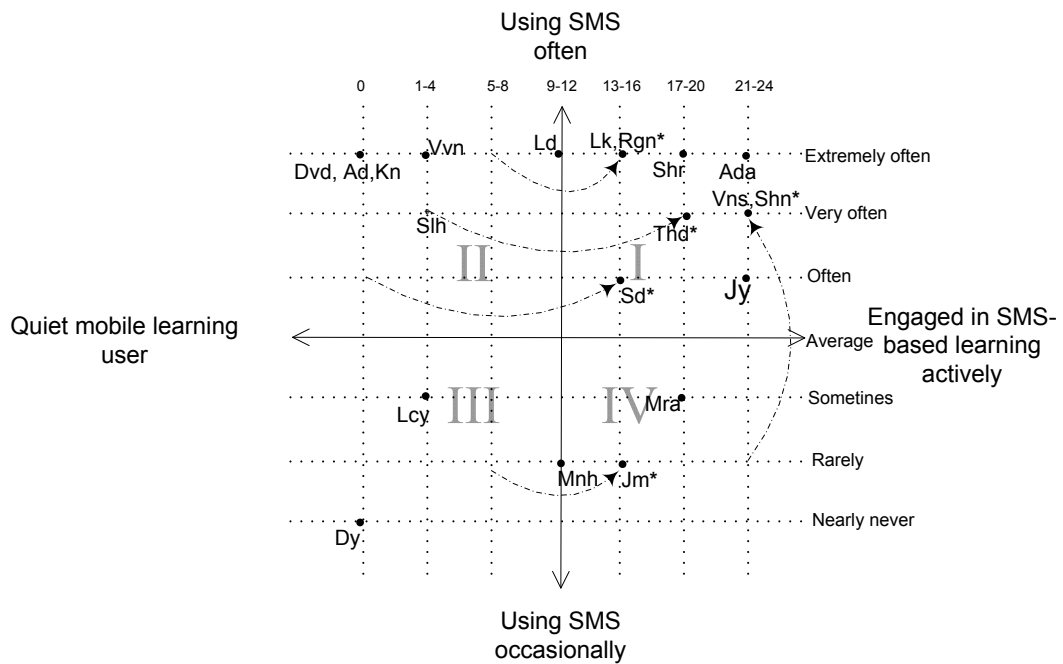


Figure 31. The changes in participants' positions in the user classification model

Five participants “moved” in cycle two (marked with asterisks in Figure 31). Three students using SMS “often” (Rgn, Thd and Sd) changed from “quiet” to “engaged” mobile learners. One participant (Shn) improved her technological skills as she continued to be “engaged” mobile learner. One “quiet” mobile learner (not a frequent SMS user) became more “engaged”.

In summary, all active mobile learners continued to be engaged in cycle two, with four formerly “quiet” mobile learners becoming more active in cycle two. This finding indicates a change in the learning style of a significant part of the sample. Only one student changed in terms of improved technical skills as a result of engaging in SMS learning.

The changes of participants' positions in Figure 31 raised four research sub questions (also listed in chapter 6). The questions and their answers are stated below:

- If participants *benefit* from the adoption of the mLearning method, what are the benefits and who are the participants who benefit?

The benefit participants gained from mLearning was the enhancement of their learning activities to meet their learning outcomes. Students' learning activities were more flexible compared with the traditional method.

The improvement in terms of meeting the learning outcomes was evidenced by the parallel trends of increasing word test grades and the relatively high percentage of participants engaged in mLearning in the corresponding periods.

Participants who benefited most are the ones actively engaged (on the right side of the vertical line in Figure 31.).

- Will the modified research settings encourage more participants to *engage* in the learning activities?

Yes, four participants moved from left to right in the model. The revised research settings with a student-centered design attracted more quiet participants to “speak”.

- What are the *factors* determining the adoption of mLearning by students?

As shown in Figure 31. The students with good SMS skills were more likely to adopt mLearning, indicating that technological skills are a major factor.

Another factor is device ownership. The importance of ownership of the mobile devices was highlighted in the responses to the questionnaire. People who did not own a particular device did not wish to implement mLearning based on the technology.

The four participants (Ada, Vns, Shn and Jy) most actively engaged in mLearning in cycle two were female, with more females than males engaged across the sample (more females positioned on the right of vertical line). This indicates that female students are more likely to adopt mLearning.

Finally, it may be assumed that the relevance of the pedagogical design for the participant also underpinned their position in the model. However, the study did not collect enough data about learners' individual styles. Petrova (2006, 2007c) suggests that students value the relevance of mLearning to the assessments they undertake in their studies (i.e. tests or exams).

- What are the *factors* facilitating the change of student behaviour in mLearning?

It may be summarized that the changed educational theory underpinning the modified mLearning process caused the change in behaviour as the resultant changes in the pedagogical materials met students' requirements at an individual level. Students personalized their mLearning from the very beginning of the learning conversation. This improvement also facilitated the "movements" across the quadrants in Figure 31.

