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# Towards an Understanding of Existing e-Learning for University Science Education in Taiwan

A thesis  
submitted in fulfilment  
of the requirements for the Degree  
of  
**Doctor of Philosophy**  
at  
**The University of Waikato**  
by  
**Su-Chen Wang**



University of Waikato

2008

## **ABSTRACT**

E-learning is a fast growing trend worldwide but it is still not universally accepted and practice does not always reach national government and tertiary institution expectations, especially in Taiwan. While issues around the effective implementation of e-learning to produce high quality education are being raised internationally, very little research has been undertaken in Taiwanese tertiary institutions, particularly for science education. No research was found that addressed the various perspectives of the stakeholders involved in blended courses which had both face-to-face and online learning components. The link between e-learning practice and views of learning had also received little attention.

This study investigated how e-learning practice was perceived and experienced at a national research-based university in Taiwan. The main focus was to identify the challenges, benefits and related success factors of e-learning practice as part of blended learning courses from the perspectives of university administrators, support people, instructors and students. An interpretative methodology using questionnaires and interviews was employed to generate data from these participant groups. Both quantitative and qualitative data were collected.

This study provides empirical evidence that e-learning practice is perceived and experienced as a technology-mediated and collaborative practice that is socially and culturally situated. The study supports the view that e-learning practice as a whole is a socio-cultural system, although when looking at instructor and student preferences for instructional design and learning processes there is a fit with both behaviorist and constructivist approaches to teaching and learning. However, instructors and students need to be active and self-managed to find e-learning efficient and effective. Students, instructors, support people and administrators held very similar perceptions of the benefits of and influences on lecturer and student use of e-learning as a component of blended learning.

Based on the findings, an explanatory model for the influences on e-learning practice as part of blended learning in a Taiwan university context was developed.

E-learning teaching and learning approaches are initiated by and created within a multi-layered context. At the first level, e-learning practice is accomplished via instructor and student engagement in day to day teaching and learning and as an educational reform it cannot be separated from the ICT technologies which mediate their interaction. Put another way, because instructor and student participation in e-learning as part of blended learning is voluntary students are included with instructors and the technology in the core enactment zone for practice. At the next level this three-way instructor-student-technology interaction is affected by and nested within the university instructor professional community and student peer community, which in turn is shaped by and nested in university-wide policies and practices. These three levels are nested in and influenced by the national policy context, external professionals, private enterprise and the public at large.

The model and associated suggestions presented in this study are expected to assist governments and universities to play a more constructive role in the development and implementation of e-learning education to improve the quality of courses for students and instructors. The hope is that the findings will contribute to enhanced teaching and learning supported by better administrator decision-making regarding institutional policies and practices including investment in learning technologies and support services for e-learning.

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# Chapter 1 Introduction

## 1.1 Background to the research

The Internet has developed into a tool that is pivotal in world communications. The convenience offered by the Internet and other Information and Communication Technology (ICT) has accelerated the emergence of an information society and knowledge economy (Kozma, 2005). ICT technological advancements and the impending knowledge society have impacted on the educational environment through the implementation of electronic learning (e-learning) systems. E-learning provides students with an anytime/any place independent learning environment. This has altered, and will continue to affect, teaching and learning contexts in universities and tertiary institutions across the world (Daugherty & Funke, 1998; Salmon & Jones, 2004; Spender, 2002) as has been the situation in Taiwanese tertiary institutions. However, support for the introduction of e-learning has not been universal. In Taiwan, for example, the government has built up a good technical infrastructure and encouraged universities to develop e-learning systems but a majority of instructors still resist this development, regardless of its supposed benefits (Ministry of Education [MOE], 2006; Yu, 2001). Questions such as, "What are the challenges and benefits of e-learning practice for students, instructors, and administrators?", "What are the factors associated with these benefits and challenges?", and, "What are the effective enhancement strategies for university education in e-learning?" are being asked by educators in Taiwan.

Much literature on e-learning focuses on "how to do" e-learning and how to design e-learning environments (e.g., Berge & Collins, 1995; Cifuentes & Shih, 2001; Khan, 2000, 2004, 2005). Research studies have also elaborated on the advantages and benefits of e-learning for institutions, instructors and students. For instance, e-learning can increase institutional reputations, improving teaching and learning quality, and provide more flexibility in student learning (e.g. Adams & Seagren, 2004; Campbell, 1998; Spender, 2002; Wilson *et al.*, 2003). The e-learning instructors also face some challenges such as being overloaded, time

constraints, irreversible pedagogical consciousness-raising and patience with new media, and support service crisis (Abel, 2005; Campbell, 1998, 2001; Eaton, 2001, 2002; Spender, 2002; Wilson *et al.*, 2003). Fewer articles discuss the views of instructors who teach on e-learning courses and why they participate while others do not yet. Instructors' perspectives and experiences are important because they are the final policy brokers (Honig, 2006; McLaughlin, 1987, 1990; Schwille *et al.*, 1983; Spillane, 1999). Similarly, students are the key users of e-learning courses and the administrators are the policy makers of e-learning practice. Thus, their perspectives, experiences and suggested strategies are also very important for enhancing e-learning practice. These are the focuses of this study.

The National Research University (NRU, a pseudonym) in Taiwan has developed its own e-learning system and provided funding and staffing support for e-learning practice since 1999. NRU follows the government definition of e-learning and treats e-learning as an 'assisted' teaching and learning tool. That is, e-learning is incorporated into face-to-face courses to provide instructors and students access to a blend of face-to-face and e-learning opportunities (National Science Council, 2000; Seng & Mohamad, 2002; Stubbs, Martin, & Endlar, 2006). NRU also advocates a "Science for all students" philosophy based on the Ministry of Education [MOE] policy (National Science Council, 2000). All students are required to take certain credits in science in order to graduate. NRU has encouraged science instructors to incorporate e-learning in courses for non-science major students. Statistical data shows that only a few instructors have done this, and, overall, few have applied for student-assistants to develop e-learning (National Cheng-Kung University, 2004). Not many instructors like implementing e-learning courses, particularly instructors in the Science College. Again, this leads to questions about instructor, student, perspectives and expectations of e-learning; the reasons why so few instructors use e-learning; what gaps exist in instructor, student and administrator understandings of the nature and value of e-learning; and the effective strategies to enhance university e-learning. Thus, investigations of participant perceptions of e-learning, the factors influencing the use of e-learning, and the nature of effective strategies are all salient. This thesis sets out to find answers to some of these questions.

Three aspects are dealt with in this introductory chapter. Section 1.2 describes the context for e-learning and tertiary education with a focus on a public national research-oriented university in Taiwan. Section 1.3 details the purpose of the study, and Section 1.4 outlines the study.

## **1.2 E-learning and tertiary education**

This section will provide the definitions of e-learning and science education as they are used in this study along with a short background to the development of e-learning in Taiwan, and at NRU where the study was conducted. This background is important for understanding the influences on and decisions made by administrators, technical support people, instructors and students in their e-learning practice.

