

**Science and Mathematics Education Centre**

**Variations in Gender and Age Perceptions of Mobile Technology  
Enhanced Learning in a New Zealand Tertiary Institution**

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**Doctor of Science Education**  
of  
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## **DECLARATION**

This thesis contains no material that has been accepted for the award of any other degree or diploma in any university.

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgement has been made.

Signature: 

Date: 1 August 2012

## **ABSTRACT**

The major purpose of this study was to investigate students' actual and preferred perceptions of a mobile enhanced learning environment at a tertiary institution in New Zealand and if these variations in perceptions differed based on gender and age. In order for this to be achieved, a new learning environment instrument was developed based on modifying the existing *Web-based Learning Environment Instrument* (WEBLEI) with scale items being modified to create the *Mobile Enhanced Learning Environment Instrument* (MOBLEI). A review of the literature examined learning environments and questionnaires on which the theoretical framework for this study was based. The use of mobile technologies in learning environments was provided along with a discussion around gender and age and differences between males and females and generational groups in relation to learning and technology. Students' perceptions of their learning environment were determined through the use of qualitative and quantitative methods with open-ended questions being included in the MOBLEI, along with follow up focus groups. The MOBLEI was distributed to 141 tertiary business and computing students, and was found to be a valid and reliable tool for application in a tertiary environment in New Zealand. Results from the MOBLEI showed no significant differences between the perceptions of males and females, however younger age groups had a more positive attitude toward the use of technology than did their more mature counterparts. Overall, the study provided an insight into how students perceive a mobile enhanced learning environment, along with practical implications for education practitioners with an aim to provide direction for an ideal mobile enhanced learning environment for education practitioners in the tertiary environment.

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## 1 CHAPTER ONE

### 1.1 INTRODUCTION

A main driving force behind change in education is a desire to improve productivity and efficiency in relation to teaching and learning and increase access to learning. The potential for this change is driven by both technology and the learners themselves. It has become increasingly important during these processes of change that institutions engage with learners to understand their perceptions and perspectives, in order to gauge whether wants and needs are being met.

Many of today's learners are digital natives, constantly surrounded by and immersed in technology and fluent in all things digital. Prensky (2001) refers to these new generations of learners as speakers of the digital language of computers, mobile phones, the internet and other associated technologies. It is important that as educators, these digital technologies are integrated into meaningful learning scenarios in order to engage and challenge these learners (Duncan-Howell & Lee, 2007).

A mobile tool currently being experimented with within the education arena is the mobile phone, through the use of delivering content via text messaging. Educators are endeavouring to connect with learners through this communication medium that is integral to so many people's lives, hence proving to be an excellent way to try to engage with learners in a non-traditional manner. With mobile technologies being such a prevalent part of our society both in New Zealand and internationally, Ryu (2007) outlines the emergence of "m-“neologisms, for example m-government, m-health, m-office, m-commerce, and m-learning. With this m-paradigm being so ubiquitous in our lives, it inadvertently affects our lives and changes the way we do many things, learning being one of them. Mobile learning is seen as a fairly new delivery method in the education sector and from a review of the learning environment literature, there do not appear to have been any studies using an existing learning environment instrument to assess the impact that mobile technologies might have on the learning environment. It is important to note that rather than being a sole delivery method, the majority of applications of mobile learning aim to provide

another layer of support to the students' learning experience, alongside other delivery methods to enhance and support the learning process. For clarification, mobile technologies are anything that are handheld with wireless capabilities in which real time access with no fixed location or time can occur. This includes devices such as mobile phones, portable digital assistants (PDAs) or Palmtops and iPods (Mellow, 2005). For the purpose of this research, the mobile phone was the tool utilised in this study.

The purpose of this study has been to investigate how the learning environment can be enhanced through the use of mobile technologies in order to enrich the student learning experience. This has been carried out by modifying, validating and applying an existing learning environment instrument in order to assess students' actual and preferred perceptions of the use of mobile devices, and if these perceptions differ based on age and gender. The study has utilized three distinct delivery method groups of students who are studying through a variety of learning modes; online (solely off campus), distance/blended delivery (off campus with some face-to-face requirements), and traditional face-to-face learners (fully on campus).

## **1.2 BACKGROUND**

Tertiary education practitioners are realising that integrating technology into programme delivery is an essential method of engaging and interacting with today's learners. In particular, the integration of mobile technologies enables students and teachers to more easily share information and co-ordinate projects and ideas in less formal ways than in the past. Utilising mobile technologies in the classroom environment moves the delivery from teacher-centred to student-centred allowing the student to more readily participate in personalising or taking part in cooperative learning (Liu, 2007). Liu (2007) also goes on to outline that the importance of the successful introduction of mobile technologies in the classroom is through professional development for the teachers involved. Effective professional development enables teachers to change their instructional practices to incorporate the effective use of mobile technologies as a delivery tool. This research study will contribute in providing more confidence for teachers around the benefits of using

mobile technologies and assist in providing an insight into how the learning experience is enriched through the use of mobile technologies.

As learning needs and processes change, it is important to provide both lecturers and institutions with an insight into what perceptions might be in relation to new learning environments. The field of learning environment research, which started around 30 years ago, has seen the emergence of a variety of valid and widely-applicable instruments which can be used to assess student and teacher perceptions of learning environments. This field of research has undergone tremendous growth and diversification over the last 30 years with most studies now including both qualitative and quantitative methods instead of the original forms which focused on the practice of gathering either quantitative or qualitative data only, rather than a combination of both (Fraser, 2003). Fraser (1998a) provided a discussion on the pioneering research into learning environments including references to the early works by Herbert Walberg and Rudolf Moos in the 1960s and 1970s which form the basis of today's learning environment field of research. Walberg developed the *Learning Environment Inventory (LEI)* (Walberg & Anderson, 1968) and Moos (1974), the *Classroom Environment Scale (CES)*, which have been used, applied, modified and validated in a variety of learning environment research projects. Other historically important learning environment instruments outlined by Fraser (1998a) include the *Individualised Classroom Environment Questionnaire (ICEQ)* (Fraser, 1990); *My Class Inventory (MCI)* (Fisher & Fraser, 1981) *College and University Classroom Environment Inventory (CUCEI)* (Fraser, Treagust, & Dennis, 1986); *Questionnaire on Teacher Interaction (QTI)* (Wubbels & Levy, 1993); *Science Laboratory Environment Inventory (SLEI)* (Fraser, McRobbie & Giddings, 1993); *Constructivist Learning Environment Survey (CLES)* (Taylor, Fraser, & Fisher, 1997) and the *What is Happening in this Class (WIHIC)* (Fraser, Fisher, & McRobbie, 1996).

Over the years, many of these original instruments have been progressively refined and modified to suit new emerging learning environments, and with the growing integration of information communications technology (ICT) into many educational settings, it is important that the effectiveness of such technology-rich environments are evaluated and assessed. From a review of this learning environment literature, there did not appear to have been any studies using an existing instrument to assess

the impact that mobile technologies might have on the learning environment. A conclusion was made that it was necessary to develop a learning environment instrument appropriate for this study. The *Technology-Rich Outcomes-Focused Learning Environment Inventory* (TROFLEI) (Aldridge, Fraser, and Fisher 2003), and the Web-based Learning Environment Instrument (WEBLEI) (Chang and Fisher 2003) were two instruments that were identified by the author as having potential, with modification, for application in this study.

The development of the Technology-Rich Outcomes-Focused Learning Environment Inventory (TROFLEI) by Aldridge, Fraser, and Fisher (2003) drew on the What is Happening in this Class (WIHIC) questionnaire. The development and validation of this instrument was considered important as it was seen as a “widely-applicable and distinctive questionnaire for assessing students’ perceptions of their actual and preferred classroom learning environments in outcomes-focused, technology-rich classroom learning settings” (Aldridge, Fraser & Fisher, 2003, p. 175). The TROFLEI measures 10 dimensions of the actual and preferred classroom environments at high school level: student cohesiveness, teacher support, involvement, investigation, task orientation, cooperation, equity, differentiation, computer usage and young adult ethos (Aldridge, Fraser, & Fisher, 2003). The attitudinal scales were the only items used from this learning environment instrument in the development of the MOBLEI.

The Web-based Learning Environment Instrument (WEBLEI) was developed by Chang and Fisher (2003) to gather quantitative data on students’ perceptions of their web-based learning environment in a tertiary environment. The WEBLEI uses four scales to measure students’ perceptions: Access, Interaction, Response and Results. Chang and Fisher’s (2003) study found the instrument to have factorial validity, acceptable reliability and discriminant validity from a statistical perspective.

The development of the learning environment instrument for use in this study was the Mobile Enhanced Learning Environment Instrument (MOBLEI) (Appendix B) which was based on the modified versions of the WEBLEI (Chandra & Fisher, 2006; Chard, 2006). Scale items were assessed for relevance to the mobile learning

environment and changed accordingly to fit. Attitudinal scales were included and modified based on the scales used in TROFLEI.

There is a plethora of literature on the effects of good learning environments on learners, but it is important to consider what a ‘good’ learning environment actually is. Fraser (1998) provides a discussion outlining that much of the research and evaluation on education had been heavily swayed toward educational outcomes or academic achievements. However, he points out that these measures alone cannot give a complete picture of the educational experiences, and that it is important to also assess the ‘quality’ of the learning environment that has been provided during a students’ period of learning. He outlines that if teachers pay particular attention to the quality of the learning environment, then it is highly likely to pay off in terms of improving student outcomes. Effective learning environments are often connected with teaching methods that connect curriculum and instruction with cultural experiences and values of students. Classroom environments that connect content to the real world, using technology in a meaningful ways, and sharing ideas collaboratively are more likely to develop effective and rich learning environments (Bentley, 1998). Effective learning environments also need to incorporate and understand the values, needs, attitudes and perceptions of today’s learners and generational age groups, and these must be considered when assessing the viability of the application of a new teaching tool or methodology. Along with age, any differentiation that may exist between how males and females learn is an important aspect to consider in a learning environment. It is of interest to discover if gender is associated with the actual and preferred perceptions of learning environments and what, if any differences exist between males and females. For clarification, gender refers to the social construction of different roles between sexes, which can change over time and is influenced by factors such as culture, religion and daily interactions through institutions such as school, work and family.

### **1.3 CONTEXT**

Bollen, Eimler, and Hoppe (2004) view mobile phones as the creator of a new “culture” of communication through SMS messaging. A survey, conducted at the start of the university year by Auckland University of Technology in 2005, found

that 82% of students owned a mobile phone (Mellow, 2005). Kolb (2008) points out that students are living in a technology-enhanced community where they have developed their own communication through their media “toys” and that there is an opportunity for educators to harness the use of these “toys” for use as tools of knowledge. Rickards (2003) points out that technology-based futures in education have several issues of certainty – “they will always be linked to the technology that is currently available, which in turn will be partly driven by what people want to use technology for” (p. 121). There is enormous potential in the use of technologies such as PDAs, mobile telephones and MP3 players to enhance the learning experience.

There is beginning to be a significant uptake in the use of mobile technologies in schools, polytechnics and universities, both in New Zealand and internationally. This is “having an impact on teaching, learning, and the connections between formal and informal learning, work and leisure” (Kukulska-Hulme, 2005, p. 3). It is now important that the impacts of these new mobile technologies on learning activities and learner support are appraised and evaluated.

This study has been carried out using student groups from tertiary programmes of study at the Universal College of Learning (UCOL), Palmerston North, New Zealand. Web texting software (websms MessageMedia) has been used by lecturers as the tool to send out text messages to students mobile phones. This texting software enables lecturers to set up class mobile phone lists which can be easily accessed and administered. The Universal College of Learning (UCOL) is a tertiary Institute of Technology in New Zealand consisting of three regional campuses with a population of 6,000 (equivalent full time) on and off campus students. UCOL wishes to use new technologies to enhance its focus on developing student independence, self-reliance, and self-motivation. Recent research (eLearning Project Team, 2006) suggests that current UCOL students use technology extensively, both at UCOL and at home. In the future, they want better technology supplementing face-to-face contact with lecturers and fellow students. Several schools within UCOL have adopted mobile learning strategies using a variety of mobile devices including the web texting software, particularly the School of Nursing and the School of Business and Computing. UCOL provides its students with free wireless access to webmail, Moodle, and online library resources and texts such as safari. It

is common to see students using laptops, mobile phones, and smartphones in the learning hub (which is the main centre of the Palmerston North campus) and also in the classrooms.

The researcher's role has been to develop and administer the newly modified learning environment instrument to students using the mobile tools, facilitate focus groups with students and analyse and report on results. Lecturers within the School of Business and Computing were asked to be active participants using mobile technologies as an additional communication method with identified student groups. One-on-one training sessions were provided by the researcher to ensure lecturers understood how to use the texting software and also to provide instruction on the type of content and material that could be disseminated to the student groups via the mobile devices. Increasing communication between the lecturer and students was the main aim with the lecturer providing support and encouragement in order to help students engage in their studies. Students provided feedback via questionnaires, and some were invited to participate in focus groups sessions.

#### **1.4 AIM & RESEARCH QUESTIONS**

The purpose of this study has been to investigate how the learning environment can be enhanced through the use of mobile technologies in order to enrich the student learning experience. The overall objectives have been to trial the mobile device to targeted student groups and to modify, validate and apply an existing learning environment instrument in order to assess any differences between 'actual' and 'preferred' students' perceptions of the use of mobile devices, and if these perceptions differ based on age and gender. These objectives led to the following specific research questions:

1. Is the learning environment questionnaire developed a valid and reliable instrument for use in New Zealand?
2. What sort of learning environment is created by mobile technology tools?
3. What differences are there between the actual mobile technology learning environment and that preferred by students?
4. Does age and gender affect students' responses to using the tools?

5. What are the attitudes of students toward their classes in which mobile technology is used?
6. Are there any differences in attitudes between different age groups and gender?
7. Can the learning environment be enhanced through the use of mobile technologies in order to enrich the student learning experience in a tertiary environment?

## **1.5 SIGNIFICANCE**

This study makes a significant contribution for a number of reasons, four in particular are discussed. First, it has provided development of a modified learning environment instrument to assess the use of mobile technologies, therefore contributing to the body of knowledge on learning environments. Secondly, it has also provided new information on whether the use of mobile technologies enhances students' learning. Thirdly, it has led to a greater understanding of whether or how gender and/or age are associated with the use of technologies and perceptions of the learning environment. Finally, it has implications for teaching practice at tertiary level by providing an insight into how the learning experience is enriched through the use of mobile technologies.

## **1.6 OVERVIEW OF METHODOLOGY**

This exploratory study has been conducted utilising a mixed methods approach. According to Yin (1989) that by using more than one method to gather evidence, converging lines of enquiry and a form of triangulation occurs, which is therefore more likely to provide more convincing and accurate information. Quantitative data were gathered utilising the previously mentioned Mobile Enhanced Learning Environment Instrument (MOBLEI). Qualitative data were obtained through the focus groups which provided rich subjective data on learners' experiences and aided in validating the learning environment instrument. Additional qualitative data were also gathered via open-ended questions included in the learning environment instrument enabling themes to be identified. The scale items on the learning environment inventory and interpretations of those scales were assessed for reliability and validity. Cronbach alpha tests were used to measure internal

consistency of the scales. Actual and preferred forms of the questionnaire were analysed for perceptions on the use of mobile technologies along with attitudinal and self-efficacy perceptions. Differentiation was made between perceptions of students based on age and gender using ANOVA and post hoc tests.

A purposive approach to sampling was taken to obtain a sample of convenience. All students enrolled in the courses being trialled were included in the study and no differentiation was made on the basis of ethnicity. The sample group was divided into three distinct groups; online students (web based learning), distance/blended delivery students (resource based learning), and traditional face to face students.

Informed consent of participants in the study was sought at the time of questionnaire distribution, and participants had the right to withdraw consent to participate at any time. No personal information was used and participant's anonymity was maintained at all times.

## **1.7 SUMMARY**

This thesis is divided into five chapters. The first chapter has introduced the concept of mobile technologies, mobile learning and how the learning environment can be enhanced through the application of these supplementary delivery tools. It has outlined the research design and specific research objectives. The development of a new learning environment instrument has also been discussed and the significance of the study was presented.

Chapter Two follows and contains the literature review. Data on mobile learning and technologies are presented, along with literature on current learning environments and instruments used to assess these environments. Gender and generational groups are also discussed in this chapter in relation to any differences in perceptions of the use of mobile technologies.

Chapter Three is a discussion of the methodology including the methods of data collection and analysis chosen for the study. The significance of the study is also

described, along with the sampling and distribution, procedures and instruments used, and any assumptions and ethical considerations.

Chapter Four contains the analyses of the qualitative and quantitative results.

The conclusions and discussion follow in Chapter Five providing answers to the research questions. The significance, limitations, practical implications and suggestions for further research are also provided.

## **2 CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 INTRODUCTION**

This review considers and discusses four main strands – learning environments and instruments, mobile learning environments and technologies, gender and generational age groups. The four strands are all linked throughout the study which focuses on mobile enhanced learning environments and the effects of gender and/or age. The study focuses on investigating how the learning environment can be enhanced through the use of mobile technologies in order to enrich the student learning experience. The review also provides a background on historical learning environments and instruments which form the theoretical framework for the study.

Technology and globalisation have changed the way education practitioners design and deliver learning programmes. Traditionally formal education has occupied the first 20 years or so of someone's life, following with people entering the workforce where they developed further knowledge and skills, rather than going back to formal training (Tait & Mills, 1999). However, increased access to technology means many people who would have traditionally completed their education in one block in a face-to-face learning mode, have now become lifelong learners with education being combined with the use of technology (Morrison & Oblinger, 2002).

Many technologies used in higher education today include the use and application of methods such as e-learning, m-learning, online learning, web based learning or blended learning, each often in combination with learning management systems. Each of these methods of delivery are often used interchangeably and can often have a similar meaning. For clarification, a definition of e-learning is provided by the New Zealand Ministry of Education (2004):

e-learning is learning that is enabled or supported by the use of digital tools and content. It typically involves some form of interactivity, which may include online interaction between the

learners and their teacher or peers. e-learning opportunities are usually accessed via the Internet, although other technologies such as CD-ROM and mobile tools are also used in e-learning. A later definition of e-learning provided by the Ministry in 2007 is portrayed as learning that is enabled or supported by the smart use of information and communications technology (ICT).

Strategically, both learners and educational institutions have shifted their focus in learning modes from mainly traditional face-to-face learning to include blended modes of delivery including online and distance programmes. Learning opportunities have become more available with the use of the internet and on-line learning. Acceptance of this type of learning has been aided due to the growing use and availability of learning management systems such as Blackboard, Moodle and WebCT. These learning management systems enable students to engage and collaborate with each other as well as with their lecturers in an asynchronous environment. Learning management systems also provide access to additional learning materials at any time and aid in developing students' technology and information literacy (Coates, 2005).

Students expect to be able to continue studying even if they cannot attend a classroom setting, and the use of e-learning, often accompanied by learning management systems, allows for this. However, this desire to study via distance learning is not necessarily new. Extramural/distance study opportunities have been available to learners for many years, however more and more, this type of study option is being combined with web enhanced and e-learning technologies rather than just paper based readings and assessments. Mobile technologies and mobile learning (m-learning) have also gained in popularity with wireless devices that can be used by students to access web servers for real time information from anywhere on or off campus. Mobile learning has an advantage of ease of access over the use of activities such as accessing learning management systems which rely on a computer terminal to interface with the learning material (Mellow, 2005). Kossen (n.d., ¶4) makes the following statement which encompasses the key benefits and power of m-learning: "A key benefit of m-learning is its potential for increasing productivity by making learning available anywhere and anytime. Because mobile devices have the power to

make learning even more widely available and accessible, mobile devices are a natural extension of e-learning”.

## **2.2 LEARNING ENVIRONMENTS – THEORETICAL FRAMEWORK**

As learning environments evolve, it is essential to assess the quality and potential impacts that an environment has on student learning and their associated experiences. Students spend a considerable amount of time in classrooms, starting from a very young age at pre-school, onto primary school, then secondary and subsequently for many, onto higher education at tertiary level. Often, a successful learning environment is measured on the number of successful academic outcomes that are achieved, and while this is an important measure it does not provide a holistic overview of a students’ learning experience and their perceptions of the quality of their learning environment. What can be considered a good experience for one student, may not be for another, therefore it is an important area of research to gather feedback in order to ensure ongoing improvements and developments are made.