Chapter 9: Discussion and Concluding Results

In this chapter, the two initial research questions will be addressed. An evaluation of the validity of the research will be provided, and a modified mLearning model will also be presented. The limitations of the study are outlined, and a brief conclusion summarizes the main results.

9.1 Answers to the Research Questions

The study aimed to investigate two research questions.

Question one: to what extent does mobile technology enhance learning activities and improve student learning?

Learning activities were able to be enhanced in three ways: first, student learning is flexible in terms of time and/or place as demonstrated. A mobile phone provided more pathways for learners to receive remote learning assistance anywhere, anytime. Mobile devices played an important role in students' regular study at home.

Second, adopting the mLearning method stimulated students' enthusiasm for learning. Students engaged more actively in memorizing and comprehending new vocabulary. The use of words in context was also practised.

Finally, the feedback from participants suggests that mLearning had contributed to an improvement in their test results; it was observed that the improvement in test grades was parallel with active engagement in mLearning activities.

In summary, student learning was enhanced by adding flexibility (Song, 2008), and providing a stronger motivation for learning. The results suggest that mLearning did contribute to improving learning.

Question two: what are the underlying success factors or obstacles to integrating mobile technology into learning activities?

The results showed that students' ownership of mobile technology, their skill level, experience, habitual use of mobile devices and their preferences in regard to mobile technology played an important role in the success of the implementation of this particular mobile technology (SMS).

Educational theory played a significant role in students' acceptance of mLearning. Student-centred mLearning design, based on constructivism, supported a personalized learning style and met students' learning requirements outside class.

The pedagogical design was hindered by a lack of relevant and proper resources for mLearning. The medium of communication between the teacher and students is different from traditional learning, therefore, the features specific to mLearning should be considered in pedagogical design, rather than simply reproducing existing material in books or online.

In summary, the more technologically experienced the students were, the more enthusiastic they became about mLearning. Student-centred design played a critical role in the success of the second cycle. However, this required significant effort on the part of the lecturer/researcher as there was no "ready made" material available.

9.2 Validity of the Research

Triangulation (Ferguson-Patrick, 2008) was used to evaluate the validity of the study. To triangulate, data collected from one or more sources were first analysed and the analysis results were crosschecked through the analysis based on the relevant sources. (Figure 32)

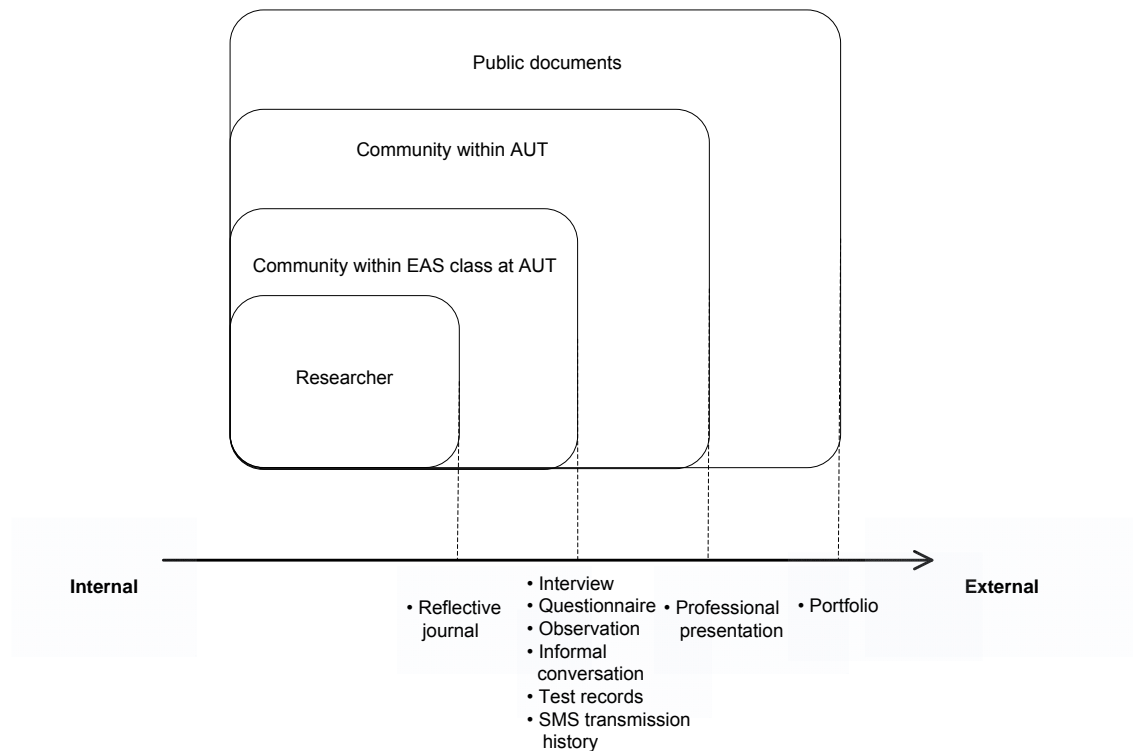


Figure 32. Internal and external data collection methods used in the two research cycles

Different sets of data were compared and tested. For example, the high concentration requirement when sending SMS found in the reflective journal was verified in the interviews and the portfolio. In addition, the figure also illustrates that issues in the study were examined from both an internal, as well as an external perspective: The study was conducted by the researcher in the EAS class at AUT. Correspondingly, evidence ranges from the most internal (researcher's reflection) to the most external (portfolio gathered outside AUT). This helped the researcher gain an in-depth understanding of the study (Harnett, 2007).