### **1.2.1 What is e-learning?**

In today's rapidly changing electronic world (e-world) the key to maintaining the appropriate impetus and momentum in organizational and academic environments is knowledge (Collis & Moonen, 2001; Kozma, 2005). In this situation continuous, convenient and economical access to training and qualifications assumes the highest priority for the ambitious individual or organization. This requirement can be met by e-learning (Seng & Mohamad, 2002), one of the fastest growing areas in the high technology sector. Numerous names are used to denote learning activities supported by the Internet and other ICTs. These include Web-Based Learning, Online learning, Asynchronous Learning Networks and Blended Learning (Becta ICT Research, 2004; Masie, 2001; Shoniregun & Gray, 2004). Thus, a definition of e-learning as it is to be used in this thesis is needed.

Broadly speaking, e-learning is a network technology-based mode of education that uses a mix of computer and other ICTs, across time and place constraints to deliver instruction and provide access to information resources (OECD, 2005; Wallhaus, 2000). It can involve delivery systems such as videotape, interactive audio-video, CD-ROMs, DVDs, video-conferencing, VOD, e-mail, live chat, use of the Web, television and satellite broadcasts. Access to these resources means students can do coursework at a time of their convenience, so learning may

happen synchronously or asynchronously (Stuart, 2004; Wallhaus, 2000). Blended learning involves a combination of traditional face-to-face and online technology-based learning (Becta ICT Research, 2004; Masie, 2001; Singh, 2003; Stubbs, Martin, & Endlar, 2006; Tallent-Runnels, Thomas, Lan, Cooper, *et al.*, 2006; Welker & Berardino, 2005). Shoniregun and Gray (2004) argue that institutions are opting for the blended learning delivery of courses to the extent that it is ‘the quiet secret’ of e-learning (Masie, 2001). Almost every tertiary institution does more blended learning than is talked about. This research focuses on the e-learning or online component of blended learning courses.

### **1.2.2 What is science education?**

The word ‘science’ originally meant ‘knowledge’ (Hayward, 2003). However, in schools and universities it tends to indicate the group of three closely linked subjects – Biology, Chemistry and Physics (Hayward, 2003) and even Mathematics and or Earth Sciences in some universities (Zumbach, Schmitt, Reimann, & Starkloff, 2006). For this study, the science education at NRU is defined as all the courses are initiated and/or taught by College of Science instructors who come from the departments of Physics, Chemistry, Life Sciences (Biology), Mathematics and Earth Sciences. Further, the e-learning science courses are limited to those developed on the NRU developed e-learning system—“University Network Teaching and Learning System”.

### **1.2.3 E-learning in the Taiwan context**

The Internet has been an important influence on the Taiwan higher education environment for many years. Most students in universities and colleges access the Internet daily. In September 1990, the Ministry of Education [MOE] began the construction of the Taiwan Academic Network (TANet) (Tseng, Lu, Yin, & Chen, 1997) with the aim of supporting educational research activity in schools and institutions, and for universities to cooperate and share information. The TANet provided a good medium for students around the country to discuss and learn after class without time and distance barriers (Tseng, Lu, Yin, & Chen, 1997). In June 1994, the Executive Yuan organized a steering committee, NII, to setup the National Information Infrastructure Plan and established a task force to build a national information superhighway (National Science Council, 2000). This plan

included upgrading TANet framework and the use of broadband routes to engage in “distance teaching”, revising inadequate laws and regulations to do with distance education.

Taiwan provides a unique context for the development of e-learning. In 1995, the MOE chose five universities to advocate distance teaching and provided these universities with funds to buy the requisite facilities and to employ technical staff. NRU, the site for this study, was one of the five universities. It is responsible for broadcasting courses to other universities in southern Taiwan. In 1999, the MOE proposed a number of additional e-learning projects to promote e-learning. In 2000, the Taiwan government initiated the Challenge 2008-the six-year National Development Plan (National Science Council, 2000). This plan stresses the cultivation of e-generation talents. The 2000 e-learning development policy, declared by the National Executive Yuan as the Digital Content Project, included a number of e-learning related sub-projects. ICT and Internet education designed by the MOE aims at establishing a mature e-learning environment enriched with substantial learning content. Recently, a number of projects (Focus on Internet News & Data [FIND], 2003) have been proposed by the MOE including promoting e-learning usage and content, developing digital content for life-long learning, and advocating distance teaching/learning, etc. It is hoped that, with proper guidance from educators and help of technological tools, the general public’s ability to acquire and accumulate knowledge will be enhanced. Meanwhile, life-long learning will no longer be an unattainable dream as the Internet makes possible education beyond and outside formal routes. The ultimate goal is that, with knowledge being constantly created, the collective growth of individual citizens will lead to the uplift of the entire society and the nation’s competitiveness.

From the descriptions above, one knows the Taiwan government has done much to put in place a good infrastructure and environment for e-learning. However, infrastructure and equipment are just one of prerequisites for successful e-learning. Computers alone are insufficient to meet the extravagant claims made for technology (Schrum, 2000). Successful e-learning practice depends on the involvement of instructors and students, and institutional administrative support.

Hence, this thesis focused on the perspectives of a range of stakeholders involved in e-learning at a National Research University (NRU).

#### **1.2.4 E-learning at the National Research University**

Universities in Taiwan have moved to a blend of face-to-face instruction and e-learning opportunities. NRU has implemented blended learning for on-campus students, providing many undergraduate and graduate courses with an e-learning component. This section outlines the background and development of NRU e-learning practice.

National Research University (NRU, a pseudonym) is located in southern Taiwan Province, in the Republic of China. NRU was established in 1931 and consists of eight colleges, 38 departments, 28 graduate programs and five affiliated units in 2004. The total area of the school is about 173 hectares including nine campuses. The NRU has 1086 academic faculty members and 359 office-staff members not including institute researchers, and doctors and nurses in the teaching hospital, and so on. In total, there are about 5000 staff members at NRU in 2004. The total amount of NRU students is about eighteen thousands including about 94 hundreds of on-campus undergraduates, 73 hundreds of on-campus postgraduates and 11 hundreds of the recruitment of postgraduate students for the Master and PhD programs.

To enhance staff capability to meet the challenge of ICT, the NRU Computer and Network Center (Simply called the Computer Center) has offered the free ICT courses for staff of around 160 hours per year since 1998. By using the installed networks, such as the campus fiber-optic network, ADSL or dial-up network, all the faculty and students can search and/or retrieve relevant information from other domestic or foreign on-line institutions from their offices, dormitories, or even at home.

NRU is designated as a TANET South (a pseudonym for an area name) branch center by the MOE and as an InterNet high-speed computer network NRU branch center by the National Science Council, too. Thus, all the colleges/universities and the research development departments of public institutions in the southern

Taiwan area can acquire relevant information simultaneously from domestic or foreign countries by joining the TANET and the InterNet through NRU.

The NRU WWW information service system was first established in February, 1995. In September, Distance-Learning details were designed and started. In March, 1997, NRU helped to carry out Distance-Learning for other two Universities of Science and Technology in southern Taiwan. The NRU Network Teaching and Learning System was developed and maintained by the Multimedia Generating and Incubating Center which belongs to "Teaching and Research" division of the Computer Center at NRU since 1999.