Curriculum and instruction need to be tied to cultural experiences and values of students, and that classroom environments with a teacher using constructivist approaches such as connecting content to the real world, thinking critically and creatively about their teaching practice, using technology in a meaningful way, and sharing ideas collaboratively are more likely to develop effective learning environments (Bentley, 1998). Constructivism has served as a basis for the creation of various teaching and learning cycle models. The most popular and widespread model for constructivism for teaching practice is the conceptual change model. This model interprets learning as a process of deconstructing misconceptions and reconstructing new valid conceptions (Hewson & Hewson, 1988; Posner, Strike, Hewson & Gertzog, 1982; Strike & Posner, 1992, cited in Bentley, 1998). Conceptual change relies upon contextual factors such as motivational beliefs and classroom environments to influence and facilitate change. Conceptual change therefore only occurs if the correct setting and conditions are provided, these being termed ‘conceptual change supporting conditions’. (Duit & Confrey, 1996, p. 81).

Baird and White (1996) describe their research into reflection, metacognition, and classroom change structures which include three guiding principles. One, the improvement in classroom teaching and learning must involve change in students and teachers. Two, that learning with understanding involves all of cognition (thoughts), affect (feelings), and behaviours. And principle three, that change must provide for cognitive and affective growth. They state that change can be difficult and often requires extensive personal development. The teacher undergoing change must be intellectually and emotionally challenged and be willing and able to accept new strategies and promote change. They believe that for change to occur incorporating the three principles above, certain conditions to promote change must apply. These being time, opportunity, guidance and support. Without these conditions, neither student can try to improve learning, nor can a teacher try to improve their teaching. A reality that all educators must face, at no matter what stage in their career, is that change and reform will not stop and they must always be striving to ensure they are evaluating what they do in order to provide valuable teaching and learning experiences for both themselves and their students.

It is of value to determine what an effective learning environment looks like. Learning cannot be viewed as a one-way, ‘distribute then learn system’ (Quinton, 2006, p. 544), where teaching is about delivering content rather than focusing on a model of collaboration which embraces all of the complexities around learning (Quinton, 2006). The social climate in education environments is often shaped by the relationships between teacher and student and also among students themselves. Interpersonal relationships, behaviours, technologies used and teacher’s communication styles all have a direct impact on the learning environment (Allodi, 2010). Learning needs to be thought of as a flexible process, taking into consideration, place, time and context to enable new technologies to enhance the learning environment and improve the quality and effectiveness of learning. Being able to deliver learning environments anytime and anywhere that is convenient to learners is now viable due to the growing power of the web and associated technologies such as mobile devices. The key to ensuring this type of delivery is effective is to ensure that newly implemented innovative teaching strategies and technology-rich learning environments are continually researched, trialled and evaluated (Quinton, 2006). To carry out these evaluations, there is a plethora of

learning environment instruments that have been developed and used across a range of learning situations.

### **2.3 LEARNING ENVIRONMENT QUESTIONNAIRES**

The field of learning environment research, which started around 30 years ago, has seen the emergence of a variety of valid and widely-applicable instruments which can be used to assess student and teacher perceptions of learning environments. This field of research has undergone tremendous growth and diversification over the last 30 to 40 years with most studies now including both qualitative and quantitative methods instead of the original forms which focused on the practice of gathering either quantitative or qualitative data only, rather than a combination of both (Fraser, 2003). Today's field of learning environment research was shaped by the earlier work of several prominent figures around personal behaviours and environments. Lewin (1936) introduced the concept that personal behaviour is a result of the interactions between an individual and their environment. Murray (1938) built on this concept by thinking about additional factors that affect an individual's behaviour, such as characteristics of personality alongside the influence of the external environment. These works were then built on by Stern, Stein, and Bloom (1956), who proposed that differences in perceptions of one same environment exist between that of an individual, a group, and an external observer.

Fraser (1998a) provided a discussion on the pioneering research into learning environments including the early works by Herbert Walberg and Rudolf Moos in the 1960s and 1970s which form the basis and theoretical framework of today's learning environment field of research and laid the foundation for assessing learning environments. Research and evaluation around the Harvard Project Physics led the development of the Learning Environment Instrument (LEI) (Walberg & Anderson, 1968) and Moos (1974) began work on social climate scales and devised a scheme for classifying human environments which ultimately resulted in the development of the Classroom Environment Scale (CES), which have been used, applied, modified and validated in a variety of learning environment research projects. The Learning Environment Inventory (LEI) and the Classroom Environment Scale (CES) became widely used and formed the basis for the development of several other instruments

commonly used to assess various learning and teaching environments (Lang & Wong, 2006). Other historically important learning environment instruments outlined by Fraser (1998a) include the Individualised Classroom Environment Questionnaire (ICEQ) (Fraser, 1990); My Class Inventory (MCI) (Fisher & Fraser, 1981) College and University Classroom Environment Inventory (CUCEI) (Fraser, Treagust & Dennis, 1986); Questionnaire on Teacher Interaction (QTI) (Wubbels & Levy, 1993); Science Laboratory Environment Inventory (SLEI) (Fraser, McRobbie & Giddings, 1993); Constructivist Learning Environment Survey (CLES) (Taylor, Fraser & Fisher, 1997) and the What is Happening in this Class questionnaire (WIHIC) (Fraser, Fisher & McRobbie, 1996). Over the years, many of these original instruments have provided the theoretical framework and basis on which others have then been progressively refined and modified to suit new and emerging learning environments. The following review provides an outline of some of these instruments that have been designed with a focus more specifically around technology-rich learning environments.

### **2.3.1 The Computer Classroom Environment Inventory (CCEI)**

The *Computer Classroom Environment Inventory* (CCEI), developed by Maor and Fraser (1996), according to Lang and Wong (2006), is one of the most important examples of subject-specific instruments. This inventory was seen as distinctive as it assessed the extent to which inquiry was supported by the use of technology and how technology could support the inquiry approach when teaching of secondary school science. It consists of five scales assessing: investigation, open-endedness, organisation, material environment and satisfaction. These scales were developed based on the Learning Environment Inventory (LEI), Individualised Classroom Environment Questionnaire (ICEQ) and the Science Learning Environment Inventory (SLEI). Further work by Maor (2000) developed the *Constructivist Multimedia Learning Environment Survey* (CMLES). This instrument examined science teachers' perceptions of their inquiry-based and constructivist-oriented multimedia learning environment.

### **2.3.2 E-learning Classroom Environment Questionnaire (ELCEQ)**

The *E-learning Classroom Environment Questionnaire* (ELCEQ) is a modified version of the Computer Classroom Environment Inventory (CCEI). Lang and Wong (2006) developed this questionnaire specifically for use in secondary schools, as other instruments designed for assessing on-line environments were for tertiary rather than for schools. They administered the questionnaire to gather an insight into students' actual and preferred perceptions of their e-learning classroom learning environments.

### **2.3.3 What is Happening in this Class (WIHIC)**

The WIHIC questionnaire was developed by Fraser, Fisher and McRobbie, (1996) in response to earlier instruments and scales becoming outdated. The original 90-item nine-scale version was refined to a final form (Aldridge & Fraser, 2000) that contained seven eight-item scales: student cohesiveness, teacher support, involvement, investigation, task orientation, cooperation, and equity. It has been used frequently in many studies and has been translated into several Asian languages and cross-validated (Riah & Fisher, 1998; Khine & Fisher, 2001; Fraser & Chionh, 2000; Khoo & Fraser, 1998; Aldridge & Fraser, 2000; Aldridge, Fraser & Huang, 1999; Chua, Wong & Chen, 2001; Margianti, Fraser & Aldridge, 2001a, 2001b; Soerjaningsih, Fraser & Aldridge, 2001a; cited in Fraser, 2002). Koul and Fisher (2006) used the WIHIC questionnaire as part of a large-scale study consisting of 1,021 year nine and ten science classes in India. This study provided further support for WIHIC as a valid and reliable instrument in science secondary school classrooms. Margianti (2006) modified the WIHIC for use at university level to a sample of 2,498 computing students in Indonesia and results confirmed the validity and reliability for the use of WIHIC at university level.

### **2.3.4 The Technology-Rich Outcomes-Focused Learning Environment Inventory (TROFLEI)**

The development of the Technology-Rich Outcomes-Focused Learning Environment Inventory (TROFLEI) by Aldridge, Fraser, and Fisher (2003) drew on the What is Happening in this Class (WIHIC) questionnaire. The development and validation of this instrument was considered important as it was seen as a “widely-applicable and distinctive questionnaire for assessing students’ perceptions of their actual and

preferred classroom learning environments in outcomes-focused, technology-rich classroom learning settings” (Aldridge, Fraser, & Fisher, 2003, p. 175). The TROFLEI measures 10 dimensions of the actual and preferred classroom environments at high school level: student cohesiveness, teacher support, involvement, investigation, task orientation, cooperation, equity, differentiation, computer usage and young adult ethos (Aldridge, Fraser, & Fisher, 2003).

### **2.3.5 The Web-based Computer Assisted Learning Questionnaire (WBCAL)**

The *Web-based Computer Assisted Learning questionnaire* (WBCAL) was developed specifically for exploring students’ perception of the web-based computer assisted learning environment (She & Fisher, 2006) and included scales adapted from the *Computer Attitude Scale* (CAS) developed by Newhouse (2001). This scale was based on work by Fraser (1981) in the *Test of Science-Related Attitudes* (TOSRA).

### **2.3.6 The Distance and Open Learning Environment Scale (DOLES)**

In response to the changing trends in teaching and learning in tertiary institutions, Jegede, Fraser, and Fisher (1995) developed the *Distance and Open Learning Environment Scale* (DOLES) designed specifically for university students studying via distance education. The DOLES has five scales: Student Cohesiveness, Teacher Support, Personal Involvement and Flexibility, Task Orientation and Material Environment, and Home Environment, as well as the two optional scales of Study Centre Environment and Information Technology Resources. Internal consistency reliability and factor structure was confirmed by the administration of DOLES to 660 university students (Fraser, 1998a).

### **2.3.7 The Web-based Learning Environment Instrument (WEBLEI)**

The Web-based Learning Environment Instrument (WEBLEI) was developed by Chang and Fisher (2003) to gather quantitative data on students’ perceptions of their web-based learning environment in a tertiary environment. In their study, the WEBLEI was administered to two groups of Electronic Commerce students from the Curtin Business School at Curtin University in Perth, Australia. The design of WEBLEI was derived from research instruments originating from the LEI, and was

developed from Tobin's (1998) work on *Connecting Communities of Learning* (CCL). The CCL was initially used to study the perceptions of mathematics and science education students enrolled in an asynchronous mode. The WEBLEI uses four scales to measure students' perceptions: access, interaction, response and results. Chang and Fisher's (2003) study found the instrument to have factorial validity and the WEBLEI scales to have acceptable reliability and discriminant validity from a statistical perspective.

From the initial design, the WEBLEI was modified by Chandra and Fisher (2006) to use in a blended environment involving high school students. Although the items were amended or changed to suit this different environment, the total number of items and number of items per scale were similar to those in the original version of the WEBLEI (Chandra & Fisher, 2006). Chard (2006) selected the WEBLEI as a suitable instrument to study online learning environments in her study of tertiary students involved in mixed mode delivery as it is targeted for web-supported and web-based learning environments, and is designed for a tertiary environment. The WEBLEI was also considered to be the most appropriate instrument by Chard as it is designed to measure learning effectiveness that includes access to materials, interaction, students' perceptions of the environment, and students' determinations of what they have learned (Chang & Fisher, 2001, cited in Chard, 2006).

After reviewing available learning environment instruments, there did not appear to have been any studies using an existing instrument to assess the effect that mobile technologies might have on the learning environment, therefore it was concluded that an instrument was required to be developed to assess this new and emerging mobile learning environment.

## **2.4 THE MOBILE LEARNING ENVIRONMENT AND TECHNOLOGIES**

Teaching is a profession that is always changing and posing new challenges to practitioners, requiring them to adapt and incorporate new approaches into their teaching and learning practices. The emerging and fast growing technological changes that continue to evolve have meant that educators have had to embrace many of these technologies into their classrooms and learning environments. Educators are often encouraged to create online and mobile resources without ever actually experiencing this type of learning themselves, often making it difficult for them to consider the pedagogical impact that technologies can have on the students learning experience and environment (O'Donnell & Sharp, 2012). In saying this, educators are increasingly seeing mobile technologies as tools that can be used for more than just social purposes, realising they can engage with their learners using this type of media which can become a powerful tool that can supplement their teaching and aid in communication with students. Learning can now take place at any time regardless of location, making education more accessible to people who may not have previously been able to participate, such as those who are unable to attend regular timetabled classes due to family or work constraints.

So what are mobile technologies? Even as this review is written, the world of mobile technologies is changing rapidly with users of these technologies always looking for new, more advanced features and better functionality. Companies are now designing mobile technologies combining multiple functions such as phone, camera, and media players into the one single device. Some of these devices include; the ubiquitous standard mobile phone, SmartPhones, iPods, iPads, laptops, PDA's, game consoles, mobile touch phones with 3G, Mobile VOIP: Voice Over Internet Protocol, enabling users to make phone calls using the internet to carry calls instead of a mobile phone network. Currently in development and just coming to market are the 4<sup>th</sup> Generation (4G) mobile phones which will give users access to high quality video streaming, broadband internet, and video chat.

With the introduction of technologies such as these added to a teacher's toolbox, the role of student and teacher is changing. Where teachers were once the primary source

of information, controlling and directing the learning, there is a shift to more of a learning facilitator, coach or mentor giving students different options for learning and handing over responsibility to the student for their own learning, often working in a collaborative manner with other students. Incorporating mobile learning into teaching practices is one way to provide these different learning options for students, and is seen as working best when used as part of a blend of delivery approaches using mobile devices as a supplementary method alongside the use of paper based materials and traditional classroom lectures (Duncan-Howell & Lee, 2007). The types of application of mobile devices by teachers are reported as things such as SMS text messaging, audio based learning, specifically designed learning modules using m-learning software, field trips using GPS positioning tools, facebook for connecting with learners and encouraging interaction with both students and teachers, online publishing, video casts, and blogging using SMS, email or web browsers. Duncan-Howell and Lee (2007) report that the use of these types of mobile technologies and their associated applications are the bridge between formal and informal learning with learners being able to access further information to read outside of prescribed materials through access the above mentioned tools and online journals and databases.

An indication of the rapid uptake and acceptance of mobile technologies is evident from some research carried out by Colmar Brunton for the Broadcasting Standards Authority (BSA) in New Zealand in 2008. The report focused on children's use of various types of media, indicating that most children use cellphones (with at least 42% owning cellphones), to play games or text, with girls more likely to text and boys more likely to play games. The research was carried out by interviewing more than 600 children between the ages of six and 13. Other statistics that came out of the research showed that 99% of children watch television, 84% play computer or video games and 62% use the internet. The overall research showed that children are interacting with a variety of current and new media in high numbers, with New Zealand overall having more mobile phones per head of population than any other county in the world (ICT Statistics Newslog, 2008).

A small survey (Appendix A) was carried out by the author in 2009 at a national computing conference in New Zealand asking other polytechnics to describe how they were using mobile technologies within their institution. Initial feedback indicated not

many had moved to integrate mobile learning into their programmes of study, however mobile phones were being used for activities such as; multi-choice testing, communication around class times and any changes, along with reminders for student to attend meetings and submit assessments. None of the institutions surveyed at that point had carried out any work around gathering feedback from students as to whether they liked this type of contact with their lecturers or if they found the interaction useful. In 2009, a study around student reactions to learning with technologies was conducted at the Dublin Institute of Technology. Results showed that 90% of the students involved in the study agreed that the use of technologies made a positive difference to their studies. More than 80% said that the use of technology effectively enhanced their learning experience and their overall satisfaction with their programme of study. Over 75% of the students reported that the use of technology had improved their engagement with the course material. An interesting comment made by one of the participants was that “lecturers will always be needed, technology cannot always be trusted” (O’Donnell & Sharp, 2012, p. 220).

There have been a number of published pieces of work outlining ways that mobile devices have been used within the education environment. In 2010, a secondary school in Auckland New Zealand, launched a pilot project called the ‘mlearning Capability Development Project’. This project aimed to develop mobile learning techniques that would allow lessons and other educational content to be accessible using any mobile device including portable game consoles. The project allowed students to record lessons on their own phones or upload recordings made by their teachers or other students to their mobile devices enabling them to review them on the bus or at home later. A piece of software called ‘WordWall’ was also used which allowed students to answer questions using their mobile phones. The project was seen as an important trial as schools are running the risk of being seen as stuck with pen and paper, and with many of today’s young learners having high levels of digital expertise, it is essential that these tools are utilised to support and assist in guiding their learning (Heffield, 2010).

Another project using cellphones as the mobile tool for learning has been trialled in 2005 in New Zealand. This project used a system called StudyText led by Dr Peter Mellow from Unitec in Auckland. This is a mobile phone on-demand study support

system. Students can access ‘knowledge bytes’ of information about a particular subject they are studying and review them in their own time. This model poses as a modern incarnation of the traditional flash cards often used for study. This project came about due to resistance from students on using traditional forms of flash cards for study. The lecturer had created paper-based powerpoints, printed them and added them to cards for students to review. Feedback from students indicated that they would not use this type of medium for study in places such as ‘waiting for a bus’ and that ‘it was not cool to be seen to be obviously studying’. To overcome this resistance, Mellow (2005) designed the StudyTxt system to include key content to fit with a form of technology the students were comfortable with. Students could then ‘snack on their study’ when they felt inclined to do so. Initially StudyTxt was considered a content delivery system only based around rote learning methodologies, however ways to make the system more interactive have been created to involve principles of constructivism. An example of this interactivity was given in the paper outlining law as the topic. An argument for a certain case was presented in a lecture and a following text message would contain scenarios it could be applied to. The student would then have to think about how they could apply the same argument in other cases presented via their mobile phone.

Attewell and Savill-Smith (2005) conducted an m-learning project carried out in the United Kingdom in which mobile devices have been used to provide literacy, numeracy and life skills learning experiences for young adults. The project explored whether the enthusiasm young adults hold for wireless devices such as mobile phones and portable entertainment devices, can be harnessed and redirected to encourage participation in education and training, in this case literacy and numeracy training. The approach of the m-learning project was to offer small sets of learning experiences on these mobile devices. The study also included a review of the types of activities that have previously been trialled for different mobile devices. Mobile phones were seen to be suited to sending text messages to students reminding them to study for exams. Additionally, they were used for quizzes, picture and sound messaging using multimedia text messaging services (MMS) and word and phrase translations. Research into PDAs or palmtop computers indicated that the distinction between these and mobile phones is becoming less and less obvious. There are a number of hybrid phone-palm devices that include both phone and palmtop functionality. The

types of use reported on include science field work for the collection and analysis of data, medical education using them for reflective logs and learning games.

Attewell and Savill-Smith's (2005) project showed that using high tech tools such as mobile devices is an effective way to attract, motivate and retain non-traditional learners into education and training that they might not otherwise have engaged in. A major finding of this research project, which has implications for institutions wishing to incorporate such delivery techniques, is that a significant amount of training needs to take place for those facilitating the learning to ensure they have both the technical ability and confidence to use the tools and delivery approach in an effective manner. For example, developing appropriate learning materials using a gaming philosophy which makes their use attractive to young adults. Trinidad (2003) supports this view, stating that it is essential that educators are assisted in changing traditional pedagogical teaching approaches from a teacher-directed approach to a learner-directed approach using technology-rich learning environments. They must go through a variety of stages to adopt and infuse technology successfully into their teaching and classrooms. The use of collaboration with peers is ideal in this situation, where models of good practice can be showcased and shared.

Colley and Stead (2004) describe a project in which they attempted to meet the challenge of producing a set of innovative games, material and activities for use on mobile devices to enhance maths and English skills. The two platforms trialled were mobile phones and PDAs. Mobile phones were selected as the primary platform as they are the communication tool of choice for most young people and are relatively inexpensive, unlike PDAs in which cost is still an issue. The authors did however also note, that the lines between mobile phones and PDAs is becoming blurred as more and more are starting to combine their functionality. An advantage palmtops have over mobile phones is their screen size and ability to store and process larger amounts of data. As in Attewell and Savill-Smith's (2005) project, Colley and Stead (2004) talked of the challenge of designing content that can stimulate learning using a small platform such as a mobile phone. Small themes of content such as themed quizzes were designed with this in mind that linked to relevant curriculum topics.