9.3 Further Research

The outcomes of the data analysis of research cycle two can be used to inform a modified mLearning model (Figure 33), which may be tested further.

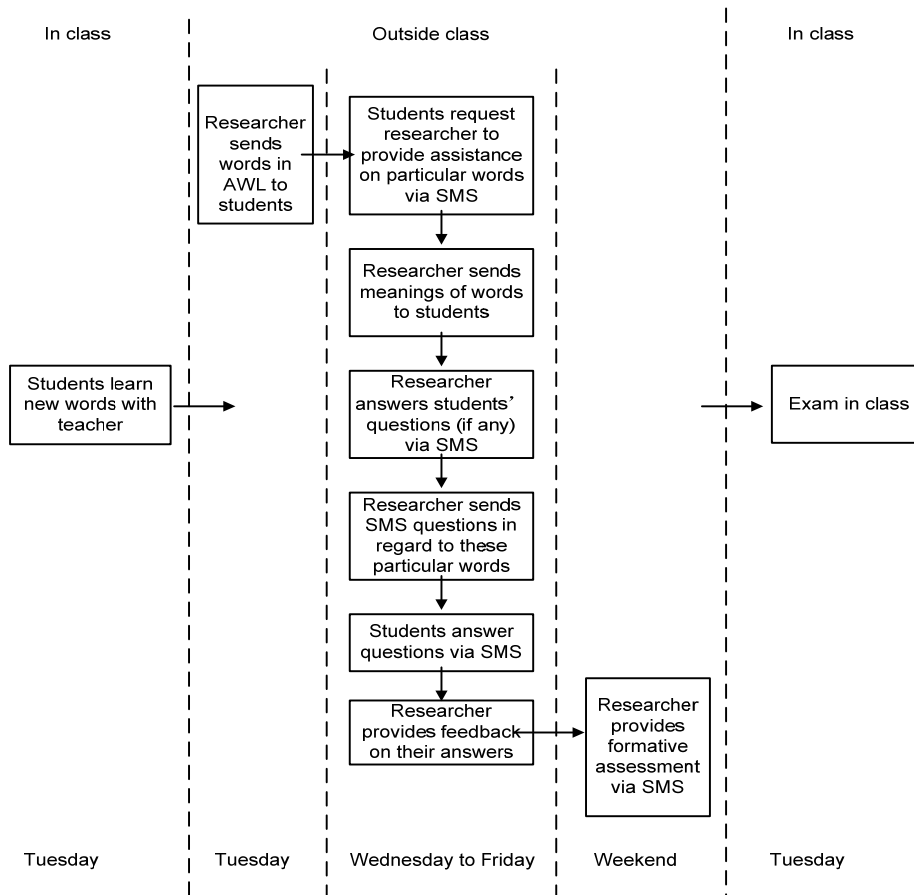


Figure 33. Modified mLearning model for further analysis

As shown, students' vocabulary study is set out in three steps outside the classroom from Tuesday to the weekend. In each step, the researcher / lecturer provides suitable challenges to the learners: on Tuesday, students will read the word list in an SMS and find out which words are new to them. From Wednesday to Friday, they are required to learn the new words and practice them. In the weekend, students' word study is pre-tested in a formative assessment. Students' word learning is scaffolded (Lin, Chen, C. & Chen, W. 2008) by these three steps. The model can be adopted and assessed in new cycles for further analysis.

9.4 Limitations of the Study

First, the study is interdisciplinary: it covers computer and information sciences, English language and education. However, the researcher's academic background in

English language and education is limited. Therefore, the research results need to be considered further by experts in these two fields.

Second, culturally speaking, the sample of ESL students was limited. In addition, cultural background in itself was not considered. Finally, the comparison of results obtained from samples of students with different language and cultural background may provide interesting insights for the design and implementation of mLearning activities.

9.5 Conclusion

The findings of the two research cycles demonstrate that an SMS-based vocabulary learning method was able to enhance ESL students' learning by adding flexibility and providing a stronger motivation for study. The results suggest that mLearning contributed to improved learning.

Experience with mobile technology promoted students' enthusiasm for mLearning. Student-centred design played an important role in the success of the second research cycle. However, the lack of relevant and proper resources for mLearning highlighted a need for new and modified pedagogical materials.