NRU is a national public research-based university which offers a full range of undergraduate programs, is committed to graduate education through the doctorate, and gives high priority to research. NRU has been chosen to be involved in the Program for Promoting Academic Excellence of Universities, and starts to receive an extra government grant of 1.7 billion NT dollars (1,000NTD  $\cong$  30USD) per year for five consecutive years (from 2006 to 2010), Taiwan's MOE announced on the 9th of October, 2005. The major concern of this project lies in two areas: firstly, aiming at quality improvement in seven research centers, and secondly, aiming at quantity improvement in overall research performance. Many policies have been enacted to retain excellent faculty members and encourage them in teaching and research. This project provides further rewards to encourage research. Faculty members who publish papers or books receive special research funds. Those who make progress in research also receive awards.

Because the university is research-based, the university considers research capability as a primary qualification for appointment, promotion, and tenure of faculty members (instructors). NRU also has graduate students and post-doctoral fellows in far greater numbers than other institutions, since graduate education is a major component of its mission. NRU has extensive libraries, well-equipped laboratories, sophisticated computer capabilities, and university presses.

As a national public university, NRU differs from other private institutions so significantly in governance and funding arrangements so it provide very different learning contexts. The university goal is influenced by the national policy. Therefore, the national e-learning policy also is a critical issue for university e-learning practice. How to encourage instructors involved in e-learning practice becomes a problematic issue particularly in such a national public research-based university. Although NRU has provided many funding and staffing supports to the instructors for encouraging the development of e-learning such as providing student assistant support, only few instructors have applied the assistant support to design e-learning courses and not many instructors like to implement e-learning courses without applying the support from university. This was one of the reasons for conducting this research.

National policy has influenced the university's development goals and tenure promotion policy. In 1999, NRU chose to define itself as a research-oriented university and subsequently it has emphasized research and changed its tenure system. Now when the university evaluates instructors, their research is a very significant contributor to their rating, meaning instructors feel pressure to undertake research for promotional purposes. Within this emphasis-on-research context, how to sustain or entice more instructors to persist with e-learning teaching has become a major challenge to the university.

In 1999, NRU provided monetary rewards and student-assistants to help instructors to video-record their classroom teaching and to put these videos, and other course materials, onto the e-learning system. Initially, the response from instructors was very positive. However, as of the 2001, the university stopped providing funding to all e-learning instructors: funding was provided only on the basis of a positive evaluation of practice. In 2005 all such support was withdrawn.

Irrespective of whether the university provided funding and student-assistants to instructors for e-learning development, statistical data from the Office of Academic Affairs and the Computer and Network Center (simply called the Computer Center) at NRU shows that only a few instructors use the NRU Network Teaching and Learning System and incorporate e-learning in their

courses. Moreover, although NRU has provided funding and manpower support, only a few instructors have applied for support to design e-learning courses and very few instructors implement e-learning courses without applying for support from university. It would seem worthwhile, therefore, for university administrators to explore why only a few instructors apply for student assistants and why some still use e-learning without support. This was one of the reasons to conduct this research. Furthermore, the students in this study are not required to use e-learning because e-learning is treated as an assisted learning tool (see Section 1.1). These factors may be important for the university when effective enhancement strategies for e-learning practice are being considered. The next section will describe the purpose of this study including the research objectives and research questions, and the significance of the study.

### **1.3 The research design**

E-learning implementation is not necessarily easy. In the case of Taiwan, media, curricula, and lessons from other countries can not always be transferred to the Taiwan educational context. Moreover, any potential benefits of the use of e-learning are dependent on how university administrators, instructors and students implement or use e-learning. This section will describe the problem, research questions and significance of the study.

#### **1.3.1 The problem**

Introducing e-learning into an organization changes the way learners learn, instructors teach, designers develop, and administrators manage (Broadbent, 2003; Fisher, Higgins, and Loveless, 2006). Because e-learning can create significant changes, so implementers and learners can expect to face challenges. For example, instructors and students might face some challenges such as the need for new teaching and learning approaches, heavy teaching or learning loads, time constraints, eye strain, lack of easy access to the necessary equipment, and lack of personal technical skills. These challenges could lead to resistance to participation in e-learning. How to deal with this resistance is a key issue. Although many solutions and initiatives have been suggested and resources invested in e-learning practice over the last few years (Abel, 2005; McPherson, Henderson & Kinshuk,

2003; Volery, 2001; Yu, 2001), the under-use issue has not been resolved (Yu, 2001). New analytical approaches are needed to gain perceptions from students and learning providers (implementers) about organizational relationships, financial operations, instructional costs, instructor work, instructor and student roles and responsibilities, and student participation patterns (Wallhaus, 2000).

Gaps still exist between the current approaches to e-learning implementation and participants' perceptions and expectations of e-learning. For instance, the Taiwan government and NRU consider they have invested considerable money and effort in e-learning infrastructures and provided extra funding and staffing for the development of e-learning. They are puzzled as to why instructors reject e-learning. The gap is widening between the level of support services available and the expectations of faculty members, administrators, support people and students. This research set out to better understand this situation with the goal of developing some solutions to reduce the gap and solve the problem of under-use. The next section outlines the research questions that framed the study.

### **1.3.2 The research questions**

The main research question for the study is:

What is the nature of the practice of e-learning for university (science) education in Taiwan?

In order to explore this question supplementary research questions were developed. These research questions were:

- 1) What do university administrators and technical support people at the NRU perceive as the benefits of, challenges of and influences on e-learning practice?
- 2) What are instructor and student perceptions and experiences of what makes for effective e-learning in a national and research-oriented university in Taiwan?
- 3) What do administrators, technical support people, instructors, and students see as possible enhancement strategies for the practice of the e-learning in general, and for science e-learning in particular?

In addressing the first question, the study sought to understand university policy for e-learning in terms of administrators' and support people's perceptions of the goals and effectiveness of the university as a context for blended learning courses

with a component of e-learning. An understanding of how e-learning is developed and implemented by the university is important from a wider political point of view and from a technological and pedagogical point of view because it has the potential to provide a clearer understanding of the role administrators and support people can play in bridging the gap between the university and instructors in the development of effective e-learning practice.

In consideration of the second question, the study sought to better understand how e-learning courses are currently conducted and the key factors associated with effective teaching and learning in this context from instructor and student perspectives. The relationships or contradictions in the views amongst university administrators, technical support people, instructors and students are also explored.

In addressing the third question, the study sought to gain an insight into perceptions of how e-learning practices might be enhanced, particularly those for science education.

The study then proposes and develops a model that considers the full range of influences on e-learning practice in a (Taiwan) university context. When the goal is to develop some solutions to reduce the gap and solve the problem of under-use for the university e-learning practice, the Spillane (1999) and Millett & Bibby's (2004) models appear appropriate for exploring existing e-learning practice with the aim of its enhancement. Thus, this study will explore a model to describe and account for the range of factors that influence e-learning as part of blended learning, in particular, for Taiwan tertiary science e-learning.