Fogg (2003) provides a discussion around technologies and mobile devices and how they can be used as ‘persuasive technologies’. He outlines that computers have come a long way in just over 50 years, performing many day to day functions from word processing to book keeping to health monitoring. He believes that computers can be used as persuasive tools designed to make a desired outcome easier to achieve by changing attitudes and behaviours and by motivating people toward a multitude of activities such as; study, exercise, donate funds to charity, buy products, pursue a new career, and stay in touch with family members and friends. He outlines seven types of persuasive technology tools, one of which has relevance in this study; Suggestion Technology. The principle of Suggestion Technology is that by offering suggestions at opportune moments, the computer technology will have greater persuasive power. For example, suggestion technologies often build on peoples existing motivations, the suggestion simply serves to cue behaviour at the right time. For example, sending text reminders to students a week before an assessment is due can provide the motivation at the right time to ensure they are on track to complete. For the technology to be successful, it must be timely enough for the recipient to implement or action it. Armatas, Holt, and Rice (2005) support this view around persuasive technologies suggesting that mobile devices, in particular mobile phones, present real opportunities for educational institutions to ‘push’ information to students to a greater extent than ever possible before.

## **2.5 GENDER**

Along with age, any differentiations that may exist between how males and females perceive the use of the tools will be investigated in this research. It is of interest to discover if gender does have any impact on these perceptions and what, if any differences exist. For clarification, gender refers to the social construction of different roles between sexes, which can change over time and is influenced by factors such as culture, religion and daily interactions through institutions such as school, work and family. Gender refers to our beliefs, ideas and social norms about what is appropriate and how each gender should behave, along with the abilities and characteristics each gender should have (De Bruyn, 1995).

When discussing learning, thoughts are often focused around the type of learning that occurs in formal educational settings, and these educational settings are often shaped by the access available for learners to formal education. In the past, females tended to be excluded from many forms of formal education, with adult education for women often being focused around things such as housewifery skills. However, in more recent times, since the 1970s, education has been seen as offering better educational access and broader curriculum for women (Stuart & Thomson, 1995). Females now represent the largest proportion and most rapidly growing cohort of students, particularly in higher education. This increase in female participation has exceeded any increase in male participation, with more females than males receiving bachelor's and master's degree. However, even with this increase in female participation, the concentration of enrolment is in programmes of study that are mostly considered traditionally female fields. For example, in 1992-1993, females received 59 percent of doctoral degrees in education, with only 11 percent being awarded to females in engineering (Hayes & Flannery, 2000). The graph below shows enrolments in Year one in 2011 and 2012 by gender at the Universal College of Learning on the Bachelor of Information & Communications Technology degree. This data clearly show the gender imbalance occurring within the ICT degree programme at UCOL.

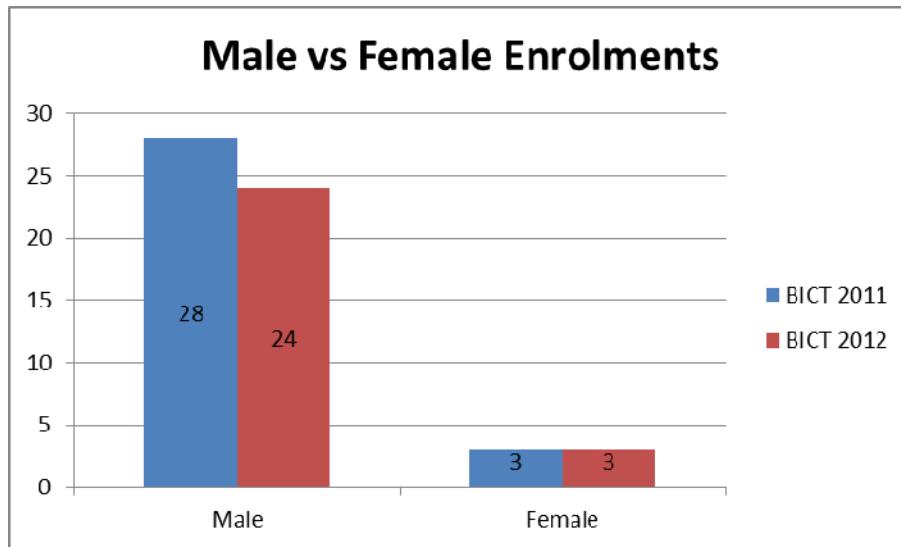


Figure 2.1. Male vs Female Enrolments at the Universal College of Learning

Hayes and Flannery (2000) suggest that there are three main influences that impact on women's and men's learning across all types of educational settings: these being

curricula, interpersonal interactions and institutional culture. They report that often text and curricula reinforce stereotypical roles and images of both genders, for example, subtly portraying men in leadership roles with women depicted as being engaged in more domestic roles. Even if these biases may not be deliberate, they are often there as ‘hidden’ curriculum containing implicit messages. This is also the case with interpersonal interactions between teacher and student. This can differ based on the fact that males and females behave differently within educational settings, which then evokes different responses from teachers. An example of this is a teacher responding more extensively to men’s comments than to women’s and giving men more formal and informal encouragement. While these responses may not be deliberate they can be evident in some classrooms. This leads on to the connection between institutional culture and the influences on women’s and men’s learning. The presence of women as academic staff members can be an important factor in supporting women’s learning and encouraging females to participate in particular fields. Often, a programme with a minority of female academic staff has a corresponding low level of female students. This is perhaps as a result of a lack of female role models which can have a direct critical impact on the choices females make when considering study and subsequent career options. Technology adoption research has shown that women are more likely than men to start using a technology if they see someone they like and respect working or studying in the field.

Cohoon and Aspray (2008) provide a discussion around women’s participation in post-secondary computing education and the types of motivations that can be used to encourage participation and engagement. This discussion supports the concept around institutional culture with the first motivational factor being around role models and mentors. They make the distinction between these two as role models do not necessarily need to interact with students to be effective, whereas mentoring is a more active role of one on one support and sponsoring. They agree that by programmes having larger numbers of available role models, this should help to assist to attract, retain and grow higher numbers of female students. They also suggest that the use of other female students who have completed their first year of studies can be used as effective role models helping newer students in the classroom environment as tutorial assistants. Peer support can be another way to describe this type of collaboration and they say that to have socially similar peers present can sufficiently influence choice,

persistence and progression in the ICT field. To outline the peer support model, they describe a study that was carried out at the Victoria University of Technology in Australia which offered a peer mentoring program which provided participants with time, space and equipment for students to meet with a higher-level student mentor of the same gender. The outcome of this interaction and assistance from fellow female students was that participating women were retained at twice the rate of non-participating women.

Barker and Aspray (2008) support some of these and other findings, outlining a number of reasons for the under representation of females in computing. They suggest issues around national and educational policies, relationships with teachers, use of computers at school and home, differences in attitude, confidence, interest and experience, family and community, influence of peers, life aspirations, images of popular culture and computer games. Cohoon (2008) outlines some of the reasons that are common for both males and females deciding to study computing as being; encouraged by parents or teachers, having a positive computing experience at home, school or work, believing themselves to be skilled in logic or maths and enjoy programming, and are wanting a career that offers opportunity and flexibility. Some women have reported about entering computing education after being recruited or encouraged by friends or if they wanted to challenge stereotypical roles with the industry being mostly dominated by males.

Much of the literature on gender and ICT speaks of gender having little impact on capabilities of skills but it does speak of a difference in levels of interest. Females perceive technology as less interesting than males, and prefer to use it as a tool rather than pursue a career in the industry, and that comfort levels with computers is much higher for men than for women (Bain & Rice, 2007). Studies have shown that women like using computers, they just use them differently to males (Bain & Rice, 2007). Shashaani (1994) suggests that the basis of gender differences in attitudes toward computing was mostly based on social and cultural influences rather than having any connection with innate ability. Her findings indicated that there were significant gender differences in computer interest, computer confidence and gender-stereotyped perceptions, all swaying toward male dominance. Her data also revealed that there was a strong correlation between positive parental encouragement and the

participation of both male and female children in computing studies at school. Children who reported that parents had shown positive attitudes to computing and IT related fields, felt more confident and interested in computing in general.

Martin (2002) suggests that parents in New Zealand tend to push boys and not girls toward technology, and that often computing is considered a masculine subject. He believes that as boys get older they generally become more confident and interested in technology, while girls often become less so. Teague and Clarke (1995) support this view, stating that even though computers are widely available in the workplace, schools and home, statistics show that computing still appeals more to males than to females. They discuss studies of abilities that demonstrate there are no gender differences in computing ability or achievement, and that when females do participate in computing programmes they perform just as well as their male counterparts. They believe that differences in gender participation and interest in computing arises directly from the way computing is offered in schools and that this facilitates the development of gender oriented perceptions in relation to computing.

Hosking (2011) agrees with this, providing a discussion on the way ICT is delivered in schools can have a direct negative impact particularly for women. ICT is skills-focused around the use of technology rather than focusing on the development of information technology. It is part of the technology curriculum as opposed to being seen as a hard-core science, which creates a negative perception for all students and particularly for those who might be the more academic or high achieving students. He goes on to say that for young girls around the age of 13 or 14, ICT is seen as a geeky subject which they would not want to pursue. This is despite the fact that the ICT industry needs graduates with high levels of soft skills and abilities around team work and collaboration, so not just hard technical skills. He suggests that the rise in social networking may influence the perceptions of young girls toward technology and what ICT can actually do, and whether it is an aspirational path for them.

However, there are gender differences reported in many areas of learning, in particular cognitive ability. Wright-Cassidy (2007) outlines findings of studies which investigated any gender differences across a variety of cognitive abilities. These included: perceptual and motor skills; memory; verbal ability; visual-spatial abilities;

and quantitative abilities. She also looked at some of the psychological and social differences between boys and girls, along with any differences in learning styles. It is important to note that while it is seen as useful to learn about gender patterns, you cannot ascribe characteristics to all, however generalisation is helpful to understand our learners and try to assist in providing effective learning environments.

The first cognitive ability discussed by Wright-Cassidy (2007) was around perceptual and motor skills. She states that gender differences exist at the lowest levels of sensation with males and females receiving information differently as it enters the brain. For example, females are better at detecting pure tone, whereas males are better at categorizing, identifying and remembering odours. Vision is also different between genders, males can detect small movements in their visual field better than females, while age-related short sightedness generally occurs earlier for women than for men. However, while males may be able to see better at a distance particularly if the object is moving, females can remember more items in a picture, being able to pick out items that have been moved faster than males can. Colour blindness is something that is much more common for males than females, it is quite rare to find females with imperfect colour vision. Differences in motor skills are also evident with studies showing that females are better at tasks that require fine motor manipulations, while males in contrast are better at motor tasks that involve throwing an object or aiming at a moving or stationary target (Nicholson & Kimura, 1996; O’Boyle, Hoff, & Gill, 1995 cited in Wright-Cassidy, 2007).

Another cognitive ability investigated was any difference between genders in relation to memory. Reviews have shown that females have better short-term memories than males, along with better memory for spatial locations, and better recognition memory (Wright-Cassidy, 2007). Even though these differences between genders were modest, females appear to perform better than their male counterparts in relation to memory. A similar outcome appears in relation to verbal abilities. Females performed better when tested on capitalisation, punctuation, writing, language usage, reference materials and reading comprehension. Halpern (2000) investigated differences around visual-spatial abilities with males appearing to have better performance around spatial and mental rotation tasks but not for spatial visualisation tasks. The data suggest that males and females use different strategies to solve some

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spatial tasks, for example, when planning a direction, females use a route strategy using room numbers and signage, whereas males use an orientation strategy relying on knowledge of direction. The final gender difference discussed surrounded quantitative abilities. Findings showed that females performed better in primary and middle schools whereas males performed better in high school particularly in the area of mathematical problem solving.

Psychological and social differences between genders also exist particularly when it comes to forming friendships and the establishment of intimacy with others. Intimacy is described as the emotional connection between two persons that arises as a result of interpersonal behaviours such as sharing, self-disclosure, and activities such as play (Wright-Cassidy, 2007). Children typically create intimacy with others by sharing in common activities, which is similar in late childhood and early adulthood, intimacy can be gained through engaging in shared discussion, self-disclosure and in forming alliances with others. The way males and females do this differs slightly. Females are more likely to establish friendships and intimacy through discussion and self-disclosure, and males are more likely to do this through shared activities such as sport. This indicates it is important for teachers to understand that male and female students make meaningful connections in the classroom in different ways. Sharing an activity with a peer will have different significance for each student; some will feel it is important to share their thoughts and feelings, while others may be content just to share in a mutual activity without having to consider any form of self-disclosure.

Gender differences in learning styles are also an important aspect to consider in classrooms and learning situations. Learning styles are an indicator of preference and ease in a particular manner of learning and are generally grouped into the three broad categories of, auditory, kinaesthetic and visual. An example of this is one person may prefer to put together a piece of furniture by working it out themselves, while another will want to follow precise written instructions. A large majority of boys, for example, tend to prefer learning that involves practical, hands-on activities representing real world tasks that are relevant to their lives. They prefer to take an active role in their learning rather than being passive or reflective observers (Irwin, 2009).

Over the years several ways have been designed to assist with characterising peoples learning styles, using different measures to assess them, many of which have documented gender and generational differences in the outcomes (Wright-Cassidy, 2007). Gurian (2011), outlines ten areas of brain-based research around learning style differences for males and females. These are: deductive and inductive reasoning; abstract and concrete reasoning; use of symbolism; use of language; logic and evidence; likelihood of boredom; use of space; movement; sensitivity and group dynamics; and use of learning teams. Each of these areas are expanded on in the following discussion.

Boys tend to be deductive in their reasoning, with girls preferring to favour inductive thinking, building general concepts based on concrete and specific examples. Males are more abstract in their reasoning, being able to calculate things without having to see or touch, whereas females are more concrete, being much better at calculating something when it is taught using objects rather than just from a whiteboard using signs and words. Boys prefer symbolic texts, diagrams and graphs, enjoying the code quality of such information, whereas girls prefer written texts. With language, on average, females produce more words than males with girls often using words as they learn, with boys tending to work silently. In regard to logic and evidence, girls generally listen better than boys, being more receptive to a greater number of details in a lesson or conversation, with boys often hearing less and having to ask for clear evidence and further instruction. Next is the issue of boredom. Boys are likely to get bored much more easily than girls. Girls are better at self-managing boredom whereas boys need varying stimulants to keep them attentive in the classroom so that they don't become disruptive and give up on their learning. Boys also tend to require more physical space when they learn, when boys and girls are put together at a table, particularly at a young age, boys tend to spread their work into the girls space, not vice versa. Movement for boys also seems important for their learning. It seems to help stimulate their brains while also managing and alleviating what can be seen as impulsive behaviour. To set boys up with jobs in the classroom, such as helping to hand out worksheets, or allowing a boy to manipulate something in their hands such as a stress ball, can all help with allowing movement to occur without being disruptive. Cooperative learning is also good for both boys and girls requiring them to abide to protocols of social interaction. At the early stages of cooperative

activities, girls often find it easier to master than boys, with boys focusing more on performing the task rather than thinking about the emotions or needs of others around them. With learning teams, again both boys and girls benefit, although they work differently with boys tending to create more structured teams and girls forming more flexible working groups. Girls spend more time managing the team process, while boys pick leaders quickly and focus on goal orientation faster than teams of girls. While looking at each of these brain-based areas of research around learning style differences for males and females, it is also of value to consider that every child is an individual and things like personalities can often play a more powerful role in forming learning styles than gender does (Gurian, 2011). One of the most important aspects to come out of assessing learning styles is to provide the stimulus for teachers to consider and reflect on the diversity in the classroom, and to use methods of teaching that engage and involve learners, including not only differences in learning preferences, individual personality attributes but also differences in gender.

### **2.5.1 Comparison of male and female achievement**

New Zealand's current national system of assessment and qualification for secondary schools - National Certificates of Educational Achievement (NCEA's) has been in place since 2004. There are three levels of NCEA ranging from Level One to Level Three including University Entrance, which span across years 11-13 or standard five to seven. Under this NCEA system individual candidates' performance is measured relative to the standards they are undertaking, not through normative scaling. This therefore, means there is meaningful achievement data that give a true indication of performance trends over time and groups rather than masking any changes in the performance of particular cohorts. Achievement data indicate that by the end of year 13, both male and female students have attained all three levels of the qualifications on a fairly even scale. However, it was reported that 10% more females than males achieved the level two qualification in one cohort. Analysis over a seven year period from 2004 to 2010 compared the performance of male and female participating cohorts in attaining NCEA Levels One to Three in a typical year since its full implementation in 2004. Results for NCEA Level One showed a difference of seven to ten percent in favour of female candidates across each year. For NCEA Level Two, again there was a consistent difference in favour of female achievement or

around nine and ten percent. However, in 2010 attainment of NCEA Level Two for both males and females increased by around four percent compared to 2009, moving from 71% to 75% for males and 80% to 84% for females. NCEA Level Three attainment results indicate a slightly bigger gap between genders ranging between eight and twelve percent. Females were at 75% in 2009, rising to 78% in 2010 compared to males who were at 63% in 2009, rising to 69% in 2010. So overall, results indicate that females are achieving NCEA in higher numbers than males but not by a large percentage (NZQA, 2011).

## 2.6 GENERATIONAL GROUPS

Generational groups and differences between these groups are based on a theory that people born within a 20 year time period share a common set of characteristics which are based on influences such as historical experiences, economic and social conditions, technology advances and other societal changes. Quinton (2005) provides a discussion on the learning preferences of our current generational groups. He believes that any attempts to accommodate the learning needs of generational groups and the new generation of ICT literate learners through the use of technologies, will enhance institutions' ability to attract and engage potential students. He also believes that a thorough understanding of the values, needs, attitudes and perceptions of today's learners must be considered when assessing the viability of the application of a new teaching tool or methodology. Many researchers have provided discussion around the naming of different generational groups. For example, Lancaster and Stillman (2002) define four key generational groups which will be used in the proposed study as a way to differentiate between the age groups of participants and to highlight trends, as the following:

Traditionalists	Birth dates: 1900-1945
Baby Boomers	Birth dates: 1946-1964
Generation Xers	Birth dates: 1965-1980
The Millenials or Generation Y	Birth dates: 1981-2000

Another, more recent generational group is being referred to as Generation Z, Generation C or Nexters. This group have been born from 2001 to the present day, however this group is not represented in this study as they are not at ages currently engaged in tertiary education.

Lancaster and Stillman (2002) describe traditionalists (and often referred to as the 'silent' generation) as a generation who were termed as 'loyal', a group who preferred to put aside individual needs and wants, and preferred to work in groups towards common goals. This group has also been referred to as the silent generation. They had faith in large corporations and often stayed with one company throughout most of their working careers. Traditionalists were made up of two generations born in the

first half of the century, and traditionalist-dominated workplaces ran very smoothly until the emergence of the younger, unorthodox generation – the baby boomers.

These baby boomers were a more optimistic, competitive group, with the availability of more jobs, a boom in the production of consumer goods, along with the promise of a good education, allowed the baby boomers to grow up with an opportunistic outlook on the world at large. The baby boomers were known as the ‘Me Generation’, mainly because they were able to focus on themselves rather than looking toward the common good as the traditionalists had done. Tapscott (2009) also referred to them as the ‘Growth Generation’. The most exciting invention and arrival for the baby boomers was the television, with the next being the fax machine. They began being able to experience important events through this new medium which they had never been able to do before (Lancaster & Stillman, 2002). Baby boomers value education and tend to be highly career focused, valuing visibility and recognition within their disciplines. In terms of communication, they are known to prefer face-to-face meetings rather than electronic modes of contact. Baby Boomers are ardent consumers of education, wanting to maintain their skill and knowledge bases, wishing to continue to work past the traditional retirement age. This is due to either financial necessity and or the desire to remain active and keep trying new things. They see great satisfaction in their professional identities and along with this like to gain certifications in their fields as part of their ongoing education. Within this education environment, Boomers like to interact with fellow students and generally prefer classroom-based programmes which allow them to establish relationships with others. However, they are comfortable with technology, and would accept online or distance learning options if there were opportunities to interact with fellow learners and lecturers in some format (Sandeen, 2008).

The next generation were the Generation Xers. Lancaster and Stillman (2002) describe this group as rather than optimistic, as being marked by scepticism. As they were entering the workforce, they were seeing large corporations being questioned on their business practices, along with a rise in divorce rates which made them distrust the permanence of both jobs and personal relationships. Due to these rising divorce rates, they were the first generation to start experiencing the complexity of blended families. Generation X children saw their fathers lose well-established jobs with

workers no longer able to rely on employers to reward dedication with long term employment and pension plans. However, this generation did see the rise of women joining the workforce. With childcare centres and afterschool programmes not yet significantly available, many members of Generation X were termed ‘latch key kids’ who were home alone after school until their parents finished their working day. In relation to careers, Generation X want portable careers and see job changing as important and necessary. As a whole, this generation tended to marry later and spent more years as single adults, many being well travelled as a result (Sandeen, 2008). Media that arose for this generation grew from just the television and fax machine for the baby boomers, to the emergence of technologies such as satellite TV, VCRS, the foundation of Microsoft and the Apple computer, video games, microwaves, pagers, cell phones, and the personal computer. This generation has also been termed the ‘digital immigrant’, with technology arriving during their lifetime rather than being born with it surrounding them (Prensky, 2001).