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Appendixes:

Appendix I: A sample of AWL used in EAS class

E.A.S.		AWL
		Academic Word List # 7b
Headword	One Meaning	Sentence (using the most frequent form of the word)
identical	exactly the same	When two siblings share the same DNA, they are identical twins.
ideology	set of beliefs	Teenagers often abandon their parents' ideology in favour of more radical ways of thinking.
infer	base on information given	I inferred from what she said that you have been unwell.
innovate	new thing/method	It is difficult to keep up with every innovation in the computer field.
insert	put something inside	Students need to learn how to correctly insert references into their essays.
intervene	try to stop a problem	The lecturer felt there was some kind of intervention required to stop the destructive behaviour.
isolate	separate from others	Patients with easily transmitted diseases can be isolated from other patients.
media	TV, radio, newspapers	Media coverage of the Olympics is always of a high standard.
mode	manner /way of doing something	A very popular mode of communication to overseas family and friends is email.
paradigm	model to explain/ show	The brain is a paradigm for how a computer works.

Appendix II: Layout of Nokia N82 Mobile Phone



Appendix III: The layout of EAS classroom



Appendix IV: Nokia Wireless Keyboard SU-8W



(Adapted from <http://www.flickr.com/>)

Appendix V: Questionnaire

SMS¹-based Vocabulary Learning for ESL² Students

Student Experience Survey 2008

semester 2



This questionnaire has been prepared by the researcher, Chun Li, who is a master student of Computer and Information Science at AUT. It helps gather feedback on your experience as a user of SMS-based vocabulary learning technology. The information you provide on this form is confidential to the researcher. You will not be individually identified and your responses will be used only of statistical purposes and for improving mobile learning technology.

For each question, please tick ☒ the most appropriate box unless otherwise specified.

Section A: About You

1. What is your name used in EAS³ class? _____

2. Where do you come from? (Sorted by English alphabet sequence)

- ☐ Afghanistan ☐ Algeria ☐ Argentina ☐ Brazil ☐ China ☐ Hong Kong
☐ Japan ☐ Iran ☐ Korea ☐ Malaysia ☐ Russia ☐ Taiwan ☐ Thailand
☐ Tunisia ☐ Vietnam ☐ Other country: _____

3. What is your first language (s)? (☒ Tick as many as apply)

- ☐ Afghan ☐ Algerian ☐ Arabic ☐ Chinese ☐ English ☐ Farsi ☐ French
☐ Japanese ☐ Korean ☐ Malay ☐ Spanish ☐ Russian ☐ Thai ☐ Vietnamese
☐ Other language (s): _____

4. How long have you studied English?

- ☐ More than 20 years ☐ More than 15 years ☐ More than 10 years ☐ More than 5 years
☐ 5 Years ☐ 4 years ☐ 3 years ☐ 2 years ☐ 1 year ☐ half a year ☐ Shorter

5. How long have you been New Zealand?

- ☐ More than 20 years ☐ More than 15 years ☐ More than 10 years ☐ More than 5 years
☐ 5 Years ☐ 4 years ☐ 3 years ☐ 2 years ☐ 1 year ☐ half a year ☐ Shorter

6. Which age group do you belong to?

- ☐ A. 60+ ☐ B. 50+ ☐ C. 40+ ☐ D. 35+ ☐ E. 30+ ☐ F. 25+ ☐ G. 20+
☐ H. 15+ ☐ I. 10+ ☐ If you do not want to answer THIS question here, you can send your answer to me by SMS later.

7. What is your gender? ☐ Female ☐ Male

Section B: General Mobile Phone Experience (Your habit of mobile phone use)

1. What is your mobile phone model? _____

¹ SMS: Short Message Service

² ESL: English as a Second Language

³ EAS: English for Academic Study

(If you are not sure, you can only write down the name of company, such as Nokia or Motorola)

2. How do you come to school and go back home? (☑ Tick as many as apply)

- ☐ Someone drives me ☐ Drive car ☐ Bus ☐ Walk ☐ Bicycle ☐ Skateboard
☐ Other ways: _____

3. How long have you used mobile phone?

- ☐ More than 20 years ☐ More than 15 years ☐ More than 10 years ☐ More than 5 years
☐ 5 Years ☐ 4 years ☐ 3 years ☐ 2 years ☐ 1 year ☐ half a year ☐ Shorter

4. How long have you used mobile phone in New Zealand?

- ☐ More than 20 years ☐ More than 15 years ☐ More than 10 years ☐ More than 5 years
☐ 5 Years ☐ 4 years ☐ 3 years ☐ 2 years ☐ 1 year ☐ half a year ☐ Shorter

5. How long have you used SMS?

- ☐ More than 20 years ☐ More than 15 years ☐ More than 10 years ☐ More than 5 years
☐ 5 Years ☐ 4 years ☐ 3 years ☐ 2 years ☐ 1 year ☐ half a year ☐ Shorter ☐ Never