### **1.3.3 Significance of this study**

Many issues regarding the effective implementation of e-learning in producing high educational quality are being raised internationally. However, very little research has been undertaken in Taiwanese tertiary institutions. Still less research has been undertaken on science education in a national public research university. No research was found that addressed the political, economic, psychological,

pedagogical and technological perspectives of institutional administrators, instructors and students towards blended courses in Taiwan where these include both face-to-face and online learning opportunities. In order to be able to enhance e-learning practice in university science education in Taiwan, this research set out to explore the factors that influence e-learning practice from an institutional, instructor, and student perspective. A systematic investigation into the policy and process of establishing and implementing an e-learning environment is warranted to better inform the academic community. The results will assist the university to play a more responsible role in the development and implementation of e-learning education and help to protect and enhance the academic quality of courses for instructors and students.

In a word, this research is intended to contribute to a better understanding of the existing practice of e-learning for university science education. Its main focus is to identify the challenges, benefits and related success factors of e-learning practice from a political, managerial, instructor and student point of view. Meanwhile, it is hoped that this research will contribute some strategies to enhance the practice of e-learning for university science education in Taiwan. It is also hoped that the findings of this study will contribute to better teaching and learning, and better decision-making regarding institutional support services, investment in learning technologies, and in the enhancement of e-learning practice.

#### **1.4 An overview of the thesis**

This thesis is organized into further seven chapters. A brief description of each chapter follows.

Chapter 2 reviews the literature related to e-learning, tertiary science education and learning theories. It begins with a look at technological innovation and education followed by an examination of research on e-learning practice in higher education. Before focusing on the issues surrounding attempts to link e-learning to current views of learning, a brief review of the issues involved in tertiary science e-learning is presented.

Chapter 3 details the methodology and research design along with the data collection methods used in the study. An explanation of how the data was analyzed is provided and the ethical and trustworthy considerations of the study discussed.

Chapter 4 presents the findings on administrator and support person perceptions of e-learning practice. These findings include perceptions of national and university policy for e-learning, of the benefits and challenges of e-learning, and of possible enhancement strategies for e-learning practice and science e-learning.

Chapter 5 presents a synthesis of the questionnaire and interview data on instructor perceptions of e-learning. The findings include instructor academic background and experiences in e-learning, perceived benefits and challenges of e-learning practice, factors influencing instructor use of e-learning and suggested e-learning enhancement strategies.

Chapter 6 presents the synthesized results of the questionnaires and the interviews with students about their perceptions of e-learning. Chapter 7 summarizes the findings of the study and links them to the literature to address the first three research questions. Chapter 8 develops a model of the influences on e-learning practice in Taiwan university context. The chapter draws these findings together to some conclusions and discusses the implications arising from these. The limitations of the study along with suggestions for further research are also described.

# **Chapter 2 E-learning in tertiary education**

## **2.1 Introduction**

The research questions for this study arose from an interest in a better understanding of the existing practice of e-learning at the university level, especially for science education. Particular perspectives on e-learning implementation, teaching, and learning shaped the focus of the questions. This chapter presents a review of the literature relevant to these perspectives along with technological innovation and education, the practice of e-learning and science education, and views of learning relevant to e-learning. Each domain is also discussed in terms of participation in e-learning practice from national, institutional, instructor and student perspectives. A socio-cultural perspective underpins this study and this perspective is outlined in Section 2.4 in this chapter.

This chapter has six sections. Section 2.2 examines how people have adapted and incorporated technology in their everyday life and in education, particularly ICT in higher education, and the three possible instructional delivery modes that incorporate the use of ICT are detailed. This section paves the way to a focus on the practice of e-learning and science education (Section 2.3), and views of learning relevant to e-learning (Section 2.4). Section 2.3 introduces the practice of e-learning in universities including influences on e-learning practice from national, institutional, instructor and student perspectives and experiences. Section 2.4 provides three views of learning relevant to e-learning. Section 2.5 sets out a model for understanding e-learning implementation. The chapter is summarized in Section 2.6.

## **2.2 Technological innovation and education**

This section examines how people incorporate, adapt, and resist technology in everyday life, including in education. Technological innovation in society and the use of ICT in education, particularly ICT in higher education, are described.

### **2.2.1 Technological innovation in society**

Technology has resulted in radical changes in politics, economics, society and warfare over the past several decades (Barro, 2000; Bereiter, 2002; Bhagwati, 2004; Dutton, Kahin, O'Callaghan, & Wyckoff, 2005; Sachs, 2005). The development of an 'information society' has arisen from the convergence and development of computer and communications technologies, their adoption throughout society, and their use for communication, collaboration and the sharing of knowledge (Collis & Moonen, 2001; European Commission, 2000; Kozma, 2005). This new technology has not only revolutionized life around the world (Dutton, Kahin, O'Callaghan, & Wyckoff, 2005; Lin, 2002) but also led to the era of the knowledge economy (Kozma, 2005). Technology has increased the possibilities for the acquisition and creation of information locally, nationally, and worldwide (Kankaanranta, 2005) so e-businesses, distance education, and so on have emerged (Katz & Oblinger, 2000). Technology has also offered individuals a flexible environment to access knowledge, information and expertise (Dutton, 1999). Advances in ICT (e.g., a growing range of versatile wireless media and higher-speed Internet and Web applications) have spanned national boundaries and enabled fundamental transformations in educational systems around the world (Moallem, Kermani, & Chen, 2005).

Nowadays, children grow up with ICT as a natural and essential part of their daily life. Added to this, the expectation is that they will become active and self-managed members in their own local communities and also in the increasingly rich and complex information society at large (Johnson & Christensen, 2000; Kankaanranta, 2005; Pelgrum, 2001). Voogt and Pelgrum (2005) state that students need to develop novel competencies and lifelong capabilities that are not addressed in the traditional curricula.

### **2.2.2 ICT in education**

The change towards an information society has impacted on the processes of education, including curriculum development and pedagogy, and also contributed to efforts toward developing innovative technological learning solutions (McCaffery, 2004; Voogt & Pelgrum, 2005). National policymakers worldwide have looked for improvement in educational systems and increased educational

attainment as primary ways that countries can prepare for global and technology-based changes (OECD, 1999, 2001, 2004; World Bank, 2003). Evident in many polices is a belief that investment in ICT can nourish a productive cycle in which education supports innovations in the technologies, which in turn improve learning and education (Castells, 2000; Department for Education and Skills [DfES], 2004). Also evident is the view that ICT can enhance student learning within the current curriculum through a positive impact on student attitude to and approaches toward learning (Jamieson-Proctor, Watson, & Finger, 2003). Thus, the integration of ICT is a policy focus in education in many countries, including in Taiwan (National Science Council, 1997, 2004).