The next generation, the Millennials, have been known under various names which include the Echo Boom, Generation Y, the Baby Busters, the Net Generation or Generation Next. They are a smart, practical and techno-savvy generation who have grown up surrounded by technology and are able to use a wide variety of media and devices to communicate, learn, socialise and entertain themselves and each other. Because of this, they are likely to prefer distance or online learning formats and enjoy receiving learning materials via wireless devices. While the traditionalists were termed loyal, baby boomers, optimistic, and generation Xers, sceptical, the Millennials have been termed practical or realistic. They are a pressured and achieving generation with Baby Boomer or Generation X parents, nurturing and preparing them for their futures very early on in their lives. Millennials can expect their learning experiences and ongoing progress into the workforce to be as similar and diverse as the world they have grown up in (Lancaster & Stillman, 2002). This generation have had access to technology since the day they were born, and have often been referred to as digital natives (Prensky, 2001). They have grown up in a world of cell phones, pagers, the web, wikis and blogs and can easily navigate themselves around often complicated pieces of software. Information beams into the Millennials bedrooms on a minute-by-minute basis, able to access information and each other at any second of the day (Lancaster & Stillman, 2002). They are a highly

networked, connected generation and are completely immersed in technology with a strong preference for high price luxury branded goods. They are now graduating and entering the workforce, expecting rapid advancement in their chosen careers along with associated perks while also repaying often substantial student loans. Growing up, this generation received recognition for almost every achievement regardless how large or small, and this is the same in the workforce. They expect to be treated as special, and on an ongoing basis enjoy having their parents' involvement in their lives (Sandeen, 2008).

It is interesting to note that even though the age groups are depicted in generational terms, it is often exposure to technology that can have a greater effect than age on perceptions. Kirkman (2012) notes that the differences between digital immigrants and digital natives are more a result of experience rather than neural circuitry, and that the older generation can learn and possibly be ahead of the younger generation with adequate support and professional development. This is reassuring for education practitioners who have many of the Generation Y or digital natives in their classrooms. In saying this, it is the Millennial generation who appear to immerse themselves into the world of technology to the extent that they associate technology along the same lines as oxygen – they can't imagine being able to live without it (Oblinger & Oblinger, 2005). In the world of this generation, the mobile phone has become an icon, symbolising freedom and flexibility. They see mobiles as something that connects them to everything, so it becomes a natural extension of their bodies. They expect things to happen quickly, with mobile phones and texting keeping them connected with others with an emphasis on immediacy, being able to contact someone wherever, and whenever they choose. This generation think that to wait for ten minutes for a response to a text or email is too long, whereas the Boomers or the Generation Xers were happy to wait for a day or two for a reply to a social phone call or request for information (Huntley, 2006). The Millennials are a generation of multitaskers. They accelerate their opportunities around education, work entertainment by multitasking and several types of media and tasks at one time. Very rarely will they be texting their friends and doing nothing else at the same time, they are probably also surfing the net and listening to their ipod as well. They appear to be less distracted by noise and more capable of working in a variety of contexts than other generations (Pletka, 2007).

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It is interesting to see the age groups of those enrolled on the Bachelor of Information & Communications Technology degree across a two year period at the Universal College of Learning with the majority of learners sitting in the Generation Y grouping. This confirms the belief that most classrooms today are made up of mostly Gen Y students.

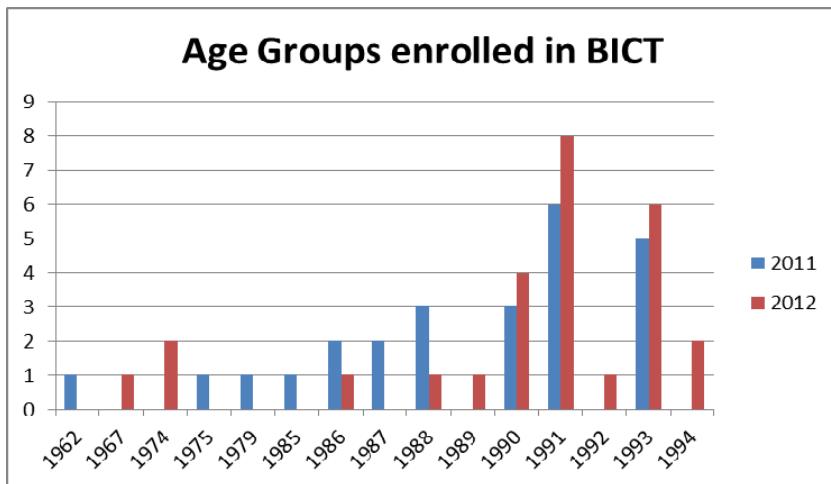


Figure 2.2. Age groups enrolled on BICT at the Universal College of Learning

As a result of this increasing Millenial generation, learning itself has undergone immense change over the last 30 years. The internet has changed the way young learners search for information, more times than not, replacing researching using Google or Wikipedia online rather than physically going to a library. Due to these changing patterns of learning, many libraries have undergone quite radical transformations. They are devoting less room for ‘on the shelf’ books and more room for computers and printers. The digitised age has meant that books in their classic form, are not the only way to convey information. Digital, or e-books are available for users to download online, either in whole forms or chapters at a time (Palfrey & Gasser, 2008).

With the Millenials using technology very differently from other generational groups, they have developed different behaviours when they are using their mobile phones or surfing the internet. Tapscott (2009) believes that this group have transformed the internet from a place where you just search for and find information, to a place where you share information and collaborate and communicate with others. They are happy

to share private details about themselves with others. They talk on Skype, share photos on facebook, and upload videos onto YouTube. Television isn't a major part of their entertainment at home as it was for the Baby Boomers or Generation X. Previous generations used to watch television for around 22.4 hours a week, carrying this activity out as passive consumers without talking back. Generation Y however, watch less television, around 17.4 hours per week, instead spending more time on the internet. They treat television more as something going on in the background, while at the same time they hunt for information, do their homework, chat with friends online or text using their mobile phones. Often when Millenials do watch television, they prefer to download the TV shows they want to see onto their computers, or prerecord them using devices such as MySky or TiVo, allowing them to watch shows in their own time and being able to fast forward through advertisements. This links back to their approach to education, wanting access to learning materials from any location at times convenient to them (Tapscott, 2009).

Lancaster and Stillman (2002), also go on to describe another group known as 'Cuspers'. This is a term given to those who have been born on the cusp between two generations, which means some may identify strongly with one generation or another, or have characteristics of both. They explain that generational identity is a state of mind shaped by many events and influences, and individuals may decide which generational group they fit into whether they were born within those years or not. Howe and Strauss (2000) agree with this viewpoint, saying that birth years are only one factor to consider when distinguishing between generations, and that instead they are shaped much more by history and experiences than their birthdates. However, regardless of which generational group our learners are born into or see themselves belonging to, it is without doubt that today's learners, no matter what their age, not only regularly engage in interactive and multiple forms of communication, they expect it. Many learners prefer to work in digital environments and are able to operate in complex technologically enhanced environments with preferences no longer around printed material, which leads researchers to believe that there is a new level of cognitive capability emerging with this new generation of learners (Quinton, 2006).

Learning styles, as discussed in the previous section in relation to gender, also have implications for different age groups. Classrooms today have to focus on the differences in students, with teachers being able to be quick and flexible to adapt to the students' different learning styles. Generation Y numbers are growing and are making up a large proportion of today's classrooms. The learning style of this generation differs somewhat in comparison to Baby Boomers and Generation X. A survey was carried out by Corich (2008), at a New Zealand tertiary institute of technology investigating the preferred learning styles of three different generational groupings (Baby Boomers, Generation x and Generation Y) and the attitudes towards the growing influence of the Generation Y students. The learning styles of each group differed around preferred methods of delivery, with one common thread between them all, this being the use of technology as an essential component of effective delivery and all liked to have support materials available online. Baby Boomers preferred logical progression of lessons, opportunities for review and reflection and teamwork. Generation X preferred clear directions, information relating to real life scenarios, interactive lessons and flexible delivery options. The Generation Y group liked short lectures, practical rather than theory, quizzes and mini tests and information around employment related skills. When asked if there were any issues around the differing learning styles, the only group to identify a problem was Generation X, who noted that many of the Generation Y group seemed to have short attention spans and were easily distracted which often resulted in a disruption to the learning for other class members (Corich, 2008).

Tapscott (2009) describes Generation Y as movers of the small screen revolution. The mobile phone is becoming their tool of choice to access not only to each other but also to the web. Parents are buying their children phones motivated by security rather than entertainment, being able to contact them when they are out and knowing that their kids can call home in an emergency. Generation Y see their phones as an indispensable social tool. Without their phones, they get anxious very quickly, they get a sense of deprivation if separated from their phones for longer than 24 hours. Many never turn their phones off, afraid they could miss out on some dramatic news at any hour of the day or night. Tapscott reports that the UK have come up with a word for the separation anxiety experienced by this generation as 'no-mo-phobia'. When asked how they would feel if they were disconnected from their

communications technologies for a whole month, the following are representative of some of the responses; nervous, dazed, unsure, tense, left behind, closed, lost, and incomplete. They feel that without their mobile devices, they are cut off from the world at large and more importantly from their social lives. Another new word or neologism to appear recently is ‘NGenophobia’. This is the irrational or morbid fear that older generations feel towards youth, especially with regards to their use of the internet. This new phobia is a representation of the looming generation gap, however in saying this, it is often the Millenials and the Boomers who are coming together in families sharing in technologies, with Boomers embracing the tools their children are using at home. Boomers and Millenials are keeping in contact a lot more than parents and children used to in the past. Through their ubiquitous access to communication technologies, both generations use these tools to connect with each other and their associated communities.

## **2.7 SUMMARY**

This literature review has provided the theoretical framework on which the remainder of this study will build upon. The chapter has outlined learning environments and questionnaires that have been used to assess these environments. The mobile learning environment has been discussed along with the development of a new instrument which was used to assess this environment. Gender and generational groups have been reviewed with a focus on technology use and preferences around learning modes. In summary, it is important that today’s tertiary institutions and educators are ensuring that decisions around teaching and learning and the use of associated technologies are evidence based and informed by empirical research. This research study has assisted in providing this evidence around the type of learning environment that is created through the use of mobile technologies for students studying in a tertiary environment. It has contributed in providing an insight into what students’ perceptions are and can provide some certainty for teachers around the benefits of using mobile technologies in the tertiary environment.

## **3 CHAPTER THREE**

### **METHODOLOGY**

#### **3.1 INTRODUCTION**

The previous chapter contains a review of the literature surrounding the use of mobile technologies in tertiary education learning environments in New Zealand. A discussion on learning environments and existing instruments that have been used to assess some of these environments were also included, along with a review of generational groups and gender with a focus on the differentiations that exist regarding the perceptions of mobile tools and technology. This chapter describes the research approach taken and provides a discussion on the development of a modified learning environment instrument for application in this study. The strategies for collecting, recording and analysing data gathered are also described in this chapter.

#### **3.2 RESEARCH AIM AND QUESTIONS**

The purpose of this study was to explore how the learning environment can be enhanced through the use of mobile technologies in order to enrich the student learning experience in a tertiary environment. This was carried out by modifying, validating and applying an existing learning environment instrument in order to assess any differences between ‘actual’ and ‘preferred’ perceptions of the use of mobile devices, and if these perceptions differ based on age and gender. This section introduces the essential research questions for this study.

1. Is the learning environment questionnaire (MOBLEI) developed a valid and reliable instrument for use in New Zealand?
2. What sort of learning environment is created by mobile technology tools?
3. What differences are there between the actual mobile technology learning environment and that preferred by students?
4. Do age and gender affect students’ responses to using the tools?
5. What are the attitudes of students toward their classes in which mobile technology is used?
6. Are there any differences in attitudes between different age groups and gender?

7. Can the learning environment be enhanced through the use of mobile technologies in order to enrich the student learning experience in a tertiary environment?

### **3.3 RESEARCH DESIGN**

This exploratory study utilised a mixed methods approach for data collection and analysis. As discussed in Chapter two, using more than one method in a single study has become a more common method in learning environment research for gathering data rather than earlier methods which often focused on the practice of gathering either qualitative or quantitative data rather than a combination of both. Fraser and Tobin (1991) provide a discussion on the merits of using questionnaires with both quantitative and qualitative questioning in order to gain a richer understanding of the learning environment. These types of questionnaires provide valuable feedback on student's views of their environments and teachers, while placing greater credibility on the findings overall when themes arise consistently from both data collection methods.

This research design is depicted in Figure 3.1:

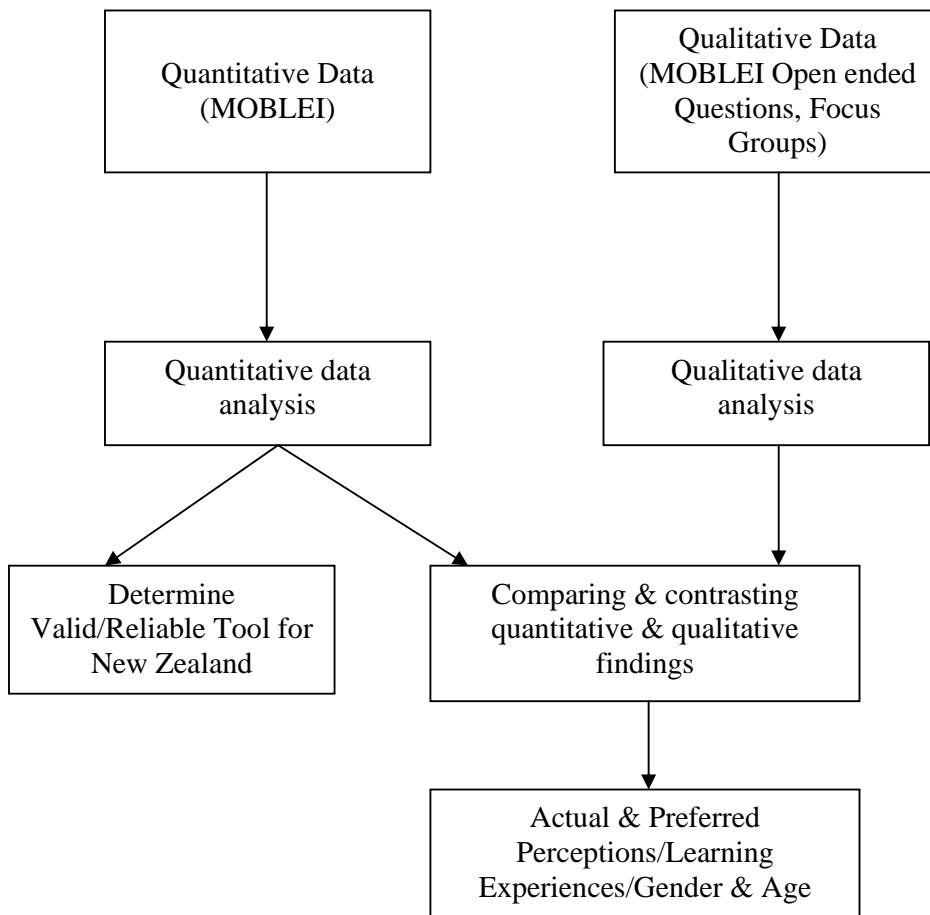


Figure 3.1. Research design

Quantitative data were gathered using the MOBLEI to aid in assessing if this modified learning environment instrument was a valid and reliable tool for use in a New Zealand tertiary environment. The instrument was then used to assess what sort of learning environment is created through the use of mobile technologies and if the learning environment is enhanced along with assessing students' attitudes towards their course, technology and self-efficacy. Differences between actual and preferred perceptions of different age groups and gender were also gathered through the use of the validated MOBLEI.

By complementing the quantitative data gathered using the MOBLEI with open-ended questions and follow up focus groups, further data were obtained which provided an

insight into students' perceptions regarding the quality of the learning environment and whether mobile technologies can enhance their learning experience.

### **3.4 DESCRIPTION OF THE MOBLEI INSTRUMENT**

The MOBLEI was created by modifying the scale items and open-ended questions used in the WEBLEI. The MOBLEI also incorporated attitudinal scales as per those that were used in the TROFLEI.

Over the years, many of the original learning environment instruments have been progressively refined and modified to suit new emerging learning environments. From a review of this learning environment literature, there did not appear to have been any studies using an existing instrument to assess the effect that mobile technologies might have on the learning environment. The Technology-Rich Outcomes-Focused Learning Environment Inventory (TROFLEI) and the Web-based Learning Environment Instrument (WEBLEI) were two instruments that were identified by the author as having potential, with modification, for application in this study.

The development of the Technology-Rich Outcomes-Focused Learning Environment Inventory (TROFLEI) by Aldridge, Fraser and Fisher (2003) drew on the What is Happening in this Class (WIHIC) questionnaire. The development and validation of this instrument was considered important as it was seen as a “widely-applicable and distinctive questionnaire for assessing students’ perceptions of their actual and preferred classroom learning environments in outcomes-focused, technology-rich classroom learning settings” (Aldridge, Fraser & Fisher, 2003, p. 175). The TROFLEI measures 10 dimensions of the actual and preferred classroom environments at high school level: Student Cohesiveness, Teacher Support, Involvement, Investigation, Task Orientation, Cooperation, Equity, Differentiation, Computer Usage and Young Adult Ethos (Aldridge, Fraser & Fisher, 2003). The attitudinal scales developed and used in TROFLEI were made up of three scales and 18 items based around Attitude to Subject, Attitude to Computer Usage and Student Academic Efficacy. Aldridge, Fraser, and Fisher (2003) provide a summary of where each of the attitudinal scales originated from. The first scale, Attitude to Subject, was based on a scale from the *Test of Science Related Attitudes* (TOSRA; Fraser 1981). The second scale, Attitude

to Computer Usage was from the *Computer Attitude Scale* (CAS); (Newhouse 2001). The third scale, Student Academic Efficacy, was based on a scale developed by Jinks and Morgan (1999).

The Web-based Learning Environment Instrument (WEBLEI) was developed by Chang and Fisher (2003) to gather quantitative data on students' perceptions of their web-based learning environment in a tertiary environment. The WEBLEI uses four scales to measure students' perceptions: access, interaction, response and results. Chang and Fisher's (2003) study found the instrument to have factorial validity and the WEBLEI scales to have acceptable reliability and discriminant validity from a statistical perspective.

The development of the learning environment instrument for use in this study was the Mobile Enhanced Learning Environment Instrument (MOBLEI) which was based on the modified versions of WEBLEI (Chandra & Fisher, 2006; Chard, 2006). Scale items were assessed for relevance to the mobile learning environment and changed accordingly to fit. In the early stages of modification, the learning environment instrument was assessed for content and face validity through a small pilot test with students who were enrolled in a range of programmes that used different delivery methods. As a result of the pilot test some changes were made to eliminate words that may not have been clearly understood by the range of participants' abilities likely to take part. For example, 'autonomous' was a word that was identified as unclear by the entire pilot group. As shown in Table 3.1 modifications to each scale item were made in order to better reflect the mobile enhanced learning environment, while still being mindful to maintain the original form of questioning used in the WEBLEI.

Within the Access scale, all eight items were modified. Examples of changes include; Question 3 changed from "I can use time saved in travelling and on campus class attendance for study and other commitments"; to "Access to my lecturer is easy using my mobile device". Question 7 changed from "The flexibility allows me to meet my learning goals"; to "Receiving information using my mobile device helps me meet my learning goals". These modifications reflect the differences between web-based learning to a mode which has a supplementary delivery method, in this case, mobile learning.

Table 3.1. Modified MOBLEI Access Scale and Items

<b>Access – WEBLEI</b>	<b>Access - MOBLEI</b>
1. I can access the learning activities at times convenient to me.	1. I can access information at times convenient to me.
2. The on-line material is available at locations suitable for me.	2. The course material is available at locations suitable for me.
3. I can use time saved in travelling and on campus class attendance for study and other commitments.	3. Access to my lecturer is easy using my mobile device.
4. I am allowed to work at my own pace to achieve learning objectives.	4. I have regular contact with my lecturer using my mobile device.
5. I decide how much I want to learn in a given period.	5. My lecturer reminds me when assessments are due using my mobile device.
6. I decide when I want to learn.	6. I decide how I want to learn.
7. The flexibility allows me to meet my learning goals.	7. Receiving information using my mobile device helps me meet my learning goals.
8. The flexibility allows me to explore my own areas of interest.	8. The mobile device allows me to get extra information on my areas of interest.