6. Which telecommunication company do you use?

- ☐ Vodafone ☐ Telecom ☐ Other company: _____

7. Do you use TXT2000?

- ☐ No, and I do not know what is TXT2000.
☐ No, but I send many short messages. (More than 3 messages per day)
☐ No, I know TXT2000 but I do not need to send many messages. (Less than 2 messages 1 day)
☐ Yes, as I need to send many short messages per month.
☐ Yes, but I only send few messages (less than 50 messages per month)

8. Why do you like to use short message? (☑ Tick as many as apply)

- ☐ Cheap ☐ Fast ☐ other reasons: _____
☐ I do not like SMS → go to next question please

9. Why do you NOT like to use short messages? (Please ignore this question if you like SMS)

(☑ Tick as many as apply)

- ☐ Health issues ☐ no need, I can use other ways, such as phone call.
☐ Too costly ☐ it is hard to use

10. Where do you like to read messages? (☑ Tick as many as apply)

- ☐ Indoor ☐ outdoor ☐ other: _____

11. Where do you like to send messages? (☑ Tick as many as apply)

- ☐ Indoor ☐ outdoor ☐ other: _____

	Yes,				No, not at			
	Very much				all			
Do you like to receive short messages?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you like to send short messages?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you think it is easy to read text on mobile phone screen?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Do you think it is easy to type on mobile phone keyboard?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you think \$0.2 per message is cheap?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you like to READ messages when you are walking?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you like to READ messages when you are standing?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you like to READ messages when you are sitting?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you like to READ messages when you are on bus?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you like to READ messages when you are driving?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you like to SEND messages when you are walking?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you like to SEND messages when you are standing?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you like to SEND messages when you are sitting?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you like to SEND messages when you are on bus?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you like to SEND messages when you are driving?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section C: EAS Academic Vocabulary Test (in class each Tuesday)

1. Were you familiar with the question style in word test (matching questions) in the beginning of this semester?

- ☐ Yes, I did the similar exercises before I came to EAS class.
☐ No, I had never done any similar exercises before I came to EAS class.

2. In the word tests in class every Tuesday, could you find the words, which had been practised in short messages?

- ☐ No, because I did not read SMS questions.
☐ No, although I read SMS questions.
☐ Yes, but I still had difficulty to answer the questions in word tests.
☐ Yes, and I knew the answer because I had practised in SMS questions.

3. Do you think the word test in class is hard?

- ☐ No, it was easy for me. ☞ Please ignore question 4 in this section.
☐ Yes, it was hard in the first ones, but later I knew how to deal with them.
☐ Yes, it is hard for me till now.

4. Why do you think the test is hard? (☑ Tick as many as apply)

- ☐ Too many new words I need to learn in one week.
☐ I did not know the meaning of the words.
☐ It was hard when the words have similar meanings.
☐ It was hard because I need to consider different forms of the words, such as noun or adjective.

Section D: Motivation and Stimulation

1. If you do not like to reply SMS questions, why? (☑ Tick as many as apply)

- ☐ I do not think it is useful. ☐ It is so costly ☐ I do not like to use SMS
☐ I have no time ☐ other reasons: _____

	Yes, very					No, not at	
	much					all	
Were you interested in this project in the beginning of this semester before you joining in?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Did you think SMS questions would help you with your word study in the beginning of this semester?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
How much you know about mobile learning before you joined this project?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you think award, such as chocolate, was important to stimulate you to join this project in the beginning?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you think award, such as chocolate, stimulated you to play word games in the weekend?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you think you could study new words very well whether with SMS help or without SMS help in the beginning of this semester?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you think you could study new words very well whether with SMS help or without SMS help NOW?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you think you are used to use SMS to do revision, and it is your habit NOW?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you think answer SMS questions is a good way to use TXT2000, so you joined this project?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you think your classmates' explanation of this project promoted you to join this project?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Did you started to use TXT2000 because you wanted to reduce the cost of replying SMS questions?							

- ☐ Yes, I started to use TXT2000 after I joined this project.
☐ No, I did not buy this service till now.

Why you do NOT like to reply SMS questions in the mid-semester break? (☑ Tick as many as apply)

- ☐ I need break ☐ no exams in the break ☐ other reasons: _____

Why you do NOT like to reply SMS after mid-semester break? (☑ Tick as many as apply)

- ☐ I found it is not useful. ☐ I have known how to do revision by myself.
☐ I had too many other exams so I did not have time.
☐ Other reasons: _____

Section E: The Organization of Mobile Learning Programme

	Yes, very much					No, not at all	
Do you like to receive SMS questions from Wednesday? (Just after the previous word test finished.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you like to receive word meanings and example sentences first before you do exercise?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you like to receive SMS questions before class? (before 9.00am)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you like to receive SMS questions during lunch break? (from 11am to 12pm)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you like to receive SMS after class? (just after 2pm)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you like to receive SMS in the evening?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you like to receive one question in one message?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you like to receive more than one questions in one message?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you think SMS questions are relevant to your test?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Did you already know the resource of SMS questions and have done them on the website?

☐ Yes, I knew the SMS questions are from a website, but I did not do them online.

☐ Yes, I found the website and have done them online.

☐ No, I do not know the website.