ICT can play interrelated roles in learning and education by providing access to information, people, services, and technology (Dutton, 1999). Information access can include searching and obtaining multimedia information; drill and practice with immediate, personalized feedback; visualizing; and learning by doing. ICT can facilitate routine transactions (e.g., course registration) and distribute educational services. People can interact with each other through the use of ICT because ICT provides for networking among administrators, students, teachers, and experts. People can learn about ICT through routine use for electronic access in the dormitories, classrooms and offices, so using ICT can improve learning and education. Seen as a whole, this implies that ICT has the potency to help not only individuals in improving their personal learning and communications but also educational institutions in managing and providing educational services. Hence, nowadays, most schools and universities have ICT access. Teachers increasingly use ICT to improve their own skills and knowledge and to bring their lessons to life. ICTs are making many administrative and assessment tasks easier. Simultaneously, by changing the way of doing things, the roles of some of the gatekeepers in education, including teachers, academic administrators and library personnel, are being changed and new roles are being created.

Many people, such as the educational reformers and policy makers, have high expectations of ICT's efficiency and efficacy in having a positive impact in education (Armstrong, 1999). The use of ICT in education carries not only the possibility of innovation but also the expectation of change to education. There

are, however, tremendous challenges to the development of pedagogically innovative and quality practices for technology-enhanced education (Barone & Hagner, 2001; Kankaanranta, 2004; Kozma, 2003). This study seeks to explicate some of these challenges in the context of university education in Taiwan.

### **2.2.3 ICT in higher education**

The emergence of ICT has impacted on the processes of higher education internationally, and in Taiwan. The impacts include governments worldwide developing national policy for the future of higher education, and ICTs providing flexible services such as flexibility of time and place of learning. ICT can change the organization structure and role of university and goals of graduates (McCaffery, 2004) and it can create new collaborations within and between institutions (Covington, Petherbridge, & Warren, 2005; Haythornthwaite, 2006). These are often seen as the key to further development in higher education.

Many governments around the world are looking to develop new policies for higher education with the proposals designed to deal with hard choices about funding, quality and management through a long-term strategy for investment and reform (Department for Education and Skills [DfES], 2003a; National Science Council, 1997). In general, national policies for higher education imply that the higher education system is an asset both for individuals and nations. The need to reform is clear because of perceived challenge and competition amongst countries in an era of increased globalization (Collis & Moonen, 2001).

Many people believe the ‘revolution’ being fuelled by techno-economic forces will bring massive structural changes to universities (Agre, 2002). In past decades, access to information has always been highlighted as a crucial contribution. With the transition from the old to the new model of a university with space and time flexibility, a new definition of ‘information institution’ is emerging in the literature (Barone & Hagner, 2001; Dutton & Loader, 2002; McCaffery, 2004).

Traditional universities and colleges, it is often argued, face a bleak future unless they significantly change their instructional methods and customize their teaching approaches (Financial Times, 2000). In the past, factors, including tradition,

funding, credit units, semester schedules, pedagogy and other academic structures, have constrained institutions to geographic boundaries and on-campus classes (Gonzales & DeMontes, 2001). As the Internet or ICT becomes commonplace 'school without walls' has slowly emerged, claiming a niche in the educational system (Spindler, 1995). In this kind of school, learning takes place any time and anywhere; resources found at home, museums, libraries, and universities are woven together to connect learners in distinctive and new ways to form a community of learners. The use of Internet or ICT as a learning space has revolutionized higher education. As universities try to reach students who do not fit the standard residential degree program, individual courses or even entire degree programs are being offered via the Internet, something which is perceived as saving both universities and students money and time. Flexibility is seen as the key to further development in higher education, and flexibility requires technology (Collis & Moonen, 2001).

ICT has changed the role of the university to be a professional school, knowledge factory, and cultural institution (McCaffery, 2004). ICT has made the university not only a producer of knowledge ('research') but also a developer of knowledgeability ('teaching') (McCaffery, 2004, p.12). This means, ICT has made colleges and universities play the dual roles that must recruit, hire, and train knowledge worker professionals and educate ICT learners to manage the ever-increasing flow of information both on campus and off (Hawkins, Rudy, & Wallace, 2002). Hence, many types of graduate programs, such as on-campus undergraduate and graduate, off-campus distance education, on-job training, lifelong continuing education, are currently provided in higher-education institutions. This indicates that universities not only have responsibilities to provide an ever-increasing flow of information via the use of ICT but also need to educate ICT learners to assimilate knowledge or manage information. Thus, universities need to clarify their role in higher education and clearly define their educational goals and policy for ICT learners. For instance, the university in this study may need to clearly define its goal and policy for their university development and e-learning practice. This is a focus of this study.

#### **2.2.4 Types of instructional delivery and e-learning**

The types of instructional delivery methods used by universities can be grouped into three broad categories in terms of how the web is involved. These categories are face-to-face, completely online, and blended learning.

##### **Face-to-face**

Traditional education institutions, including universities, are designed on the assumption that all students learn at the same pace and in the same place. They are designed to support the rapid and efficient transmission of blocks of sequential information to relatively large groups of students in compressed time frames. The assumption is of an expert at the front of the room and relatively passive learners ranged in fixed rows of seats. While this may be efficient, the large number of students involved and the finite number of contact hours limit discussion between the instructor and students during class time.

##### **Completely online**

When courses are completely online, all the teaching, learning and assessment is online although students may post in hard copies of assignments. Completely online education is becoming more readily available at universities and colleges, especially at the graduate level, due in part to the presence of mature, motivated students capable of the independent work required, and faculties familiar with ICT applications to offer the courses (Kearsley, 2000). Online interaction can be synchronous (involve real time interaction) or it can be asynchronous (interaction that takes place at different times for different students as they access material by email, websites and voicemail) (Stubbs, Martin, & Endlar, 2006). Fully online learning has the power to enormously enrich the learning experience through the use of interactivity and multiple media, but such instructional delivery does not meet every educational need. It is not expected that online or e-learning will replace traditional forms and, in practice, most academic institutions and organizations offer blended learning courses. Blended learning is the use of more than one delivery system for teaching and learning (Kishore, 2002; Shoniregun & Gray, 2004).

## **Blended learning**

The term blended learning has been discussed and adopted widely in the literature although it has a variety of interpretations. Heinze and Procter (2004) suggest, “blended learning is learning that is facilitated by the effective combination of different modes of delivery, models of teaching and styles of learning, and is founded on transparent communication amongst all parties involved with a course” (p. 10). Other writers describe blended learning as a combination of face-to-face and technology-based learning, particularly online learning (Clark, 2003; Kearsley, 2005; McArthur, Parker, & Giersch, 2003; Singh, 2003; Stubbs, Martin, & Endlar, 2006). Some newer blends include innovative technologies such as web logs, mobile devices, wireless laptops, synchronous voice communication and broadband (Groen & Li, 2005; Mason, 2005).

Educational administrators trying to promote the best strategy for learning have recognized that different instructional delivery methods have their own advantages and disadvantages. For instance, face-to-face instructor-led instruction offers rich interactivity. Online or full e-learning has advantages in cost structures, something that many institutions are realizing, leading to their opting for blended learning delivery of courses (Kishore, 2002; Shoniregun & Gray, 2004). Deciding the right blend of instructional strategies or pedagogical approaches for a particular purpose is crucial. Various factors such as scalability of delivery method, the learning culture of the students, types of content, costs and learning effectiveness affect the implementation of blended learning (Kishore, 2002). The appropriateness of a delivery system needs to be based on the benefits of each medium, the course content, and the needs of the learner, not on the convenience to the designer or instructors. This places the focus on learning and the learner, rather than on instruction or teaching (Berge, 2005, p.16).