In the Interaction scale, again all eight items were modified. An example of change is reflected in the first question, Question 7 changed from “I communicate with other students in this subject electronically (email, bulletin boards, chat line)”; to “I communicate with my lecturer using my mobile device”, and Question 16 from “I was supported by positive attitudes from my peers”; to “I have been supported by positive feedback from my lecturer via my mobile device”. The changes to these scale items were made to reflect the communication channels involved which was based around lecturer to student rather than student to student.

**Table 3.2. Modified MOBLEI Interaction Scale and Items**

<b>Interaction – WEBLEI</b>	<b>Interaction - MOBLEI</b>
9. I communicate with other students in this subject electronically (email, bulletin boards, chat line).	9. I communicate with my lecturer using my mobile device.
10. In this learning environment, I have to be self-disciplined in order to learn.	10. In my learning environment, I have to be self-disciplined in order to learn.
11. I have the autonomy to ask my tutor what I do not understand.	11. I am able to ask my tutor what I do not understand.
12. I have the autonomy to ask other students what I do not understand.	12. I am able to ask other students what I do not understand.
13. Other students respond promptly to my queries.	13. My lecturer responds promptly to my queries.
14. I regularly participate in self-evaluations.	14. I communicate with other students using my mobile device.
15. I regularly participate in peer-evaluations.	15. I receive valuable information from my lecturer using my mobile device.
16. I was supported by positive attitude from my peers.	16. I have been supported by positive feedback from my lecturer via my mobile device.

The Response scale had very minor modifications to five of the scales with three remaining the same. The modifications made were only to reflect the use of a mobile device rather than a purely web-based delivery method.

**Table 3.3. Modified MOBLEI Response Scale and Items**

<b>Response – WEBLEI</b>	<b>Response - MOBLEI</b>
17. This mode of learning enables me to interact with other students and the tutor asynchronously.	17. My mobile device enables me to interact with other students and the lecturer whenever I want to.
18. I felt a sense of satisfaction and achievement about this learning environment.	18. I felt a sense of satisfaction and achievement about this learning environment.
19. I enjoy learning in this environment.	19. I enjoy learning in this environment.
20. I could learn more in this environment.	20. I could learn more in this environment.
21. It is easy to organise a group for a project.	21. It is easy to organise a get together with other students using my mobile device.
22. It is easy to work collaboratively with other students involved in a group project.	22. It is easy to work collaboratively with other students using my mobile device.
23. The web-based learning environment held my interest throughout my course of study.	23. The mobile-enhanced learning environment held my interest throughout my course of study.
24. I felt a sense of boredom towards the end of my course of study.	24. I felt a sense of satisfaction towards the end of my course of study.

In the last scale which is Results, all eight items were modified. An example of changes include; Question 26 from “The organisation of each lesson is easy to follow”; to “The information provided via my mobile device makes the content easier to follow”, and Question 28 from “Expectations of assignments are clearly stated in

my unit”; to “The content provided via my mobile device helps me with my assignment and test preparation”. These changes reflect the supplementary delivery method of the mobile tools rather than the sole delivery approach of learning material.

Table 3.4. Modified MOBLEI Results Scale and Items

<b>Results – WEBLEI</b>	<b>Results - MOBLEI</b>
25. The scope or learning objectives are clearly stated in each lesson.	25. The learning objectives of my course are made clearer by learning in this environment.
26. The organisation of each lesson is easy to follow.	26. The information provided via my mobile device makes the content easier to follow.
27. The structure keeps me focused on what is to be learned.	27. The contact with the lecturer via my mobile device keeps me focused on what is to be learned.
28. Expectations of assignments are clearly stated in my unit.	28. The content provided via my mobile device helps me with my assignment and test preparation.
29. Activities are planned carefully.	29. Information is delivered via my mobile device in a structured way.
30. The subject content is appropriate for delivery on the Web.	30. The content provided by my lecturer is appropriate for delivery via my mobile device.
31. The presentation of the subject content is clear.	31. The content provided by my lecturer via my mobile device is clear.
32. The quiz in the web-based materials enhances my learning process.	32. The tips provided by the lecturer via my mobile device enhance my learning process.

### Attitudinal Scales

In order to investigate the associations between the learning environment and student outcomes, three attitudinal scales were also included in the MOBLEI and modified based on the scales used in TROFLEI. These scales were used to address the research questions around what the attitudes of students were toward their classes in which mobile technology was used, and to assess if there were any differences in attitudes between different age groups and gender. The three modified scales were Attitude to Course, Attitude to Technology and Student Self Efficacy. As can be seen in Table 3.2 modifications were made to the TROFLEI attitudinal scales including changes to the scale headings “Attitude to Subject”; to “Attitude to Course”, and “Attitude to Computers” to “Attitude to Technology”. These changes were made, firstly from the wording “Subject”; to “Course” as students were not necessarily doing just one subject in relation to mobile learning but could be across a number of courses, and secondly, “Computers” was changed to “Technology” to better reflect the fact that students were not just using computers but additional technologies.

Table 3.5. Modified TROFLEI Attitudinal Scales and Items

<b>Attitudinal Scales – TROFLEI</b>		<b>Attitudinal Scales – MOBLEI</b>	
<b>Attitude to Subject</b>	<b>Attitude to Course</b>	<b>Attitude to Computers</b>	<b>Attitude to Technology</b>
1. I look forward to lessons in this subject	1. I look forward to learning in this course		
2. Lessons in this subject are fun	2. This course is fun		
3. I dislike lessons in this subject	3. I dislike the content of this course		
4. Lessons in this subject bore me	4. This course bores me		
5. This subject is one of the most interesting school subjects	5. This course contains some of the most interesting work		
6. I enjoy lessons in this subject	6. I enjoy this course		
7. Lessons in this subject are a waste of time	7. Topics in this course are a waste of time		
8. These lessons make me interested in this subject	8. The topics covered make me interested in this course		
<b>Student Self Efficacy</b>	<b>Student Self Efficacy</b>		
9. I'm good with computers	9. I'm good with technology		
10. I like working with computers	10. I like working with technology		
11. Working with computers makes me nervous	11. Working with technology makes me nervous		
12. I am comfortable trying new software on the computer	12. I am comfortable trying new technologies		
13. Working with computers is stimulating	13. Working with technology is stimulating		
14. I get a sinking feeling when I think of using a computer	14. I get a sinking feeling when I think of using technology		
15. I do as little work as possible using a computer	15. I do as little work as possible using technology		
16. I feel comfortable using a computer	16. I feel comfortable using technology		
17. I find it easy to get good grades in this subject	17. I find it easy to get good marks in this course		
18. I am good at this subject	18. I am good at this course		
19. My friends ask me for help in this subject	19. My friends ask me for help on in this course		
20. I fid this subject easy	20. I find this course easy		
21. I outdo most of my classmates in this subject	21. I outdo most of my classmates in this course		
22. I have to work hard to pass this subject	22. I have to work hard to pass subjects in this course		
23. I am an intelligent student	23. I am an intelligent student		
24. I help my friends with their homework in this subject	24. I help friends with subjects on this course		

### **3.5 SAMPLING AND DISTRIBUTION**

This study was conducted at the Universal College of Learning in New Zealand. Participants were students enrolled in programmes of study in the School of Business & Computing in the Faculty of Humanities & Business at UCOL. As previously stated in the Introduction chapter, lecturers were also included as active participants using the mobile tools with identified student groups aiming for increased communication between lecturers and students to help students engage in their studies. The student sample group was divided into three distinct groups; online students (web based learning), distance/blended delivery students (resource based learning off-campus), and traditional face to face on-campus students. This study utilised purposive sampling to obtain a sample of convenience and all students enrolled with a mobile phone in the courses being trialled were included in the study with no differentiation made on the basis of ethnicity.

### **3.6 DATA COLLECTION**

#### **3.6.1 Quantitative Data**

The MOBLEI was distributed in class times in a paper-based format to face-to-face students. Students who were blended or online learners were sent the MOBLEI in the post with a pre-paid return envelope.

The MOBLEI surveys were administered to student groups as described above over a period of one and a half years from November 2009 to June 2011. 141 surveys were returned. Included in the MOBLEI was a sheet asking students if they would like to take part in a follow up focus group, and if they responded yes, they provided their name and contact details. These sheets were kept separately from the MOBLEI, and once the participant's location was checked to ensure they were regionally based, a random selection was then made by selecting every fifth name to be invited to take part in a focus group session. An information sheet and consent form was then handed or sent out depending on if the student was an on campus student or studying via distance.

Two focus group sessions were carried out at UCOL, one in 2010 and one in 2011 and each session was tape recorded. A total of 12 students attended the sessions. The

sessions were run in a tutorial room at UCOL and tea, coffee and light refreshments were provided to participants. At the beginning of each session, an overview of the study was given to participants, including an explanation of mobile technologies and learning environments. Participants were also asked to give information on a separate piece of paper on demographic details such as age range, gender and learning mode, either online, blended, face to face.

Informed consent of students was sought at the time of questionnaire distribution and each student was given an information sheet and consent form (Appendix C). Participants had the right to withdraw consent to participate at any time. No personal information other than age and gender was used and participants' anonymity was maintained at all times. The procedures for safeguarding students' privacy was ensured through the provision of coded class lists and questionnaires given to participating lecturers to hand out to students during class times convenient to them. Results were then recorded against student ID numbers from the class lists rather than including student names.

### **3.6.2 Qualitative Data – Open-Ended Questions**

The qualitative data were collected through open-ended questions included in the MOBLEI. The open-ended questions were included to gather additional data from students on their perceptions of a mobile enhanced learning environment. Open-ended questioning has been outlined by Mitchell and Jolly (2004) as having the distinct advantage of being able to gather participants' views, beliefs and opinions without the power of suggestion influencing their answers. The answers to open-ended questions are in no way predetermined and impose none of the restrictions of closed or multiple-choice questions. After completing the quantitative section of the MOBLEI, students were invited to write short comments on four questions. These questions were:

1. What other mobile devices, apart from your mobile phone, would you like to use while studying?
2. What are the advantages that you have encountered of studying in a mobile enhanced environment?

3. What are the disadvantages that you have encountered of studying in a mobile enhanced environment?
4. Are there any suggestions to improve the delivery of the course in a mobile-enhanced mode?

### **3.6.3 Qualitative Data – Focus Groups**

Further qualitative data were collected through focus groups. Students were able to indicate their willingness to participate in a focus group by indicating their interest on a separate sheet within the MOBLEI. One of the most common purposes of focus groups is to stimulate an in-depth explorative investigation into a particular issue or topic that is linked to an explorative study. They are particularly useful for identifying qualitative similarities and differences among participants in an environment where a rich body of data can be gathered as the participants are responding using their own words, thoughts and feelings (Stewart & Shamdasani, 1990).

Below is an outline of the open-ended questions that were designed for use in the focus groups (which are also included in Appendix D). Participants were also asked to give information on a separate piece of paper on demographic details including age range, gender and learning mode (e.g., online, blended, face-to-face).

1. Can you describe in what way mobile phones were used by your lecturers during your programme of study?
2. Do you think the use of mobile technologies enhanced your learning experience? In what way?
3. Was the amount of contact using the mobile device appropriate?
4. Was the content delivered using the mobile device appropriate?
5. Are there any other ways you think they could have been used?
6. Do you think the contact you received via the mobile device increased your motivation? In what ways?
7. Are there any other mobile tools you would like to use e.g.; iPods, PDA's? In what way do you think they could be used?

The data from the open-ended questions were collected on the paper-based MOBLEI forms and the focus group results were tape recorded and transcribed. The results of this analysis are presented and discussed in Chapter Four of this study.

## **3.7 DATA ANALYSIS**

### **3.7.1 Quantitative Data – MOBLEI**

In this study, all quantitative data were recorded and coded in Excel and analysed using SPSS (Norusis, 2008). Data from the MOBLEI questionnaire were coded and entered as 1 (*Never*), 2 (*Seldom*), 3 (*Sometimes*), 4 (*Often*), and 5 (*Always*). The scale items on the learning environment instrument and interpretations of those scales were assessed for reliability and validity. Cronbach alpha testing was used to measure the internal consistency of the scales.

Actual and Preferred Forms of the questionnaire were analysed for perceptions on the use of mobile technologies along with attitudinal and self-efficacy perceptions, differentiations were made between perceptions of students based on age and gender using ANOVA and post hoc tests.

### **3.7.2 Qualitative Data – Open-Ended Questions**

The open-ended questions were collected from the MOBLEI forms and stored in a word document which kept a summary of all responses. To identify themes, issues or concerns, the responses to each question were grouped in order to identify emerging themes between respondents' answers. This feedback from students is summarised and discussed in Chapter Four of this study.

### **3.7.3 Qualitative Data – Focus Group Questions**

Recordings from focus groups were transcribed and reflectively analysed for any themes that arose. Again, to identify themes, issues or concerns, the responses to each question were grouped in order to identify emerging themes between respondents' answers. Results from these focus groups are also discussed in Chapter Four.

## **3.8 ADMINISTRATION**

### **3.8.1 Facilities and Resources**

No specific facilities were required to complete the study. The use of mobile phones was required but if students did not already have a mobile phone they were not expected to purchase one if they did not wish to, and therefore did not participate in the study. The UCOL computer software already in place was used to send students text messages.

### **3.8.2 Data Storage**

Data collected were both quantitative and qualitative in nature and were stored electronically while analyses were carried out. All files (electronic and paper based) were stored in my office at UCOL and transferred to my supervisor's office at the Science and Mathematics Education Centre (SMEC) at Curtin University at the end of this study and will be kept for five years after which they will be destroyed.

## **3.9 ETHICAL CONSIDERATIONS**

The researcher's role was to develop and administer the learning environment instrument to those students using the mobile tools, conduct focus groups with students and analyse and report on results. Students provided feedback via questionnaires, and some were invited to participate in focus groups sessions. Informed consent of students was sought at the time of questionnaire distribution, and participants had the right to withdraw consent to participate at any time. No personal information was used and the participants' anonymity was maintained at all times. Students only provided their name and contact details if they wished to be part of the focus groups. Students who did not wish to be sent texts from their lecturers could request for their names to be removed from texting class lists.

Approval was granted for this research by the Human Ethics Committee at Curtin University in 2008. Approval was also granted by the Research and Ethics Committee at the Universal College of Learning in 2009 (Appendix E).

### **3.10 SUMMARY**

The aim of this research was to study students' actual and preferred perceptions on the impact that mobile tools may have on their learning environment. Any differentiations of perceptions between age and gender were also investigated.

This chapter has provided a description of the methodology used to undertake this study along with a description of the newly modified learning environment instrument along with justification for using both qualitative and quantitative methods. Seven research questions have been presented which have formed the basis of this study.

The next section is Chapter Four where quantitative and qualitative findings regarding students' actual and preferred perceptions of their experiences of a mobile enhanced learning environment are presented.

## **4 CHAPTER FOUR**

### **RESULTS**

#### **4.1 INTRODUCTION**

This chapter provides the results of the quantitative and qualitative analyses based on the research questions outlined in Chapters One and Three. It also provides results and evidence around the reliability and validity of the MOBLEI for use in a tertiary environment. Actual and preferred perceptions and attitudes of students are provided in relation to the mobile learning environment, as well as data on differences between gender and age. The data are based on 141 responses from students studying within the School of Business & Computing at the Universal College of Learning, Palmerston North, New Zealand.

#### **4.2 RELIABILITY AND VALIDITY OF THE MOBLEI**

The Mobile Enhanced Learning Environment Instrument (MOBLEI) was developed based on modifying the Web-based Learning Environment Instrument (WEBLEI) originally developed by Chang and Fisher (2003) to gather quantitative data on students' perceptions of their web-based learning environment in a tertiary situation. The WEBLEI uses four scales to measure students' perceptions: Access, Interaction, Response and Results. The Access scale measures how easily students can gain access to learning materials at times and locations suitable to them. The Interaction scale measures the extent to which students participate with each other in order to achieve learning outcomes. The Response scale measures how the students feel about their learning environment, with the Results scale measuring what students have gained from participating in that learning environment. Chang and Fisher's (2003) study found the instrument to have factorial validity and the WEBLEI scales to have acceptable reliability and discriminant validity from a statistical perspective. In this study, analyses were carried out to determine the internal consistency and reliability of the MOBLEI using the Cronbach alpha reliability coefficient and discriminant validity as the mean correlation of one scale with the other scales.

Table 4.1. Cronbach Alpha Reliability and Discriminant Validity of the MOBLEI

Scales	Alpha Reliability			Discriminant Validity	
	Items	Actual	Preferred	Actual	Preferred
Access	8	0.82	0.81	0.67	0.45
Interaction	8	0.72	0.75	0.69	0.48
Response	8	0.84	0.87	0.67	0.49
Results	8	0.91	0.93	0.68	0.47

n= 140

The Cronbach alpha reliability coefficients, including both actual and preferred results, showing in Table 4.1 range from 0.72 to 0.91 for the actual and 0.75 to 0.93 for the preferred scales. These results suggest that the scales of the MOBLEI are reliable for use in a tertiary environment in New Zealand. The levels of reliability are well above the recommended accepted level of 0.6 as documented by Nunnally (1978).

In keeping with past traditions of learning environment research, the mean correlation of a scale with the other three scales was taken as a measure of discriminant validity. The mean correlation of the scales in the preferred version of the MOBLEI were all less than 0.5 which indicates that the instrument does have discriminant validity although somewhat overlapping between the scales. The correlation of scales of the actual version shows that there was a positive correlation between each of the scales which ranged from 0.67 to 0.69. However, in Chang and Fisher's study (2003) mean correlations of scales were reported ranging from 0.37 to 0.49. The results of their factor analysis confirmed that there were indeed four scales in the WEBLEI.

Taking these two studies together and given that the sample was from one institution this might have caused an increase to the mean correlation figure, however, based on the figures of this study and the previous ones, it was decided that MOBLEI could be used with confidence with New Zealand samples.

Table 4.2 displays the means and standard deviations for the actual form of the MOBLEI which represents students' perceptions around what sort of learning environment is created by mobile technologies.

Table 4.2. Actual Means and Standard Deviations of the MOBLEI Scale

Scale	Means	SD
Access	3.51	0.77
Interaction	3.36	0.70
Response	3.43	0.80
Results	3.48	0.98

n=131

The minimum score that can be obtained on any of the scales is 1, with a maximum of 5. The means on all scales were between 'sometimes' and 'often' indicating that students found the mobile enhanced learning environment a favourable environment to participate within, being satisfied with levels of access, interaction, response and results. Standard deviations also indicated that there was a fair amount of agreement between the students who responded.

With Table 4.2 showing us that students were fairly satisfied with their learning environment, the actual responses were compared against the preferred responses to ascertain if there were any differences between actual and preferred.

Table 4.3. Actual and Preferred differences of the MOBLEI Scales

Scale	Means		SD		Mean Difference (P-A)	t test
	Actual	Preferred	Actual	Preferred		
Access	3.51	4.30	0.77	0.60	0.79	13.56***
Interaction	3.36	4.10	0.70	0.60	0.74	14.25***
Response	3.43	4.10	0.80	0.76	0.67	12.12***
Results	3.48	4.23	0.98	0.80	0.75	10.08***

n=131 \*\*\* $p<.001$

To test the differences between the actual environment and what the students preferred, a t-test of equal variances was used. Results showed statistically significant differences between the actual and preferred for all of the scales with students

preferring more of everything. We know from previous research the closer you can get actual results to the preferred results, the more desirable the learning environment will be (Fraser & Fisher, 1983). These results indicate that with the provision of higher levels of access and interaction to learning materials and to lecturers and other students, the better the perceptions of response and results will be, resulting in students overall being more satisfied with their learning environment.

### **4.3 RELIABILITIES OF ATTITUDINAL SCALES**

Attitudinal scales were included in the MOBLEI in order to determine what the students' attitudes were toward their classes when mobile tools were used. The reliability of these scales are represented in Table 4.4.

Table 4.4. Cronbach Alpha Reliability and Means and Standard Deviations of Attitudinal Scales

Scales	Items	Alpha Reliability	Mean	SD
AttToCourse	8	0.83	3.93	0.60
AttToTechnology	8	0.85	4.04	0.67
StuSelfEfficacy	8	0.78	3.13	0.59

n=141

The Cronbach alpha reliability coefficients results range from 0.78 to 0.85, with means ranging from 3.13 to 4.04 suggesting that the attitudinal scales included in the MOBLEI are reliable for use in the tertiary environment in New Zealand. As in the MOBLEI scales the minimum score that can be obtained on any of the scales is 1, with a maximum of 5. Again, the means on all scales were between 'sometimes' and 'often' indicating students attitudes towards the mobile enhanced learning environment is favourable.