Section F: The Workload of Mobile Learning Programme

	Yes, very much					No, not at all	
Do you think 10 SMS questions in one WEEKDAY are too many?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you think 10 SMS questions in one WEEKEND day are too many?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you like to receive SMS questions every weekday?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you like to receive SMS questions in weekend?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you think read and reply messages cost much attention and it interrupts your normal activities?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

How many SMS questions do you think is enough in one day? (Weekday)

☐ 10+ ☐ 5+ ☐ 4 ☐ 3 ☐ 2 ☐ 1 ☐ not everyday. ☐ Specify number if it is in Weekend ____

Which day do you like to receive SMS questions?

☐ All 7 days ☐ all weekdays but not weekend ☐ only weekend ☐ Wednesday ☐ Thursday

☐ Friday ☐ Saturday ☐ Sunday ☐ Monday ☐ Tuesday before the test

Section G: The Usage of Mobile Phone for Learning Purposes

Where do you like to reply SMS questions? (☑ Tick as many as apply)

☐ At home ☐ in car ☐ on bus ☐ waiting for bus ☐ Walking on the road

☐ Other places: _____

If you did not reply SMS questions very often, did you read it?

☐ Yes, I read it and I found only read it was also helpful for revision.

☐ No, I did not read the messages.

Yes, very

No, not at

much

all

Do you think it is easy to read SMS questions on mobile phone screen?

☐ ☐ ☐ ☐ ☐ ☐ ☐

Do you think it is easy to type answers using mobile phone keyboard?

☐ ☐ ☐ ☐ ☐ ☐ ☐

Did you use the SMS questions again for revision after you have replied them?

☐ Yes, I checked out the history of inbox and read the messages again.

☐ No, I did not read them again after I replied.

☐ No, I did not reply you.

Section H: Learning Activity Enhancement and Learning Outcome Improvement

Yes, very

No, not at

much

all

Do you think in the beginning of this semester, SMS helped you understand the style of vocabulary test?

☐ ☐ ☐ ☐ ☐ ☐ ☐

Do you think receiving SMS questions reminded you to do revision?

☐ ☐ ☐ ☐ ☐ ☐ ☐

Do you think sometimes SMS question was an instant way to do revision, where the place you were in was not suitable to read books or use computer.

☐ ☐ ☐ ☐ ☐ ☐ ☐

Do you think SMS questions help you remember new words and acquire how to use the new words?

☐ ☐ ☐ ☐ ☐ ☐ ☐

Do you think SMS questions inspired you to check the meanings of new words in dictionary?

☐ ☐ ☐ ☐ ☐ ☐ ☐

Do you think you could achieve better test results after you did SMS questions every week?

☐ ☐ ☐ ☐ ☐ ☐ ☐

Do you think answer SMS questions, was a good passive way to learn, when you had no passion to do revision?

☐ ☐ ☐ ☐ ☐ ☐ ☐

Do you like to do SMS questions to exam yourself, after you have done revision?

☐ ☐ ☐ ☐ ☐ ☐ ☐

Do you think word games sent by SMS were enjoyable?

☐ ☐ ☐ ☐ ☐ ☐ ☐

Do you think SMS questions were helpful when

you had not much time to do revision at home or at school? ☐ ☐ ☐ ☐ ☐ ☐ ☐

DO you think you can do revision only by SMS, without out text book or dictionary?

☐ ☐ ☐ ☐ ☐ ☐ ☐

Do you find a particular time frame to reply SMS questions? (Such as waiting for bus or people; or do revision at home)

☐ Yes. Please specify where and when: _____

☐ No, I did not reply you

☐ No, no fixed time frame or place when I replied SMS questions.

Section I: Communication with the Researcher

Yes, very

No, not at

much

all

Do you think it is more helpful if you and the researcher (Chad) can have face to face discussion about new words?

☐ ☐ ☐ ☐ ☐ ☐ ☐

Do you think researcher's feedback on your answer to SMS questions was quick enough?

☐ ☐ ☐ ☐ ☐ ☐ ☐

Do you think researcher's feedback on your answer to SMS questions was clear enough?

☐ ☐ ☐ ☐ ☐ ☐ ☐

Do you think researcher's feedback is better than only providing right answers?

☐ ☐ ☐ ☐ ☐ ☐ ☐

Section J: Internet Usage for Learning Purposes

Yes, very

No, not at

much

all

Do you like to use email to receive questions rather than SMS?

☐ ☐ ☐ ☐ ☐ ☐ ☐

Do you like to use email to answers questions rather than SMS?

☐ ☐ ☐ ☐ ☐ ☐ ☐

Do you like to use email to receive feedback rather than SMS?

☐ ☐ ☐ ☐ ☐ ☐ ☐

Section K: Usage of Mobile Devices for Learning Purposes in the Future

Which mobile device do you use else? (☑ Tick as many as apply)

☐ MP3 ☐ MP4 ☐ PDA ☐ Other: _____

Yes, very

No, not at

much

all

Do you want to use SMS to help you learning in the future?