A successful blended learning practice needs to consider many concerns in personal, policy, pedagogy or the teaching approaches used, technology, and other influences in the wider context. Boyle (2005) suggests that significant changes in the content of the curriculum, the organization of the modules, and the development and use of a major e-learning component which involved the use of multimedia learning objects are essential for successfully developing a blended

learning environment and its associated pedagogical approaches. Thus, the design and development of blended learning solutions should be pedagogically driven and organizational support and constraints act as secondary shaping influences in the blended learning approach (Boyle, 2005).

Blended learning has its strengths and weaknesses and could promote and prevent learning (Heinze & Procter, 2004; Kitchenham, 2005). Kitchenham (2005) found that poor infrastructure, limited resources and lack of time were significant factors preventing teachers from implementing blended learning, but demands from students motivated and encouraged the teacher to use of ICT in the classroom. Similarly, Heinze and Procter (2004) focus on the conversational framework of blended learning and found some strengths and weaknesses from their part-time adult student group-interviews. All these enablers or barriers are also identified in the web-based or online learning environments (Khoo, Forret, & Cowie, 2003). It is a focus of this study to investigate the strengths and weaknesses of the online component of blended learning; the factors influencing instructor and student use of e-learning, and provide possible enhancement strategies to improve e-learning practice.

Despite its prevalence, there has been very little research on school or campus student experiences of blended learning. Some researchers have explored the use of blended practice for training elementary teachers (Kitchenham, 2005), and corporate training (Collis, Bianco, Margaryan, & Waring, 2005). Others have investigated distance education for staff development (Pettit, 2005). At university level, in particular, teaching and learning now not only happen face-to-face but also completely online and via a blend of online, face-to-face and other ICT technologies. Universities in Taiwan have been at the forefront in pursuing the benefits of e-learning for instructors, students and the institutions themselves but very little research has investigated actual student and instructor experiences of e-learning, especially for science education, as part of a blended learning courses in Taiwan. This is the focus of this thesis.

The next section reviews research on the practice of e-learning, particularly in higher education and includes institutional impacts and influences, and instructor and student perspectives and experiences in e-learning.

### **2.3 The practice of e-learning in universities**

The emergence of e-learning or online learning has altered, and will continue to affect teaching and learning contexts in universities and tertiary institutions (Daugherty & Funke, 1998; Gilbert, 2000; Spender, 2002). Its introduction has raised many questions about the nature of the effective implementation of e-learning for instructors, students, and administrators in educational institutions who are demanding empirical evidence of the effectiveness of such initiatives in producing high quality learning outcomes. E-learning can create significant changes in the way students learn, instructors teach, designers develop, and administrators manage (Broadbent, 2003), so administrators or implementers can expect to face some resistance. How to deal with this resistance is an important issue.

Traditionally, e-learning implementation strategies have focused on technical issues. However, the human element is now recognized as an influential aspect of any technology innovation. Ultimately, the success of the innovation is up to the individuals who use it (Geisman, 2001). Technical infrastructures can always be upgraded or replaced but altering human perceptions and attitudes can require deliberate and substantial intervention. Successful e-learning practice in higher education requires the engagement and endeavors of instructors, students, technical support people, and institutional administrators (Geisman, 2001). Moreover, good interpersonal relationships and cooperation among all participants is important (Keller & Suzuki, 2004). Therefore, new analytical approaches are being used that explore the perceptions of both learners and learning providers (implementers) about organizational relationships, financial operations, instructional costs, faculty work, faculty roles and responsibilities, and student participation patterns (Wallhaus, 2000). This section provides an overview of research on the perceptions of and influences on e-learning institution and also

the perspectives and experiences of instructors and students in e-learning. Each will be discussed in turn.

### **2.3.1 Institutional impacts and influences**

As institutional leaders, higher education administrators face numerous challenges when they attempt to launch online or e-learning in their institutions. Issues to do with which courses or programs to migrate, which faculty to involve, which platform to use are just a few of the many complex decisions that institutional leaders confront in building online programs. The factors that emerged from the literature as enablers and inhibitors of e-learning at the institutional level were a well-defined e-learning policy, effective leadership, university organization and culture, reputation, financial issues. These are described in the next section.

#### **Effective leadership**

Effective leadership within the education, government and business communities is critical to the successful integration of technology into a nation's schools (Adams & Seagren, 2004; Branigan, 2004b; Broadbent, 2003). Among the attributes Branigan (2004) used to define "effective leadership" was the recognition that educational technology is really about education, not technology. He also noted an effective leader needs to have the ability to establish and communicate a clear and common vision for technology use in schools; and the ability to change and manage change. Adams and Seagren (2004) indicated that if a leader is knowledgeable about distance education or e-learning, this helps him/her effectively manage the changes needed to implement online or e-learning. Berge and Lin (2001) also pointed out that without key players within the organization who are knowledgeable and supportive of distance learning or e-learning, implementing a distance or e-learning program can be a slow and difficult process.

Most institutions resist change but successful institutions usually have a well documented e-learning strategy which sets out the institution's overall e-learning direction and objectives (BECTA ICT Research, 2004; McGraw, 2001; Moloney & Tello, 2003). Without a shared vision for e-learning and an explicated strategic plan, implementation programs can meet with difficulty and progress slowly.

Moreover, government policy has impacted institutional development policy and goals (see Section 2.2.3) and other policies such as administrative support and recognition (Clark, 1993). Tenure and promotion decisions (Wolcott, 1997) also influence institutional e-learning policy. Thus, each institution needs to clearly define their e-learning goals and policy and have a detailed development plan and strategy to encourage people to use e-learning and help to overcome any challenges.

### **Institutional organization and culture**

Institutional organization and its culture are important influences in shaping the uptake of e-learning practices. Different organizations are at different stages or levels of maturity regarding the capabilities that support e-learning practice (Adams & Seagren, 2004; Berge & Lin, 2001; Schreiber, 1998). Some researchers have reported that administrative support, organizational culture, and institutional commitment to access were important institutional factors (Armstrong, 2000; Moore, 1994). Thus, some specific strategies related to organizational and cultural change are suggested to be required (e.g., Stuart, 2004). These suggestions included developing a culture that values e-learning as much as possible, building e-learning into regular employee milestones; promoting the e-learning initiative in e-mails, newsletters, etc.; using a familiar interface and focusing on the desired result, and acknowledging employees who complete significant courses and rewarding them publicly or privately. These strategies for cultural change have the potential to affect the atmosphere of using e-learning and improve the effectiveness of e-learning practice. This is a focus of the study.