#### 4.4 GENDER DIFFERENCES

To investigate any gender differences in students' actual perceptions or response to using mobile tools, the total number of students involved in the study were split into two gender groups - males (74) and females (67). Mean scores for each scale item for males and females were analysed. One-way analysis of variance (ANOVA) was carried out to determine whether there were significant differences in perceptions of students according to their gender.

Table 4.5. Actual Scale Means and Standard Deviations for Gender Differences on Scales of MOBLEI

Scale	Means		SD		Mean Difference (F-M)	F Value
	Male	Female	Male	Female		
Access	3.47	3.60	0.74	0.79	0.13	0.13
Interaction	3.34	3.42	0.71	0.69	0.08	0.35
Response	3.43	3.48	0.85	0.76	0.05	2.12
Results	3.45	3.57	0.94	1.02	0.12	0.22

---

n= 74 Males, 67 Females

Though the means for males were slightly higher, there were no statistically significant differences between genders which indicates that both males and females had similar perceptions of the mobile enhanced learning environment.

To investigate whether there were any gender differences in students' preferred perceptions or response to using mobile tools, again, mean scores for each scale for males and females for each scale were analysed. One-way analysis of variance

(ANOVA) was carried out to determine whether there were significant differences in perceptions of students according to their gender.

**Table 4.6. Preferred Scale Means and Standard Deviations for Gender Differences on Scales of MOBLEI**

Scale	Means		SD		Mean Difference (F-M)	F Values
	Male	Female	Male	Female		
Access	4.20	4.40	0.67	0.46	0.2	10.46**
Interaction	3.94	4.20	0.67	0.47	0.26	4.44*
Response	4.05	4.12	0.89	0.59	0.07	10.18**
Results	4.08	4.42	0.91	0.60	0.34	13.64***

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\* $p < .05$  \*\* $p < .01$  \*\*\* $p < .001$

Analysis showed differences between males and females with all of the scales, with Access, Response and Results being the most statistically significant for both males and females. However, compared with actual results, where there were no significant differences, this time the females indicated that they would prefer more of everything for each scale.

To assess any attitudinal differences, the means and standard deviations again were analysed, along with a one-way analysis of variance (ANOVA) to determine whether there were significant differences in attitudes of students according to their gender.

Table 4.7. Attitudinal Scale Means and Standard Deviations for Gender Differences

Scale	Mean		SD		F Value
	Male	Female	Male	Female	
AttToCourse	3.89	3.97	0.68	0.49	11.16**
AttToTechnology	3.82	3.59	0.60	0.45	5.38*
StuSlfEfficacy	3.28	2.97	0.60	0.54	1.01

---

n= 74 Males, 67 Females \* $p<.05$  \*\* $p<.01$

The female mean responses to the Attitude to Course scale items were higher than males, with the male mean response higher than females for Attitude to Technology.

Student Self-Efficacy results did not show the mean results as statistically significant, however, with males having higher scores for attitude to technology, this appeared to result in higher scores for self-efficacy for males. Literature reviewed in Chapter Two around differences in males and females attitudes to technology support these findings with research often indicating that males are more confident and interested in using technology.

#### 4.4 AGE DIFFERENCES

To assess any differences based on age for actual perceptions of students' responses to using the mobile tools, means and standard deviations were analysed, along with a one-way analysis of variance (ANOVA) between groups to determine whether there are significant differences in attitudes of students according to their age.

Table 4.8. Actual Scale Means and Standard Deviations for Age Differences

Scale	Age	n	Means	SD	F Value	Post Hoc
Access	20 & Under	49	3.67	0.71	1.13	
	21-25	37	3.50	0.76		
	26-30	11	3.16	0.79		
	31-35	11	3.51	0.66		
	36 & Over	33	3.48	0.86		
Interaction	20 & Under	49	3.46	0.68	0.51	
	21-25	37	3.34	0.67		
	26-30	11	3.19	0.48		
	31-35	11	3.48	0.79		
	36 & Over	33	3.32	0.78		
Response	20 & Under	49	3.58	0.72	1.09	
	21-25	37	3.47	0.88		
	26-30	11	3.31	0.55		
	31-35	11	3.61	0.80		
	36 & Over	33	3.24	0.91		
Results	20 & Under	49	3.67	0.90	3.34*	21-25>36 & Over
	21-25	37	3.77	0.87		
	26-30	11	2.98	0.86		
	31-35	11	3.31	0.91		
	36 & Over	33	3.15	1.13		

\* $p<.05$

The Access, Interaction and Response scales showed no statistical significant differences between the age groups. However, there were statistically significant differences for the Results scale. With ANOVA analysis indicating that there were differences in the mean scores on the dependent variable (age) across the five groups, post-hoc tests were carried out to determine between which groups the differences in perceptions were for the Results scale. This post-hoc analysis showed that the difference occurred between the 21-25 age group and 36 and over group. The 21-25

age group perceived that a mobile enhanced learning environment assisted in making their course content easier to follow, learning objectives clearer, and overall enhanced their learning experience. With the 36 and over group falling into the Baby Boomer/Generation X generational groupings, this perhaps indicates that these older generations do perceive the mobile learning environment differently, and do not perceive it assists them in the same way as the younger groups.

To assess any differences based on age for the preferred perceptions of students' responses to using the mobile tools, means and standard deviations again were analysed, along with a one-way analysis of variance (ANOVA) between groups to determine whether there were any significant differences of students according to their age. However as shown in Table 4.9 no statistically significant differences for the preferred scales for any of the age groups occurred.

Table 4.9. Preferred Scale Means and Standard Deviations for Age Differences

Scale	Age	n	Means	SD	F Value
Access	20 & Under	49	4.41	0.52	1.71
	21-25	37	4.36	0.53	
	26-30	11	4.07	0.75	
	31-35	11	3.99	0.73	
	36 & Over	33	4.26	0.63	
Interaction	20 & Under	49	4.10	0.61	0.80
	21-25	37	4.16	0.52	
	26-30	11	3.95	0.68	
	31-35	11	3.88	0.75	
	36 & Over	33	3.98	0.61	
Response	20 & Under	49	4.20	0.78	1.33
	21-25	37	4.20	0.76	
	26-30	11	4.03	0.62	
	31-35	11	3.80	0.85	
	36 & Over	33	3.90	0.73	
Results	20 & Under	49	4.35	0.86	2.34
	21-25	37	4.42	0.63	
	26-30	11	3.76	0.83	
	31-35	11	3.97	0.76	
	36 & Over	33	4.09	0.84	

To assess any attitudinal differences, means and standard deviations were analysed, along with a one-way analysis of variance (ANOVA) to determine whether there were significant differences in attitudes of students according to their age group.

Table 4.10. Attitudinal scale means and standard deviations for age differences

Scale	Age	n	Means	SD	F Value	Post Hoc
AttToCourse	20 & Under	49	3.92	0.63	2.47	
	21-25	37	3.81	0.62		
	26-30	11	3.70	0.40		
	31-35	11	3.80	0.63		
	36 & Over	33	4.18	0.51		
AttToTechnology	20 & Under	49	4.22	0.63	3.59*	20 & Under
	21-25	37	4.10	0.68		>36 & Over
	26-30	11	4.17	0.57		
	31-35	11	3.99	0.63		
	36 & Over	33	3.69	0.65		
StSlfEfficacy	20 & Under	49	3.17	0.66	1.03	
	21-25	37	3.13	0.57		
	26-30	11	3.35	0.56		
	31-35	11	3.19	0.59		
	36 & Over	33	2.10	0.52		

\* $p<.05$

With the mean scores showing a statistical significant difference for the Attitude to Technology scale, post hoc tests were carried to determine between the age groups the difference occurred. This post-hoc analysis showed that the difference occurred between the 20 and under age group and the 36 and over age group with the 20 and under age groups having more positive attitudes toward the use of mobile technologies.

The 36 and over age group fit into the Baby Boomer/Generation X generational group discussed in Chapter Two, with the under 20 age groups fitting into the Generation Y or Millennials generational group. The results above which indicate that the under 20 age group have a more positive attitude to technology is not surprising as they have grown up immersed with technology as digital natives, unlike the Baby Boomers and Generation X who are digital immigrants.

## **4.5 OPEN-ENDED RESPONSES FROM THE MOBLEI**

Open-ended questions were included at the end of the MOBLEI designed to gather further comments and gain a richer understanding of the perceptions of students around the use of mobile technologies and the associated benefits, advantages or disadvantages to their learning experience and environment.

### **4.5.1 Four Discussion questions attached to the MOBLEI**

The four questions in the open-ended comments section of the MOBLEI were as follows:

1. What other mobile devices, apart from your mobile phone, would you like to use while studying?
2. What are the advantages that you have encountered of studying in a mobile enhanced environment?
3. What are the disadvantages that you have encountered of studying in a mobile enhanced environment?
4. Are there any suggestions to improve the delivery of the course in a mobile-enhanced mode?

The responses from each participant were recorded and analysed for any evident emerging themes.

### **4.5.2 Comments presented from the MOBLEI**

The first discussion question asked students to list any other mobile devices other than their mobile phones that they would like to use while studying. Many responses indicated that they were satisfied with just using their mobile phones. Of the 28 responses received, the next preferred mobile device emerged as being laptops with 8 students indicating this preference. Another device mentioned by 4 students was the ipod. The following are some of the typical responses to question 1:

**What other mobile devices, apart from your mobile phone, would you like to use while studying?**

*laptop, iPod*

*Laptop*

*My iPod*

*At the moment I am definitely satisfied with all incoming correspondence*

*Currently I use my laptop and mobile internet*

*Laptop*

*Tablets that use the cell network.*

*Laptop*

*Laptops with content optimises for wireless speeds*

*PDA and laptop*

*Laptop – it has wireless access to the internet and can be used anywhere inside/outside the campus as long as the user is in range*

*Wireless enabled iPads and PDA's*

Question number 2, asked students to comment on any advantages they had encountered while studying in a mobile enhanced environment. Eighty responses were provided for this question with themes emerging from the responses being around ‘ease of communication’, ‘reminders’, ‘access’, and ‘class time/exam changes’. Other comments were around preferring to receive texts than emails from their lecturers as they only checked emails every few hours, whereas their mobile phones were always with them. Overall, all students that provided responses to the open-ended questions appeared to appreciate receiving messages and contact from their lecturers via their mobile phones. This supports the results from the quantitative data with means on all scales showing as being answered at ‘sometimes’ and ‘often’ indicating that students find the environment a favourable one to participate within. Below are some of the typical responses to question 2:

**What are the advantages that you have encountered of studying in a mobile enhanced environment?**

*When classes have changed I do not need to worry about checking my email'*  
*easy communication*

*easier communication i.e.; room changes and meetings with lecturers and other students*

*reminders for deadlines and assessments – convenience*

*reminders for assignment due dates*

*that I know if I need to go in for a resit assessment or not. Also when our next assignment is happening*

*knowing in advance about tests and assignments*

*any changes on the timetable the lecturer can easily inform us through texting, this is helpful as often checking an email is not always easy*

*I can prepare for tests etc as I am reminded of the dates and times via my mobile*

*getting reminders about assessments*

*I can receive valuable information related to the paper immediately*

*It allows my study life to smoothly integrate with my personal life in a way that does not interfere with the other*

*Reminders of when assignments are due to when we especially have to be in class. Also when marking is ready to be picked up.*

*The information is received immediately because we have our phones with us and we don't have to waste as much time with email which you may not check for a few hours*

*The information reaches everyone at the same time. If I don't have my phone with me one of my friends will have it and they tell me or ask if I have got it*

*Reminders of assignments or exam locations and times have kept me up to date and on track.*

*Being able to contact lecturers outside of class with no internet/home phone available for me at home*

*Lecturers can give us updates of class changes and times*

*Messages get across faster to more people*

*Getting friendly reminders*

*Remembering room changes and what if anything where are supposed to bring to class. Reminders about tests*

*The benefits of being monitored and reminded is awesome*

*Reminders to be ready for assessments*

*You always know when your assignments are due*

*Unobtrusive reminders*

*It is an easier way to communicate with the tutor and other students*

*Am well informed.*

*Easier to keep up with assignment deadlines as sometimes I forget.*

*Fast and up to date information and/or feedback.*

*Quick reminders when things are due for coming up. Especially good over mid semester breaks.*

*Its small and easy to carry on the move*

*Keeping track of class times and exams and any changes that may apply.*

*Reminders of due dates come in handy*

*You get info on the course without having to check your emails*

*Used to remind me of deadlines and due dates. Very handy.*

*Getting messages from the lecturer when the labs are due. Also messages regarding classes, lab sessions etc.*

*You always know when exams and assignments are coming up.*

*Having communication with you at all times, receiving and sending immediately*

*Know the latest information immediately*

*Makes lecturers readily available whenever needed, also a better way to be able organise study groups.*

Question 3 asked students to provide feedback around any disadvantages they had encountered while studying in a mobile enhanced learning environment. It was useful to gain qualitative feedback around any disadvantages of using mobile technologies, as this data was not represented in the quantitative results. Of the 42 responses received, the main themes that arose were around ‘distraction’, and ‘connectivity issues’. Some students talked about receiving texts from one lecturer while in class with another lecturer, and commented that this was discourteous to the lecturer whose class they were in at the time. Some interesting comments were also noted around

becoming too dependent on receiving reminders from their lecturers around due dates for assessments. The theme emerging here links to discussions in the literature review around the importance of professional development for teachers to ensure they are aware of when and how to effectively integrate the use of technologies into students' learning. Again, listed below are some of the typical responses to question 3.

**What are the disadvantages that you have encountered of studying in a mobile enhanced environment?**

*distraction and sometimes texts aren't received*

*distractions during lectures*

*sometimes I receive text messages late ie; sometimes there are delays in sending and receiving*

*cellphones ringing/buzzing in one class as we were receiving messages from another lecturer. Ten cellphones buzzing at once was a distraction and discourteous to that tutor*

*Network coverage issues – not receiving messages*

*I haven't encountered any disadvantages*

*Can be distracted*

*Sometimes texts can arrive too late. A day or night before reminders would be better as phone not always turned on in time.*

*None, although too many messages may be intrusive.*

*Lack of connectivity sometimes*

*People need to know how to put their devices on silent.*

*Sometimes become dependent on it for due dates etc*

Question 4 asked for any ideas or suggestions they had on improving the delivery of their courses in a mobile enhanced learning environment. Of the 24 who responded to this question, the main theme that arose included students wanting all of their lecturers to text rather than just some of them. Some comments arose around students not always having credit on their phones meaning that they couldn't text their lecturers back. Quantitative analyses did show some differences around how the students actually perceived their environment and what they preferred, with most indicating they would prefer more of everything. These qualitative responses assist in

learning what these preferred perceptions are, providing suggestions for improvement to their learning environment. Some of the typical responses were:

**Are they any suggestions to improve the delivery of the course in a mobile-enhanced mode?**

*ensure people update numbers regularly*

*more tips like what book the information is in if we have started a new topic*

*Receiving messages in a classroom from a tutor gives mixed messages to younger students who would like to text friends in a classroom situation'*

*More texts from all our lecturers not just come of them*

*In my opinion, only students who are extramural who simply can't be on campus need to have access to mobile learning.*

*I like the idea, just simple texts for me. When it is a huge paragraph that's when I stop reading.*

*Make it so it happens at a certain time and day*

*Lecturers should text as well as email because some people don't have internet at home or may not have a phone*

*No. I am completely satisfied with the delivery of this course via mobile-mode.*

*Video links from lectures and tutorials*

*The mobile texts are a nice reminder to submit assignments closer to the time.*

*keep online students motivated and reminding them their lecturer actually wants them for us to pass.*

*All lecturers should send assignment deadlines via text.*

*Use it more, all lecturers should*

*Make texting back to lecturers free – sometimes having credit on your phone can be an issue*

*Give students credit on their phones to ensure can text back to lecturers*

*Having marks texted to you would be good. But having a tutor text you saying an assignment is due is a new experience, that is a huge positive.*

## 4.6 FOCUS GROUPS

Students were asked on a separate sheet included in the MOBLEI to indicate their willingness to take part in a focus group to further present and discuss their

perceptions around the use of mobile technologies. Of those that indicated their willingness to attend a focus group, once the participant's location was checked to ensure they were regionally based, a random selection was then made by selecting every fifth name to be invited to take part in a focus group session. An information sheet and consent form were then handed or sent out depending on whether the student was an on campus student or studying via distance.

#### **4.6.1 Description of the Focus Groups**

Two focus group sessions were carried out at UCOL, one in 2010 and one in 2011 and each session was tape recorded. A total of 12 students attended the sessions. The sessions were run in a tutorial room at UCOL and tea, coffee and light refreshments were provided to participants. At the beginning of each session, an overview of the study was given to participants, including an explanation of mobile technologies and learning environments. Participants were also asked to give information on a separate piece of paper on demographic details such as age range, gender and learning mode, either online, blended, or face-to-face. Gender and age ranges were fairly well represented, along with blended and face-to-face learners, however there were no online students at the focus groups. This is most probably because many students in this delivery mode are not from within the region, therefore not that willing to come onto campus.

#### **4.6.2 Focus Group Questions**

The following are selected quotes from participants' responses to the focus group questions.

##### **Question One**

**Can you describe in what way mobile phones were used by your lecturers during your programme of study?**

*Mainly for assessment reminders and any class changes*

*Study tips*

*Notified when results were ready to collect*

### **Question Two**

**Do you think the use of mobile technologies enhanced your learning experience?**

*Really like the reminders*

*Definitely enhances the whole learning experience*

*Yes, it made me feel like my lecturer cared about me, and was willing to talk to me using my tools*

*I liked getting advice after lectures on additional stuff to look up as extra learning*

*As a distance student I really liked getting texts at different times, felt like I was noticed even though I wasn't on campus much*

### **Question Three**

**Was the amount of contact using the mobile device appropriate?**

*I think the amount of contact was great – keep it coming*

*Would like to see all of our lecturers using it*

*Bring it on – I always have my mobile with me – is like my baby I can never leave alone.*

*Could increase frequency of texts*

*Would be good to get texts that remind you that there is a lecture today and what the topic is going to be and what time*

### **Question Four**

**Was the content delivered using the mobile device appropriate?**

*Would be good to have different texting group options, so could choose to belong to a group that is just for assessment reminders, or one that is for assessment reminders and study tips etc.*

*I was glad that they didn't send us things that I would have needed a smartphone for because I only have a cheap standard mobile phone*

### **Question Five**

**Are there any other ways you think they could have been used?**

*Could be good to get a wake up text every morning – save us setting an alarm!*

*I would like it if the library could send us texts when our books were overdue – save on fines.*

*Would be good to get assessment results sent via text, especially exam results*

### **Question Six**

**Do you think the contact you received via the mobile device increased your motivation?**

*Yes – increase to motivation to turn up to things if had a moment of thinking ‘oh, I might not bother going to class today’.*

*Always good to get reminder of stuff.*

*Yes, feeling noticed and cared about by the lecturer was really good*

*I felt like it mattered if I came to class or not because if I didn’t, I would get a text from my lecturer*

*Getting a reminder for an assessment got me motivated to get started and hand in on time*

### **Question Seven**

**Are there any other mobile tools you would to use eg; ipods, PDA’s? In what way do you think they could be used?**

*Smartphones once they are cheaper could be used for heaps more than just reminders  
ipods could be good if could download lectures and listen to while on the bus heading home or I couldn’t get to a lecture.*

*Apps for your iphone*

*Give every student an ipad*

*An app like Moodle that can run on your iphone with an interface designed to run on a small screen.*

*Would be good to have access to timetables from your phone*

Below is a selection of statements made when participants were asked if there were any additional comments participants would like to add:

*Just get all of our lecturers to use it would be great for consistency knowing they will all contact you using texts*

*Would prefer it if we could reply to the texts without it costing us anything*

*Could use for texting for organisation wide information; library book overdues, outstanding paper fees, enrolment confirmations, need to enrol for the following years papers.*

#### **4.6.3 Summary of Focus Group Discussion**

The focus groups were valuable in gaining further insight into the students' experiences and perceptions of their mobile enhanced learning environment. They found that the majority of texts they received were for assessment reminders, study tips and advice on test results. All participants were in agreement that receiving texts had made a difference to their learning experience with comments that they appreciated being noticed by lecturers and had a heightened sense of being cared about. The students considered the level of contact from their lecturers via texts was very appropriate which correlates to the questions asked in the Results scale in the quantitative section of the MOBLEI, however the overwhelming response from participants was for an increase in the use of texts, both in frequency and consistency, ie; more widely used by all lecturers. This feedback confirms the comments made in the open-ended questions and the results from the quantitative analyses, showing that students preferred more of everything in regard to a mobile enhanced learning environment. When asked whether the content of texts was appropriate, the comments were positive and the participants confirmed that they would not want to have too much content sent via text as some did not have phones capable of viewing more than just a text message.