☐ ☐ ☐ ☐ ☐ ☐ ☐

Do you want to use MP3 (audio devices) for learning purposes?

☐ ☐ ☐ ☐ ☐ ☐ ☐

Do you want to use PDA for learning purposes? ☐ ☐ ☐ ☐ ☐ ☐ ☐

Do you want more kinds of mobile learning methods, so you can study anytime, anywhere? ☐ ☐ ☐ ☐ ☐ ☐ ☐

Section L: Overall Experience

Very

Very

Dissatisfied

Satisfied

1. Overall, how satisfied are you with SMS-based learning technology? ☐ ☐ ☐ ☐ ☐ ☐ ☐

2. Please make any further comments you may have relating to your experience on SMS-based learning.

3. Please comment on any aspects of being a participant of SMS-based learning project that you are dissatisfied with.

Thank You Very Much

Appendix VI: Participant Information Sheet

Participant Information Sheet



Date Information Sheet Produced:

30th June 2008

Project Title

SMS-based vocabulary learning for ESL students

An Invitation

I am a master student of Computer and Information Sciences at AUT. I am going to do research on SMS-based vocabulary learning. The English words are from AWL (Academic Word List) in students' textbooks.

You are being invited to take part in the research project. Before you deciding to participate in research, it is important for you to understand why the research is being done and what will be involved in it. Please take the time to read the following information carefully.

Your participation is voluntary and you may withdraw at any time without any adverse consequences.

Thank you for reading this.

What is the purpose of this research?

I was an EAS student. When I was learning new vocabularies, I wanted to memorize the meaning of them iteratively and practice them regularly. However, paper-based learning or e-learning limited my English study to school or home. I wanted a new approach to achieving more flexible learning activities.

This research is designed to improve student's academic vocabulary learning with mobile technology, and investigate issues emerging from mobile learning activities. The main purposes of this research are to investigate to what extent, will mobile technology be able to enhance learning activity and improve student's learning outcome, and success factors or obstacles to integrating mobile technology into learning activities. The outcome from the research may inform mobile learning practice in the future. The research will be included in my dissertation, which is for my master degree.

How was I chosen for this invitation?

EAS students at AUT are chosen as participants in research. Participants must have mobile phones. AWL (Academic Word List) must be included in their study. 15 to 20 EAS students will be chosen as participants.

What will happen in this research?

First, students will study new vocabularies with teacher in class. Then students can do revision using SMS outside class. Finally, there will be an exam in class to evaluate their learning of academic words.

Gap-fill exercises will be sent to participants to assist word learning. Participants need to reply the answers to the SMS questions using SMS; read the right answers using their mobile phones and check feedback in E-mails using computers. The researcher will pay the cost of SMS for participants. The duration is from week one to week 11. Participants' results of word tests will be collected. Questionnaires will be distributed to participants. The researcher will interview participants, which will last about 20 minutes in the group study room in WA building at AUT. The researcher will join class and have word tests.

Participants' information will be referred to anonymously and will be kept confidential to the researcher.

What are the discomforts and risks?

The researcher may not guarantee that participants will benefit from mobile learning or their improvement on English word study will occur. As SMS-based is a new approach to assist learning, to some extent, the results of the adoption of it may not be expectable. Participants may waste time on using SMS, and be disappointed, if their purpose is purely to improving their marks of word tests.

How will these discomforts and risks be alleviated?

The feedback will be sought from participants. Their suggestions and recommendations may be used to modify the design of research. In the second research cycle, a modified approach may be adopted to enhance participants learning activities.

What are the benefits?

The participants' learning activities may be enhanced and their vocabulary study may be improved. Their study will be more flexible, as they would study using SMS anytime, anywhere.

The outcomes of research may inform mobile learning in the future. Organizations, such as universities, may adopt the success factors or obstacles in the deployment of mobile learning. Mobile telecommunication companies may use the outcomes in their "SMS plan" for customers, as mobile learning is a kind of business application.

To some extent, there are no immediate benefits for those people participating in the project. The Koha or gift will be offered afterwards.

How will my privacy be protected?

The data collected from participants will be referred to anonymously and will be kept strictly confidential. Only the researcher and the primary supervisor have access to the original data. All original information will be deleted after the data analysis finished.

What are the costs of participating in this research?

Participants need to spend about 120 minutes in the whole research activities.

What opportunity do I have to consider this invitation?

As the adoption of SMS will commence in week 4, please inform the researcher or his supervisors before the end of week 3.

It is up to you to decide whether or not to take part in. Refusal to take part will involve no penalty or loss of benefits to which you are otherwise entitled.

The second supervisor, which is a lecturer in EAS, will not be involved in the research. The integrity in assessment processes will be preserved.

If you do decide to take part in, you will be given this information sheet to keep and be asked to sign a consent form. If you decided to join research, you are still free to withdraw at any time without penalty, or loss of benefits, or giving a reason. The report of outcome will be provided if you wish to have one.

How do I agree to participate in this research?