### **Influence of university reputation**

Reputation also influences how an institution approaches the instigation of e-learning. Institutions with higher reputations often attract their students with their brand image, special features and other factors of interest to students (Fornaciari, Forte, & Mathews, 1999; Porter, 1980). These institutions tend to avoid price-based competition and instead focus on earning student loyalty through the uniqueness and distinctive value of their service (Fornaciari, Forte, and Mathews, 1999). For example, the promotional literature for Stanford

University's new online master's degree in electrical engineering stresses Stanford's brand image as well as the e-learning aspects. On the other hand, institutions with lower reputations may use low-cost leadership strategies which relying on high volume and a large market share to achieve efficiencies and attract students (Downes, 1998; Fornaciari, Forte, & Mathews, 1999; Gladieux & Swail, 1999). The essence of a low-cost e-learning strategy is low-cost tuition. Efficiencies gained through electronic registration, reduced physical facilities expenditure, and lower maintenance costs can also contribute to a low cost leadership strategy (Fornaciari, Forte, & Mathews, 1999). Britain's Open University is a classic example of low cost leadership. It has the lowest expenditure per student of all British institutions yet it ranks in Britain's top 20 for teaching quality (Daniel, 1997). This suggests that a low cost strategy does not exclude a reputation for high quality. However, perceptions of potential impact on institutional reputation may affect implementers' or administrators' attitudes and or approaches to decision-making around e-learning practice.

### **Financial issues**

One of the primary barriers to the development of e-learning is finance because e-learning typically involves a large initial expenditure, although this can be followed by relatively low marginal costs (Shoniregun & Gray, 2004). Those investing in e-learning often consider the likely return on any investment. To do this, one needs to inspect the factors of infrastructure and personnel cost, platforms, and factors that generate return on investment (ROI) such as increased enrolments, and the potential savings per student.

The implementers usually need to consider both fixed and variable costs in the potential of e-learning environments. Before implementing e-learning practice, institutions need to know the total cost of the infrastructure and any personnel expenses (Levine & Sun, 2003; Mayberry, 2001). Full exploitation of the potential of e-learning environments would certainly drive up both fixed and variable costs (Hülsmann, 2004). The cost-effectiveness arguments against e-learning are often biased when infrastructure is not in place because high infrastructure costs are charged to e-learning projects (Hülsmann, 2004). Once the infrastructure is in place, personnel costs are the main decisive cost drivers in many e-learning

options (Hülsmann, 2004; Rumble, 2001). Personnel costs are dependent on how many technical support staff and instructors or tutors are employed and in the long term, expenditure on institutional personnel management may include incentive pay for an e-learning faculty (Daugherty & Funke, 1998). Thus, lack of grant monies to fund distance or e-learning start-up and subsequent projects is also a problem (Berge & Lin, 2001).

To implement e-learning practice, an institution must provide an effective and efficient platform for the development of learning objects. Universities often need to source funding from government or other, private organizations to do this (Moses, 2004; Sanders, 2004). Usually there are three options: purchasing off-the-shelf programs, outsourcing development, or developing materials in house (Shoniregun & Gray, 2004). Whatever option is selected the provision of a reliable effective platform is a substantial cost. In this study, the researcher will explore the ways the university provides the e-learning platform and how it supports instructors and students.

Institutional decision-makers need to consider ROI and long-term funding related to the implementation of e-learning and be able to demonstrate why, and how, e-learning could improve their organizational competitiveness (Geisman, 2001; Shoniregun & Gray, 2004). By far the most common reason for getting into e-learning for institutions is that of expanding geographic reach, with success primarily measured in terms of enrolment increases, student revenue increases, and improved learning (Shepherd, Martz, Ferguson, & Klein, 2002). One advantage of e-learning can be that it lowers the average costs per student because it increases enrolments (Moloney & Tello, 2003). E-learning is also able to deal with large numbers of students more cost-effectively than traditional education (Hülsmann, 2004). The study by Whalen and Wright (1999) suggests that e-learning courses designed with significant multimedia content when delivered to a large numbers of students lower the average cost per student. Another advantage of e-learning related to return on investment can be that it can save time and cost in printing and distributing paper and, or in the assessment of student learning outcomes (Branigan, 2004a; Geisman, 2001).

Moreover, school leaders or administrators also need to focus on sustainable funding for technology and finding public and private partnerships (Branigan, 2004b). To implement effective e-learning practice, the institution must aggressively consider how to get the long-term funds either from government or other, private grants and also needs to prepare remedial measures if the funds are suddenly terminated or they run out of funds (Moses, 2004; Sanders, 2004).

In sum, the institution or university needs leadership and a detailed vision and plan for the implementation of e-learning. E-learning has university reputation and financial issues. Key factors in this are the consideration of how e-learning could benefit the university weighed or balanced against financial, reputation and organization costs and changes. These aspects are investigated in this study.

### **2.3.2 Instructor perspectives and experiences**

The effectiveness and success of e-learning programs are dependent on instructor delivery and management of instruction (Hootstein, 2002; Littler & Mahyuddin, 2001; Sevilla & Wells, 2000). As Matuga (2001) notes, the successful design and teaching of any course hinges on the personality, educational philosophy and pedagogical style of the instructor. More generally, the factors that motivate and inhibit instructors have been shown to relate to personal, university policy and practices, technological, pedagogical and other factors (Salmon & Jones, 2004; Schifter, 2000). These factors are discussed next in turn but inevitably there is overlap among them.

#### **Instructor personal factors**

Instructor participation is imperative for e-learning practice to succeed because they are the ones who put the technology and associated learning objects into practice (Salmon & Jones, 2004; Schifter, 2000). An important finding from the implementation research in education over the past decades is the importance of local will and capacity in reform implementation (Honig, 2006; McLaughlin, 1990). Will is generally defined as an implementer's disposition toward educational policy. Capacity is assumed to be the degree to which implementer posses the skills, knowledge, networks, and financial resources to execute reform

ideas. Therefore, it is important to understand instructor personal will and capacity.

### ***Instructor personal will***

Instructor personal will is affected by instructor personal characteristics such as their attitude to the use of technology and perceptions of learning and e-learning. Extra pressures from others, role changes, time required, and role overload also impact personal motivation to use e-learning. Dillon (1989) studied faculty rewards in e-courses and discovered instructors participated “for a variety of personal reasons, ranging from diversity of experience to altruism toward the non-traditional learner” (p. 42). Dillon and Walsh (1992) reviewed 225 articles and concluded that “...faculty motivation to teach at a distance results from intrinsic [prestige, self esteem] rather than extrinsic incentives [monetary rewards]” (p. 16). Instructor personal will is an important factor in the use of e-learning and is a focus for this study.