Suggestions of other ways mobile devices could have been used were for administration type advice such as library books being due and receiving exam results. All of the students believed that their motivation to study and attend classes had increased through the increased communication they received via texts. Just the fact that their lecturer cared or might notice them not being in class was enough to motivate them to get out of bed in the morning. When asked what other mobile tools they would like to see used and how they would use them, responses varied from smartphones, iPods, and iPads including suggestions for the creation of applications like moodle that could interface with their smartphones enabling them to access learning materials via their phones.

Final additional comments from participants reconfirmed some of the above responses with students wanting all of their lecturers to use texts as a preferred method of contact, as well as being very keen for the use of texting to be used not just by their lecturers but for organisation wide information, receiving texts around enrolment confirmations, library fees, and outstanding paper fees. These comments align with the responses given to the Access and Interaction scales in the MOBLEI, which asked students questions around accessing information at times convenient to them, having easy access and interaction with their lecturer, and being supported by positive feedback from their lecturers via their mobile phones.

#### **4.7 SUMMARY**

This chapter has presented the quantitative and qualitative results providing findings around the central research questions presented in chapters one and three. It has presented data confirming the validation and reliability of the MOBLEI and attitudinal scales for use in a tertiary institution in New Zealand. Mean results of scale items around actual and preferred perceptions of students were presented, showing some variances with students preferring more access, interaction, response and results in relation to their learning environment than they perceived they were actually experiencing.

Data around actual and preferred perceptions of the learning environment between genders were outlined as well as differing perceptions of age groups in order to ascertain if gender and age affected students' responses to using mobile tools.

Statistically significant differences were reported for both genders around their preferred learning environment with females preferring more on all of the scales. Differences between age groups were presented with variances occurring between the 21-25 and 36 and over age groups for their actual perceptions of the results scale item, and between the 20 and under and 36 and over age groups for attitudes to technology, with the 20 and under group having a more positive attitude towards technology.

Qualitative data around open-ended comments and focus groups were also presented providing further insight into if the use of mobile technologies had enriched their learning experience.

The next section is Chapter Five which includes an overview of the study including a discussion on the major findings and answers to the specific research questions. Final conclusions and practical implications are also presented.

## **5 CHAPTER FIVE**

### **CONCLUSION**

#### **5.1 INTRODUCTION**

In this concluding chapter, an overview of the study, along with its major findings and answers to the research questions, including implications and limitations of the study are presented and discussed. Final conclusions and recommendations for further research are also discussed.

#### **5.2 OVERVIEW OF THESIS**

This research study investigated variations in perceptions and attitudes of students studying in a mobile technology enhanced learning environment in a tertiary learning institution in New Zealand. To gather data a new learning environment questionnaire was developed based on modifying the existing Web Based Learning Environment Instrument (WEBLEI). Using the newly developed questionnaire and results from the validated Mobile Enhanced Learning Environment Instrument (MOBLEI), differences in perceptions around gender and age were explored. Conclusions for each of the research questions were drawn from the MOBLEI survey analyses and from the open-ended questions included in the MOBLEI and the follow up focus groups.

Chapter One introduced the background to this study providing an outline of learning environment research on which the theoretical basis of this study was formed. An overview of the methodology was provided along with the context in which this research was based. The specific research aim and research questions were also outlined.

Chapter Two reviewed the literature surrounding learning environments and questionnaires on which the theoretical framework for this study was based. The use of mobile technologies in learning environments was provided along with a discussion on gender and age, and differences between males and females and generational groups, in relation to learning and technology.

Chapter Three described the research approach taken, the research design and methodology and provided a discussion on the development of the learning environment instrument showing where modifications had occurred from the original WEBLEI questionnaire. The strategies for collecting, recording, and analysing the data were also described in this chapter.

Chapter Four presented the qualitative and quantitative analyses. Results were presented showing the reliability and validity of the MOBLEI and also for the three attitudinal scales. Differences in responses were examined pertaining to actual and preferred perceptions of differing genders and age groups.

The current study outlines the results from a modified learning environment instrument designed to assess the actual and preferred perceptions and attitudes of students in a mobile enhanced learning environment in a New Zealand tertiary institution. Varying perceptions of this learning environment for males and females and different age groups were also outlined, with an aim to provide direction for an ideal mobile enhanced learning environment for education practitioners in the tertiary environment. The sample included 141 business and computing certificate, diploma and degree students at the Universal College of Learning in Palmerston North, New Zealand. This study is unique in developing and implementing the use of a Mobile Enhanced Learning Environment instrument to assess this learning environment in a tertiary setting.

### **5.3 MAJOR FINDINGS OF THE STUDY**

The aim of this study was to investigate how the learning environment can be enhanced through the use of mobile technologies. The overall objectives have been to trial the mobile device to targeted student groups and to modify, validate and apply an existing learning environment instrument in order to assess any differences between actual and preferred students' perceptions of the use of mobile devices, and if these perceptions differ based on age and gender. The findings are summarised in order of the research questions presented in Chapters One and Three of this study.

**Research Question 1: Is the learning environment questionnaire developed (MOBLEI) a valid and reliable instrument for use in New Zealand?**

The results in this study that were presented in Chapter Four illustrate that the newly developed MOBLEI is a valid and reliable instrument for use in the tertiary environment in New Zealand. To determine the validity and reliability of the questionnaire, Cronbach alpha reliability coefficients and discriminant validity were assessed. The results of this analysis showed that the Cronbach alpha coefficients, including both Actual and Preferred Forms, ranged from 0.72 to 0.91 for the Actual scales, and 0.75 to 0.93 for the Preferred. This clearly suggested that the scales of the MOBLEI are reliable for use in a tertiary environment in New Zealand. The mean correlation of the scales in the Actual Form showed a positive correlation between each of the scales which ranged from 0.67 to 0.69 indicating that scales do overlap. However, the preferred scales all were less than 0.5, and this when compared with values in previous studies (Chang & Fisher, 2003), indicated the instrument did have discriminant validity. The three attitudinal scales included in the MOBLEI (Attitude to Course, Attitude to Technology, and Student Self-Efficacy) were also assessed for reliability. The Cronbach alpha reliability coefficients results ranged from 0.78 to 0.85 again indicating that they are reliable for use in the tertiary environment in New Zealand. These results indicate that this study provides a valuable contribution to the learning environment field of research and body of knowledge by providing a new questionnaire that can be used to assess mobile enhanced learning environments. With further use across institutions, and with larger studies either nationally or internationally, this will also provide further and ongoing validation of the newly developed questionnaire.

**Research Question 2: What sort of learning environment is created by mobile technology tools?**

To gather data pertaining to what students perceived their mobile learning environment to be, scale means and standard deviations of the Actual Form of the questionnaire were analysed. This analysis indicated that all students answered all four of the scale items – Access, Interaction, Response and Results as ‘Sometimes’ and ‘Often’. This implied that students found the mobile enhanced learning

environment a favourable one to participate within. Specifically, it showed that students found that they liked the level of access to course materials and their lecturer at times and locations suitable to them which was reflected in both the quantitative and qualitative results. They liked the interaction the environment provided allowing them to communicate and receive feedback from their lecturer easily. They felt that the mobile enhanced environment enabled them to work collaboratively with others and they also felt satisfied and motivated throughout their course. They believed that the content and objectives were easy to follow and the contact with their lecturer resulted in keeping them focused and well prepared for assessments.

**Research Question 3: What differences are there between the actual mobile technology learning environment and that preferred by students?**

As noted in previous studies it is of interest to ascertain if there are any differences between the actual and preferred environments of learners. Previous research has found (Fraser & Fisher, 1983) that if there are differences in perceptions, the closer you can get the actual environment to the preferred, the more satisfied learners will be. To test for any differences between the perceptions of the actual mobile enhanced learning environment and what the students preferred, t-tests were carried out. These t-test values showed significant differences between the Actual and Preferred Forms for all four of the MOBLEI scales, namely, Access, Interaction, Response and Results.

With the preferred scales being statistically significant from the actual scales, this indicated that the provision of higher levels of access and interaction to learning materials, lecturers and other students, the better the perceptions of response and results will be, resulting in students being more satisfied with their mobile enhanced learning environment. Notwithstanding this, the results did not indicate that students were unhappy with the actual environment they were participating within, just that they would prefer more of everything. This could be addressed by encouraging all lecturers to use texting to provide an additional layer of communication and interaction for students.

**Research Question 4: Does age and gender affect students' responses to using the tools?**

An ANOVA was performed to determine if there were any differences between males' and females' perceptions or response to using the mobile tools. Males and females were fairly evenly represented in this study, with 74 males and 67 females providing responses. Results showed that even though the means for males were slightly higher, there were no statistically significant differences between genders, indicating that both males and females had similar perceptions to the learning environment. The literature reviewed around gender and ICT in chapter two indicated that males are more highly represented within the ICT industry but that gender did not have any impact on capability of the use of technologies and that when females do participate in computing programmes of study, they perform just as well as their male counterparts. However, in saying this, studies showed that there was often a difference in levels of interest, attitude and confidence, with females being happy to use technology as a tool, just not to necessarily pursue a career in the industry (Teague & Clarke, 1995). It was noted that these perceptions are often a result of the way computing is offered in schools, and due to a lack of female role models in the industry. Discussions around a positive institutional culture and the connection this has with providing a beneficial learning environment for both males and females was also provided (Hayes & Flannery, 2000). Of the male and females who participated in this study, it is encouraging to see that the environment that they participated in seemed to provide equal levels of satisfaction for both genders. These results indicated that neither gender felt that they were disadvantaged by the use of technologies, and that they felt supported in their learning through the use of the mobile tools. When looking for any differences between the actual and the preferred environment provided by mobile technologies, analysis showed that there were some differences between genders, most notably with females, who preferred more of everything for each scale. When compared with the actual results, where there were no significant differences, this shows there is still some work to do around refining the mobile enhanced learning environment for females.

To assess any differences in perceptions based on age, first an ANOVA with age groups as the main effect, was carried out to determine if there were any significant

differences. These results showed no differences for the Access, Interaction and Response scales, however there were statistically significant differences for the Results scale. To determine between which age groups these differences occurred, post-hoc analyses were performed. This revealed that the 21-25 age group perceived that the mobile enhanced learning environment was a more favourable environment to study in than did the 36 and over age group. This was particularly evident for the Results scale, indicating that the younger age group found the information provided via their mobile phones made content and assessment preparation easier to follow, with tips and contact with their lecturer keeping them focused and enhanced their learning process. With the 36 and over group falling into the Baby Boomer/Generation X generational groupings, this appears to suggest that these older age groups do perceive the mobile learning environment differently, and perhaps perceive it as assisting them differently than the younger groups do. The literature does suggest that the younger generations perceive technology as an extension of themselves, associating technology along the same lines as oxygen – that is being unable to live without it (Oblinger & Oblinger, 2005). This may be where the differences in perceptions occur, with the older generation perceiving and using technologies quite differently both in their daily lives and for educational purposes, more as a useful aid in their lives but not something they cannot live without.

However, even though there were some differences in perceptions on the actual environment, when assessing for any differences between the actual and preferred environment between the age groups, no significant differences occurred. This indicated that all students who participated in the study, regardless of their age group, were fairly content with the way technologies were used to support their learning, and didn't prefer for them to be used any differently than they actually were.

**Research Question 5: What are the attitudes of students toward their classes in which mobile technology is used?**

To assess the attitudes of students towards their course, technology and their perceived self-efficacy, means and standard deviations of the responses to scale items for the three attitudinal scales were analysed. With students indicating their scores between ‘Sometimes’ and ‘Often’ this meant that they had reasonably positive

attitudes toward their learning environment and found it a favourable experience to participate in. As Mellow (2005) states, learning opportunities have become more available for all learners with the use of the internet, technologies and on-line or distance learning. Mobile technologies and mobile learning have gained in popularity with more and more students using wireless devices to access both learning materials and their lecturers than ever before, and those students who are studying in today's tertiary learning environments expect technology to be part of the delivery. Convenience and ease of access seem to be key to many students' attitudes around education and with mobile technologies providing this flexibility, students' attitudes were therefore more positive.

**Research Question 6: Are there any differences in attitudes between age groups and gender?**

An ANOVA was performed to determine if there were any significant differences between males and females attitudes to using mobile tools. Significant differences were revealed for Attitude to Course and Attitude to Technology but not for Student Self-Efficacy. They showed that females had a higher mean response in their attitudes to their course, whereas males had a higher mean response for their attitude to technology. However, in saying that there were no statistically significant differences around self-efficacy for either males or females, results for males showed higher scores for attitudes to the use of technology. This then appeared to result in higher scores for self-efficacy for males. This supports previous studies around males displaying higher levels of confidence and interest in computing and technology (Bain & Rice, 2007).

To assess any differences in attitudes based on age, an ANOVA was carried out to determine if there were any significant differences. These results showed only one statistical significant difference, this being for Attitude to Technology. To determine between which age groups these differences occurred, post-hoc analyses were performed. This revealed that the 20 and under age group had more positive attitudes to the use of technology than did the 36 and over age group. These results correlate with the findings from research question 4 - does age and gender affect students' responses to using the tools? Results for both questions indicate that the younger age

group have a more positive attitude and perception around the use of mobile technologies in their learning environment. This is likely due to the fact that this younger age group have grown up as digital natives immersed in technology from the day they were born, and interact with current and new technologies on a daily basis therefore expecting it to be integrated into their learning environments.

**Research Question 7: Can the learning environment be enhanced through the use of mobile technologies in order to enrich the student learning experience in a tertiary environment?**

Open-ended questions and focus group discussions were used to gain further insight into whether students believed that their learning environment was enhanced by the use of mobile technologies. Analysis of these qualitative findings provided feedback on perceptions of advantages, disadvantages and the appropriateness of using mobile technologies in a tertiary environment. Students were asked if there were any other mobile devices they would like to use with answers being laptops, iPods, and iPads. This supports Rickards (2003) view that technology-based futures in education will always be linked to the technology that is currently available. Feedback on the advantages of using mobile tools was sought, with the main themes arising in regard to ease of communication with lecturers, excellent for receiving reminders, easy to access course information, and notification of class time/exam changes. Mellow (2005) noted ease of access as one of the main advantages of mobile learning, with Kossen (n.d.) also saying that a key benefit of mobile learning is its power for making learning even more widely available to learners than ever before.

When asked about any disadvantages to studying in a mobile enhanced environment, comments mainly arose in regard to distraction and connectivity issues. Comments about distraction show the importance of a coordinated approach from lecturers so they are making contact with students at appropriate times. The feedback on connectivity issues illustrates the importance of the use of multiple methods alongside texting such as emails and messages via learning management systems when contacting students, particularly for important messages. When asked for further thoughts around the use of the tools, many students responded saying they would like

all of their lecturers to text them rather than just some of them, along with administration staff for non-academic based information.

The focus groups confirmed the findings in the open-ended questions with all participants in agreement that receiving texts had made a difference to their learning experience with comments that they appreciated being noticed by lecturers and had a heightened sense of being cared about. All of the students believed that their motivation to study and attendance in classes had increased through the increased communication they received via texts.

The responses from the open-ended questions and the focus groups provided another layer of data along with the quantitative analyses to assist in interpreting the perceptions of students. These responses have confirmed that the mobile enhanced learning environment is a positive one for those students who participated in the study. The provided valuable insight for practitioners and for the future delivery of mobile enhanced learning environments in a tertiary setting.

#### **5.4 SIGNIFICANCE OF THIS STUDY**

This study has made an important contribution to the body of knowledge in the field of learning environment research. It has provided validation of a modified learning environment instrument to enable practitioners and researchers to assess the use and application of mobile technologies in a tertiary environment in New Zealand. It has also provided new information on the use of mobile technologies and that students do find it a favourable environment to participate within in regards to Access, Interaction, Response, and Results. The study has led to a greater understanding of how gender and/or age is associated with the use of technologies and perceptions and attitudes of the learning environment. Finally, it has provided insight into the implications for teaching practice at tertiary level by providing evidence that the more access to learning materials and increased communication with students using mobile technologies heightens their sense of satisfaction and motivation towards their studies.

## 5.5 PRACTICAL IMPLICATIONS OF THIS STUDY

The MOBLEI which was developed for use in the tertiary environment in New Zealand has been shown to be a valid and suitable tool for use in the tertiary environment. This instrument was developed by modifying the original form of the WEBLEI developed by Chang and Fisher (2003). Through the use of the MOBLEI, considerable insight into the mobile learning environment and students' perceptions and attitudes were obtained. This awareness of the mobile enhanced learning environment provided valuable feedback in assessing the impact of the use of mobile technologies in the tertiary environment. The results of the analysis showed some differences between the actual and preferred perceptions of the mobile learning environment indicating that there is room for improvement and a need to reflect on ways to bridge the gap between these actual and preferred perceptions. Practitioners need to be using mobile technologies to provide as much access and interaction as possible in order to increase students' perceptions around response and results to provide an ideal learning environment. Practitioners also need to be aware of differences in the classroom including gender and age groups and to be sensitive to these different groups, offering not just mobile technology options but to integrate the use of these tools into their teaching alongside other delivery methods to ensure they are reaching and engaging all learners.

Professional development for lecturers around the use and application of mobile technologies within the teaching environment is essential to ensure the tools being used are based on sound pedagogical approaches. This includes ensuring there are coordinated approaches in regard to the design, planning and evaluation of mobile enhanced learning environments. Baird and White (1996) purport that for effective change and the successful integration of new teaching methods to occur certain conditions must apply, these being time, opportunity, guidance and support. They go on to say that educators must always be striving to ensure they are evaluating what they do in order to provide valuable teaching and learning experiences for both themselves and their students.

## **5.6 LIMITATIONS OF THIS STUDY**

The limitations of this study can be categorised into two broad areas. These being sample group and sample size.

### **5.6.1 Sample Group**

No differentiation was made on the basis of ethnicity. This study looked at any differences in perceptions from difference age groups and gender, it would be of interest to also determine any differences in perceptions based on participants ethnicity. Another limitation around the sample group was that only students from one institution were surveyed. It would be of interest to gain further insight into perceptions by broadening this study across multiple institutions.

### **5.6.2 Sample Size**

The sample size of this study was relatively small with 141 participants responding to the surveys. However, this study did represent a good cross section of students from certificate, diploma and degree programmes of study.

## **5.7 SUGGESTIONS FOR FURTHER RESEARCH**

To further validate the MOBLEI, a similar study to this could be carried out across a number of tertiary institutions. Additionally the use of the MOBLEI in another county other than New Zealand could be trialled to further test the reliability and validity of the instrument. It would also be of interest to replicate this study and include ethnicity as another variable to measure, along with the use of a larger sample size which would again further validate the questionnaire. This study did utilise students from three different learning approaches, blended, online and face-to-face, however, differences in perceptions of these groups was not reported and could be an opportunity for further study. Another area for further investigation could be to measure students' cognitive outcomes against their perceptions and attitudes of a mobile enhanced learning environment.

## 5.8 FINAL COMMENTS

This study has provided an insight into the application of mobile technologies in a tertiary learning environment, and the resulting perceptions of students on the use of these technologies to support their learning. Differing results based on gender and age have shown that both males and females were content with the mobile enhanced learning environment with neither group feeling disadvantaged or disliking the use of mobile tools. There were some differences in perceptions for age groups, with the younger generation having more positive attitudes towards the use of technology in their learning. Incorporating mobile learning into teaching practices is one way to provide multiple learning options for students, and is seen as working best when used as part of a blend of delivery approach using mobile devices as a supplementary method to provide another layer of communication and interaction with students (Duncan-Howell & Lee, 2007).

Being able to accommodate the learning needs of all generational groups and genders including the new generation of ICT literate learners is key to attracting and engaging students along with a good understanding of their attitudes and perceptions. The successful introduction of mobile technologies in the classroom is through professional development for the teachers involved, enabling them to change traditional pedagogical approaches. Effective professional development enables these educators to change their instructional practices to successfully infuse technology into their teaching and incorporate the effective use of mobile technologies as a delivery tool (Liu, 2007).