If you agree to participate in this research, please complete and sign a Consent Form. The researcher will give you the form.

Will I receive feedback on the results of this research?

Yes, you will. You can contact the researcher to request the feedback after the research completion. The feedback is only general summary.

What do I do if I have concerns about this research?

Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisor, Krassie Petrova, krassie.petrova@aut.ac.nz, 921-9999 extension 5045. Helen Cartner, helen.cartner@aut.ac.nz, 921-9999 extension 6092.

Concerns regarding the conduct of the research should be notified to the Executive Secretary, AUTECH, Madeline Banda, madeline.banda@aut.ac.nz, 921 9999 ext 8044.

Whom do I contact for further information about this research?

Researcher Contact Details:

Researcher's name: Chun LI

Email address: ffd9484@aut.ac.nz

Project Supervisor Contact Details:

The primary supervisor: Krassie Petrova Email address: krassie.petrova@aut.ac.nz

The second supervisor: Helen Cartner Email address: helen.cartner@aut.ac.nz

Approved by the Auckland University of Technology Ethics Committee on
AUTECH Reference number

Appendix VII: Consent Form

Consent Form



Project title: SMS-based vocabulary learning for ESL students

Project Supervisor: Krassie Petrova

Helen Cartner

Researcher: Chun Li

- ☐ I have read and understood the information provided about this research project in the Information Sheet.
- ☐ I have had an opportunity to ask questions and to have them answered.
- ☐ I understand that notes will be taken during the interviews and that they will also be audio-taped and transcribed.
- ☐ I understand that I may withdraw myself or any information that I have provided for this project at any time prior to completion of data collection, without being disadvantaged in any way. If I withdraw, I understand that all relevant information including tapes and transcripts, or parts thereof, will be destroyed.
- ☐ I grant permission for any information collected to be used for purpose as outlined in the information sheet.
- ☐ I agree to take part in this research.
- ☐ I wish to receive a copy of the report from the research (please tick one):

Yes ☐ No ☐

Participant's signature:

Participant's name:

Participant's Contact Details (if appropriate):

Date:

Approved by the Auckland University of Technology Ethics Committee on

AUTEC Reference number

Appendix VIII: Ethics Approval



MEMORANDUM

Auckland University of Technology Ethics Committee (AUTEC)

To: Krassie Petrova
From: **Madeline Banda** Executive Secretary, AUTEC
Date: 11 September 2008
Subject: Ethics Application Number 08/164 **SMS-based vocabulary learning for ESL students.**

Dear Krassie

Thank you for providing written evidence as requested. I am pleased to advise that it satisfies the points raised by the Auckland University of Technology Ethics Committee (AUTEC) at their meeting on 14 July 2008 and that I have approved your ethics application. This delegated approval is made in accordance with section 5.3.2.3 of AUTEC's *Applying for Ethics Approval: Guidelines and Procedures* and is subject to endorsement at AUTEC's meeting on 13 October 2008.

Your ethics application is approved for a period of three years until 11 September 2011.

I advise that as part of the ethics approval process, you are required to submit the following to AUTEC:

- A brief annual progress report using form EA2, which is available online through <http://www.aut.ac.nz/about/ethics>. When necessary this form may also be used to request an extension of the approval at least one month prior to its expiry on 11 September 2011;
- A brief report on the status of the project using form EA3, which is available online through <http://www.aut.ac.nz/about/ethics>. This report is to be submitted either when the approval expires on 11 September 2011 or on completion of the project, whichever comes sooner;

It is a condition of approval that AUTEC is notified of any adverse events or if the research does not commence. AUTEC approval needs to be sought for any alteration to the research, including any alteration of or addition to any documents that are provided to participants. You are reminded that, as applicant, you are responsible for ensuring that research undertaken under this approval occurs within the parameters outlined in the approved application.

Please note that AUTEC grants ethical approval only. If you require management approval from an institution or organisation for your research, then you will need to make the arrangements necessary

to obtain this. Also, if your research is undertaken within a jurisdiction outside New Zealand, you will need to make the arrangements necessary to meet the legal and ethical requirements that apply within that jurisdiction.

When communicating with us about this application, we ask that you use the application number and study title to enable us to provide you with prompt service. Should you have any further enquiries regarding this matter, you are welcome to contact Charles Grinter, Ethics Coordinator, by email at charles.grinter@aut.ac.nz or by telephone on 921 9999 at extension 8860.

On behalf of the AUTEK and myself, I wish you success with your research and look forward to reading about it in your reports.

Yours sincerely



Madeline Banda

Executive Secretary

Auckland University of Technology Ethics Committee

Cc: Chun Li ffd9484@aut.ac.nz

Appendix IX: Interview Questions

General question 1: Do you like to use mobile phones (SMS)?

General question 2: Do you like to use short messages to (help) study vocabulary?

Structured question 1: Where and when did you reply to my SMS?

Structured question 2: Do you think mobile phones are easy to use?

Structured question 3: Do you think short messages were useful for vocabulary learning?