This research study contributes in providing evidence and more confidence for educators on the benefits of using mobile technologies and assists in providing an insight into how the learning experience can be enriched through the use of mobile technologies. It is concluded that the students who participated in this study found mobile technologies supported and enhanced their learning resulting in being more satisfied and motivated. This along with the development, application and validation of the MOBLEI, has provided an important contribution to the learning environment field of research.

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## **APPENDICES**

Appendix A: Institution Survey

Appendix B: Mobile Learning Environment Instrument

Appendix C: Information sheets and consent forms

Appendix D: Focus Group Questions

Appendix E: Ethics Approval Forms

**Appendix A  
Institution Survey**

### **Mobile Technologies Institution Survey**

The aim of this research is to explore the impact mobile technologies may have on students learning environments, including actual and preferred perceptions and experiences. As part of my literature review I would like to gain some feedback on what, if any, mobile technologies you are currently using in your programmes of study. All information gathered for the purpose of the research will be treated confidentially and your identity will not be revealed.

1. Please circle the modes of delivery you utilise within programmes of study at your institution:

*Face to face*      *Online*      *Distance*      *Blended*      *Other?* \_\_\_\_\_

2. Do you use mobile technologies to support learning within any programmes of study? Yes / No

If yes, please go to Q 3.

If no, please to Q 7.

3. Please list any forms of mobile technologies (eg; cellphones, iPods, PDA's etc.) used within any programmes of study?

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4. With each of these modes of delivery, please indicate which mobile technologies you have used:

*Face to face*

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*Online*

---

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*Distance*

---

---

*Blended*

---

---

*Other*

---

---

5. How have these tools been used? Ie; as a primary or supplementary tool used for study tips, lecture reviews etc?

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5. Have you or your institution conducted any research on student perceptions regarding the use of these mobile technologies?

Yes / No

If Yes, what has the feedback been like? Positive/negative?

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7. Do you have any further comments or views on the use of mobile technologies in education?

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Thank you for your participation ☺

**Appendix B**  
**Mobile Enhanced Learning Environment Instrument**

# MOBILE-ENHANCED LEARNING ENVIRONMENT INSTRUMENT

## Directions for Respondents

This questionnaire contains statements related to your learning in a mobile-enhanced learning environment. You will be asked how often each practice takes place.

There are no 'right' or 'wrong' answers. Your opinion is what is wanted.

Think about how well each statement describes what the mobile-enhanced learning environment class is like for you.

The '**Actual**' column is to be used to describe how often each practice actually takes place. The '**Preferred**' column is to be used to describe how often you would like each practice to take place (a wish list).

Draw a circle around

<b>1</b>	if the practice takes place	<b>Never</b>
<b>2</b>	if the practice takes place	<b>Seldom</b>
<b>3</b>	if the practice takes place	<b>Sometimes</b>
<b>4</b>	if the practice takes place	<b>Often</b>
<b>5</b>	if the practice takes place	<b>Always</b>

Be sure to give an answer for all questions. If you change your mind about an answer, just cross it out and circle another.

Some statements in this questionnaire are fairly similar to other statements. Don't worry about this. Simply give your opinion about all statements.

## Section A – Background Information

For each statement/question, please tick the **○** box which best represents you.

1. Gender

- Male       Female

2. Age

- 20 and under     21 – 25     26 – 30     31 – 35     36 and above

3. How is your programme of study delivered to you?

- Face to face, on campus  
 Solely online off campus  
 Distance with some face to face on campus component

4. Where do you spend most of your time studying?

- Home  
 UCOL Campus  
 Workplace  
 Library  
 Other \_\_\_\_\_

Student No or Name: \_\_\_\_\_

## Section B - MOBILE-ENHANCED Learning Environment

For each statement, please circle the number which best represents your answer.

### ACCESS

	ACTUAL					PREFERRED				
	Always	Often	Some times	Seldom	Never	Always	Often	Some times	Seldom	Never
1. I can access information at times convenient to me.	5	4	3	2	1	5	4	3	2	1
2. The course material is available at locations suitable for me.	5	4	3	2	1	5	4	3	2	1
3. Access to my lecturer is easy using my mobile device.	5	4	3	2	1	5	4	3	2	1
4. I have regular contact with my lecturer using my mobile device.	5	4	3	2	1	5	4	3	2	1
5. My lecturer reminds me when assessments are due using my mobile device.	5	4	3	2	1	5	4	3	2	1
6. I decide how I want to learn.	5	4	3	2	1	5	4	3	2	1
33. Receiving information using my mobile device helps me meet my learning goals.	5	4	3	2	1	5	4	3	2	1
34. The mobile device allows me to get extra information on my areas of interest.	5	4	3	2	1	5	4	3	2	1

**MOBILE- ENHANCED Learning Environment (Cont)**

INTERACTION	ACTUAL					PREFERRED				
	Always	Often	Some times	Seldom	Never	Always	Often	Some times	Seldom	Never
35. I communicate with my lecturer using my mobile device.	5	4	3	2	1	5	4	3	2	1
36. In my learning environment, I have to be self-disciplined in order to learn.	5	4	3	2	1	5	4	3	2	1
37. I am able to ask my tutor what I do not understand.	5	4	3	2	1	5	4	3	2	1
38. I am able to ask other students what I do not understand.	5	4	3	2	1	5	4	3	2	1
39. My lecturer responds promptly to my queries.	5	4	3	2	1	5	4	3	2	1
40. I communicate with other students using my mobile device.	5	4	3	2	1	5	4	3	2	1
41. I receive valuable information from my lecturer using my mobile device.	5	4	3	2	1	5	4	3	2	1
42. I have been supported by positive feedback from my lecturer via my mobile device.	5	4	3	2	1	5	4	3	2	1

**MOBILE- ENHANCED Learning Environment (Cont)**

<b>RESPONSE</b>	<b>ACTUAL</b>					<b>PREFERRED</b>				
	Always	Often	Some times	Seldom	Never	Always	Often	Some times	Seldom	Never
43. My mobile device enables me to interact with other students and the lecturer whenever I want to.	5	4	3	2	1	5	4	3	2	1
44. I felt a sense of satisfaction and achievement about this learning environment.	5	4	3	2	1	5	4	3	2	1
45. I enjoy learning in this environment.	5	4	3	2	1	5	4	3	2	1
46. I could learn more in this environment.	5	4	3	2	1	5	4	3	2	1
47. It is easy to organise a get together with other students using my mobile device.	5	4	3	2	1	5	4	3	2	1
48. It is easy to work collaboratively with other students using my mobile device.	5	4	3	2	1	5	4	3	2	1
49. The mobile-enhanced learning environment held my interest throughout my course of study.	5	4	3	2	1	5	4	3	2	1
50. I felt a sense of satisfaction towards the end of my course of study.	5	4	3	2	1	5	4	3	2	1

**MOBILE- ENHANCED Learning Environment (Cont)****RESULTS**

	ACTUAL					PREFERRED				
	Always	Often	Some times	Seldom	Never	Always	Often	Some times	Seldom	Never
51. The learning objectives of my course are made clearer by learning in this environment.	5	4	3	2	1	5	4	3	2	1
52. The information provided via my mobile device makes the content easier to follow.	5	4	3	2	1	5	4	3	2	1
53. The contact with the lecturer via my mobile device keeps me focused on what is to be learned.	5	4	3	2	1	5	4	3	2	1
54. The content provided via my mobile device helps me with my assignment and test preparation.	5	4	3	2	1	5	4	3	2	1
55. Information is delivered via my mobile device in a structured way.	5	4	3	2	1	5	4	3	2	1
56. The content provided by my lecturer is appropriate for delivery via my mobile device.	5	4	3	2	1	5	4	3	2	1
57. The content provided by my lecturer via my mobile device is clear.	5	4	3	2	1	5	4	3	2	1
58. The tips provided by the lecturer via my mobile device enhance my learning process.	5	4	3	2	1	5	4	3	2	1

## Open-Ended Questions

Please write your responses in the space provided below. Your comments could provide an explanation of previous responses and/or additional information you may wish to provide.

1. What other mobile devices, apart from your mobile phone, would you like to use while studying?

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2. What are the advantages that you have encountered of studying in a mobile enhanced environment?

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3. What are the disadvantages that you have encountered of studying in a mobile enhanced environment?

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4. Are there any suggestions to improve the delivery of the course in a mobile-enhanced mode?

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**Focus Group (Optional Attendance)**

The most common purpose for running focus groups is to gather participants further thoughts and feelings on a particular issue or topic in a shared environment. During this session you will be asked questions relating to the use of mobile technologies on which to provide your feedback on.

I would be interested in attending a brief focus group session at the UCOL campus in Palmerston North.

No

Yes

I can be contacted on: Phone: (\_\_\_\_) \_\_\_\_\_

Email: \_\_\_\_\_

**Section C – Attitudinal Scales**

<b>Attitude to Course</b>	Always	Often	Some times	Seldom	Never
1. I look forward to learning in this course	5	4	3	2	1
2. This course is fun	5	4	3	2	1
3. I dislike the content of this course	5	4	3	2	1
4. This course bores me	5	4	3	2	1
5. This course contains some of the most interesting work	5	4	3	2	1
6. I enjoy this course	5	4	3	2	1
7. Topics in this course are a waste of time	5	4	3	2	1
8. The topics covered make me interested in this course	5	4	3	2	1
<b>Attitude to Technology</b>	Always	Often	Some times	Seldom	Never
9. I'm good with technology	5	4	3	2	1
10. I like working with technology	5	4	3	2	1
11. Working with technology makes me nervous	5	4	3	2	1
12. I am comfortable trying new technologies	5	4	3	2	1
13. Working with technology is stimulating	5	4	3	2	1
14. I get a sinking feeling when I think of using technology	5	4	3	2	1
15. I do as little work as possible using technology	5	4	3	2	1
16. I feel comfortable using technology	5	4	3	2	1
<b>Student Self Efficacy</b>	Always	Often	Some times	Seldom	Never
17. I find it easy to get good marks in this course	5	4	3	2	1
18. I am good at this course	5	4	3	2	1
19. My friends ask me for help on in this course	5	4	3	2	1
20. I find this course easy	5	4	3	2	1
21. I outdo most of my classmates in this course	5	4	3	2	1
22. I have to work hard to pass subjects in this course	5	4	3	2	1
23. I am an intelligent student	5	4	3	2	1
24. I help friends with subjects on this course	5	4	3	2	1

**Appendix C**  
**Information Sheets and Consent Forms**

## **Mobile Technologies and the Impact on Tertiary Learning Environments**

### **Information Sheet for Questionnaire**

As a student who is undertaking tertiary education in either a distance, online or face to face mode, you are invited to take part in a questionnaire to share your perceptions and your participation in this arena. The research is being conducted by Sarah Snell, Universal College of Learning, Palmerston North. This research is being conducted for the purpose of partial fulfilment of a Doctorate in Science Education.

The aim of the research is to explore the impact that mobile technologies may have on students learning environments and outcomes, including your actual and preferred perceptions and experiences.

You are under no obligation to accept this invitation. If you decide to participate, you have the right to:

- ☒ decline to answer any particular question
- ☒ withdraw your consent to participate at any time during the research
- ☒ ask any questions about the study at any time during participation
- ☒ provide information on the understanding that your identity will not be revealed
- ☒ be given access to a summary of the project findings when it is concluded

All information gathered for the purpose of the research will be treated confidentially and your identity will not be revealed. The researcher does not expect any harm to come about as a result of taking part in the research. Non-participation will not affect your grades. Collected data will be stored securely by the researcher and information collected will be destroyed at the end of the research.

This project has been reviewed and approved by the Curtin University Human Ethics Committee in Perth, Western Australia, and UCOL's Research Ethics Committee.

Should you have any questions, please contact myself on (06) 9527195 or email [s.snell@ucol.ac.nz](mailto:s.snell@ucol.ac.nz), or my supervisor, Dr Darrell Fisher on +61 8 9266 3110 or email [D.Fisher@curtin.edu.au](mailto:D.Fisher@curtin.edu.au). Please indicate on the tear off slip overleaf if you agree to participate in the research and return in the pre-paid envelope provided as soon as possible. You will then receive the questionnaire in the post.

Yours sincerely

Sarah Snell  
UCOL

**Mobile Technologies and the Impact on Tertiary Learning Environments**

**Participant Consent Form**

**This consent form will be held for a period of five (5) years**

I have read the information sheet and have had the details of the study explained to me. Any questions I have had have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I agree to participate in this study under the conditions set out in the information sheet.

Name \_\_\_\_\_

Signed \_\_\_\_\_ Date \_\_\_\_\_

## **Mobile Technologies and the Impact on Tertiary Learning Environments**

### **Information Sheet for Focus Group**

As a student who is undertaking tertiary education in either a distance, online or face to face mode, you are invited to take part in a focus group to share your perceptions and your participation in this arena. The research is being conducted by Sarah Snell, Universal College of Learning, Palmerston North. This research is being conducted for the purpose of partial fulfilment of a Doctorate in Science Education.

The aim of the research is to explore the impact that mobile technologies may have on students learning environments and outcomes, including your actual and preferred perceptions and experiences.

The focus group may take up to one hour of your time and your participation is entirely voluntary. It is anticipated there will be around 6-10 participants in your focus group. The focus group will be held at a time that is convenient to all participants and refreshments will be provided. This focus group session will be facilitated by Sue Ireland and the session will be audiotaped.

You are under no obligation to accept this invitation. If you decide to participate, you have the right to:

- ☒ decline to answer any particular question
- ☒ withdraw your consent to participate at any time prior to the focus group or during the focus group session
- ☒ ask any questions about the study at any time during participation
- ☒ provide information on the understanding that your name will not be used unless you give permission to the researcher
- ☒ be given access to a summary of the project findings when it is concluded
- ☒ ask for the audio tape to be turned off at any time during the focus group

All information gathered for the purpose of the research will be treated confidentially and your identity will not be revealed. The researcher does not expect any harm to come about as a result of taking part in the research. Participation or non-participation will not affect your grades. Collected data will be stored securely by the researcher and information collected will be destroyed at the end of the research.

This project has been reviewed and approved by the Curtin University Human Ethics Committee in Perth, Western Australia, and UCOL's Research Committee.

Should you have any questions, please contact Sarah Snell on (06) 9527195 or email [s.snell@ucol.ac.nz](mailto:s.snell@ucol.ac.nz), or my supervisor, Professor Darrell Fisher on +61 8 9266 3110 or email [D.Fisher@curtin.edu.au](mailto:D.Fisher@curtin.edu.au). Please indicate on the tear off slip overleaf if you agree to participate in the research and return in the pre-paid envelope provided as soon as possible.

Yours sincerely

Sarah Snell/Catherine Snell-Siddle  
UCOL

**Mobile Technologies and the Impact on Tertiary Learning Environments Study**

**Participant Consent Form**

**This consent form will be held for a period of five (5) years**

I have read the information sheet and have had the details of the study explained to me. Any questions I have had have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I agree to not disclose and to keep confidential anything discussed in the focus group.

I agree/do not agree to the focus group being audiotaped.

I agree to participate in this study under the conditions set out in the information sheet.

Name \_\_\_\_\_

Signed \_\_\_\_\_ Date \_\_\_\_\_

**Appendix D**  
**Focus Group Questions**

### **Focus Group Questions**

The interview will be framed at the beginning of the session, including an explanation of mobile technologies and learning environments.

Below is an outline of topics to be covered with suggested questions.

The researcher will also ask the participants to give information on a separate piece of paper on demographic details such as age range, gender and learning mode (eg; online, blended, face to face).

5. Can you describe in what way mobile phones were used by your lecturers during your programme of study?
6. Do you think the use of mobile technologies enhanced your learning experience? In what way?
7. Was the amount of contact using the mobile device appropriate?
8. Was the content delivered using the mobile device appropriate?
9. Are there any other ways you think they could have been used?
10. Do you think the contact you received via the mobile device increased your motivation? In what ways?
11. Are there any other mobile tools you would like to use eg; ipods, PDA's? In what way do you think they could be used?

### Summary and Conclusion

General overview - summary of questions and answers

Have we missed anything? What advice do you have for me?

**Appendix E**  
**Ethics Approval Letters**



memorandum

To	Sarah Snell, SMEC	Office of Research and Development
From	Pauline Howat, Coordinator for Human Research Ethics, Science and Maths Education Centre	<b>Human Research Ethics Committee</b>
Subject	Protocol Approval SMEC20080042	TELEPHONE 9266 2784
Date	24 July 2008	FACSIMILE 9288 3753
Copy	Darrell Fisher, SMEC Divisional Graduate Studies Officer, Division of Science and Engineering	EMAIL hrec@curtin.edu.au

Thank you for your "Form C Application for Approval of Research with Minimal Risk (Ethical Requirements)" for the project titled "**MOBILE TECHNOLOGIES AND THEIR IMPACT ON TERTIARY LEARNING ENVIRONMENTS: ACTUAL AND PREFERRED PERCEPTIONS AND THE AFFECT OF AGE AND GENDER**". On behalf of the Human Research Ethics Committee I am authorised to inform you that the project is approved.

Approval of this project is for a period of twelve months **24th July 2008 to 23rd July 2009**.

If at any time during the twelve months changes/amendments occur, or if a serious or unexpected adverse event occurs, please advise me immediately. The approval number for your project is **SMEC20080042**. Please quote this number in any future correspondence.

A handwritten signature in black ink, appearing to read "Pauline Howat".

PAULINE HOWAT  
Coordinator for Human Research Ethics  
Science and Maths Education Centre

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Please Note: The following standard statement must be included in the Information sheet to participants.  
*This study has been approved by the Curtin University Human Research Ethics Committee (Approval Number SMEC20080042). If needed, verification of approval can be obtained either by writing to the Curtin University Human Research Ethics Committee, c/- Office of Research and Development, Curtin University of Technology, GPO Box U1987, Perth, 6845 or by telephoning 9266 2784.*

J:\offic\Pauline\ETHICS\Ethics Approval Letter-Sheet.doc

memorandum



To	Sarah Snell, SMEC
From	Pau inc Howat, Coordinator for Human Research Ethics, Science and Maths Education Centre
Subject	PROTOCOL APPROVAL - EXTENSION SMEC20080043
Date	14 August 2009
Copy	Darrell Fisher, SMEC

Office of Research and Development  
**Human Research Ethics Committee**  
TELEPHONE 9266 2784  
FACSIMILE 9266 3783  
EMAIL [hrec@curtin.edu.au](mailto:hrec@curtin.edu.au)

Thank you for keeping us informed of the progress of your research. The Human Research Ethics Committee acknowledges receipt of your Form B progress report for the project **MOBILE TECHNOLOGIES AND THEIR IMPACT ON TERTIARY LEARNING ENVIRONMENTS: ACTUAL AND PREFERRED PERCEPTIONS AND THE AFFECT OF AGE AND GENDER**.

Approval of this project has been extended for the year to **8th July 2010**.

Your approval number remains **SMEC20080043**. Please quote this number in any further correspondence regarding this project.

A handwritten signature in black ink that appears to read "Pauline".

PAULINE HOWAT  
Coordinator for Human Research Ethics  
Science and Maths Education Centre

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Please Note: The following standard statement must be included in the information sheet to participants:  
*this study has been approved by the Curtin University Human Research Ethics Committee (Approval Number SMEC20080043). If needed, verification of approval can be obtained either by writing to the Curtin University Human Research Ethics Committee, c/- Office of Research and Development, Curtin University of Technology, GPO Box U1987, Perth, 6845 or by telephoning 9266 2784.*

## Appendices

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16 July 2009

Sarah Snell  
School of Business and Computing  
UCOL

Dear Sarah

*Mobile Technologies and their impact on tertiary learning environments*

Thank you for submitting a research application for this project. I am pleased to advise that your application has now been approved.

On behalf of the subcommittee, I would like to wish you all the best for this research.

Yours sincerely

A handwritten signature in blue ink, appearing to read "Marian Bland".

Dr Marian Bland  
Chair, UCOL Research subcommittee

Manawatu: UCOL ALMERSTON NORTH Cnr King and Princess Streets, Private Bag 11022, Palmerston North 4442, New Zealand, Fax 06 952 7023 Phone 06 952 7000  
Wairarapa: UCOMWAIRARAPA 143- 159 Chapel Street, PO Box 698, Masterton 5840, New Zealand, Fax 06 946 2302 Phone 06 946 2300  
Whanganui: WHANGANUI UCOL 6 Rutland Street, Private Bag 3020, Whanganui 4540, New Zealand, Fax 06 965 3802 Phone 06 965 3800  
General and Course Information Phone 0800 46 82 65 Email [enquiry@ucol.ac.nz](mailto:enquiry@ucol.ac.nz) Website [www.ucol.ac.nz](http://www.ucol.ac.nz)