Instructor attitude towards the use of technology in teaching has been shown to be a crucial determinant of the involvement in e-learning (Campbell, 2001; Mehlinger, 1995; Stratford, 2000). Some researchers suggest online instructors need to change their attitude to adopt an online mode of teaching (Mehlinger, 1995; Willis, 1994). Instructor personality traits are also an indicator of their attitude to change (Rogers, 1995). Those who are confident and adventurous are more likely to be self-motivated, and respond quickly and positively to the e-learning innovation than those who are more cautious, conservative instructors. Mehlinger (1995) identified that innovative instructors tend to be independent, self-confident, and unafraid to take risks. Innovative instructors were also proactive in solving their own problems rather than merely complaining. However, some instructors fear an increase in the use of distance or e-learning technologies may decrease the need for instructors and challenge their authority (Berge & Lin, 2001; Spender, 2002). As Chapple (1991) noted, “[some] people are fearful of things which are too technical for their stage of development or state of mind” (p.3). The most significant reasons behind active resistance to computer integration into teaching practices are feelings of frustration and incompetence, because instructors would have to move outside their comfort zone if they were to

apply technology in their work (Murray & Campbell, 2000). Thus, instructor confidence and competence is important although it does not necessarily lead to successful implementation of technology in e-learning teaching (Page, 1999). All these aspects need to be acknowledged in order to help instructors integrate technology into their practice. The nature of instructor attitude in response to e-learning is a focus in this study.

It is not surprising that more technology is used in teaching, but the barriers still exist since the technology innovation process is ongoing. The barriers (e.g., time, support, models, infrastructure, and culture) to technology adoption persist and even reappear with new technologies (Brzycki & Dudt, 2005). These phenomena were well described in the 1980s in the literature on school reform and innovation (Hord, Rutherford, Huling-Austin, & Hall, 1987). Researchers were still reporting on computer anxiety, a powerful obstacle in the early stages of technology adoption (Christiansen & Knezek, 2002). Even when anxiety is reduced, there is still a need to integrate technology into teaching itself. Instructors may still question whether technology devalues their profession, threatens the traditional campus to change its organization and culture, and enables students to learn as well as face-to-face instruction (Adams, 2002).

Incessant technology innovation can be exhausting both mentally and financially (Brzycki & Dudt, 2005). Instructors have been besieged with successive waves of innovations for decades and may see each innovation as a mere fashion. Teaching innovations, combined with growing social and economic change, can look like just another problem to compete for attention, time, and resources. However, Brzycki and Dudt (2005) noted this is another way to learn how to manage continual change, finding methods to overcome barriers to infusing technology into teacher preparation.

The value and recognition of technology use is an important issue related to tenure promotion policy. Confirming studies have found a variety of external forces are affecting tenure policies, including information technology (Alstete, 2000; Saba, Agree, & Haakenson, 2003; Westney, 2000). Although Wolcott (1997) stated that teaching in e-learning or distance education is not highly valued

and is not related to tenure and promotion decisions, Saba, Agree and Haakenson (2003) suggested tenure system and promotion policy still are concerns related to the implementation of distance or e-learning practice. One aim of this research will find the related factors and give some suggestions to enhance the e-learning practice. This factor will be investigated.

Instructor perceptions of learning and e-learning have been shown to be influential. Research shows that instructors often perceive themselves as providers of knowledge rather than facilitators of learning (Cuban, 1986, 2001; Norton, McRobbie, & Cooper, 2000). They tend to believe that knowledge should be transmitted from them to the students and that students can absorb knowledge from them (Norton, McRobbie, & Cooper, 2000). Thus, they often have unfavorable attitudes toward the use of technology (Cuban, 1986, 2001; Mehlinger, 1995; Meyer, 2004; Page, 1999; Self, 1983; Willis, 1994) because they consider technology can not help them express their knowledge and transmit this to students. Added to this, Cuban (1986) noticed that instructors usually value the personal relationships with students because they believe they are essential to student learning. Many perceived that using technologies would displace, interrupt or minimize their relationship with their students which in turn affected their willingness to explore the potential added value of technology in their classroom (Berge & Collins, 1995; Fox, 2001). As a result, they did not foresee any advantages of using technology in classroom (Norton, McRobbie, & Cooper, 2000; Parr, 1994). On the other hand, the convenience of multimedia in e-learning and the potential of the Web can motivate instructors to adopt e-learning (Armstrong, 2000; Daugherty & Funke, 1998). Daugherty and Funke (1998) found several instructors cited the reason for their wanting to continue to use technology as being due to perceived benefits for their students and the view that technology-based applications are fun, new, exciting, challenging and would allow them more creativity than traditional instructional methodologies. Instructor perception of their role to e-learning and technology use is a focus for this study.

Extra pressures emerge when instructors are seen as role models for the use of the technology by colleagues and or students (Campbell, 1997). Students expect that instructors will know what they are doing with the technology and are often

surprised to learn that instructors are learning with them (Campbell, 1997; Willis, 1994). Another kind of pressure maybe for the need for a Web presence arising more from marketing initiatives to attract students rather than from a real desire to improve student learning (Fox, 2001). Instructors may be pressured to have their course content available to students online. Despite this, however, e-learning teaching is not always highly valued nor related to tenure and promotion decisions (Wolcott, 1997). The range of external pressures or influences from the wider context experienced by instructors and students is a focus for this study.

Another barrier impeding the development of e-learning is that of changes in instructor role (Adams, 2002; Campbell, 1998; Moore, 1994). The traditional roles of instructors and students can become blurred when they are not in face-to-face contact. Instructors in e-learning generally have to change their role to that of a facilitator and discussion guide to help students develop their potential and achieve academic success and self-fulfillment (Weir, 1989; Willis, 1994). This is because e-learning can provide for a new teaching and learning approach and more interaction opportunities between instructors and students. The shift from 'instructor in charge' to 'learner in charge' is probably at the heart of the shift to the online medium (Spender, 2002) so instructors need to revise their perceptions of their role in e-learning. However, Gibson (1996) warned that Dede's (1996) description of instructors moving aside from 'sage on stage' to 'guide on side' is not easily achieved. In this study, the impact of instructor role change is explored.

Instructor role overload was seen by Self (1983) as being the primary cause for the lack of innovation and development of alternative teaching activities. Traditional instructor classroom management skills do not cover the management of learners who might expect access to their instructor twenty-four hours a day (Campbell, 1998; Spender, 2002). Levine and Sun (2003) pointed out that e-learning is more labor intensive for instructors because of the new levels of 24/7 service it demands. Distance/online learning courses can require a greater time commitment in development and maintenance, so additional faculty compensation, incentive and release time are important issue (Adams & Seagren, 2004; Berge & Lin, 2001; Campbell, 1998; Daugherty & Funke, 1998; Fox, 2001; Gilbert, 2000).

Instructor perception of the amount of time needed to prepare ICT-mediated or e-learning lessons is another barrier to e-learning development (Hord, Rutherford, Huling-Austin, & Hall, 1987; Lim & Khine, 2006). Instructors in studies by Beggs (2000) and Adams (2002) ranked lack of time as the foremost barrier to technology adoption. In the face of rising technology demands, instructors not only lack time but some also see the call to incorporate more technology as an “imposition on their academic freedom, their personal time, and their teaching competency” (Wanda & Broughton, 2002, p. 748). To minimize the time it takes to learn new technology, some instructors deliberately wait for groundbreakers or enthusiastic experimenters to try it and work out the bugs (Waldron, Dawson, & Burnett, 2005; Wanda & Broughton, 2002).

### ***Instructor personal capacity***

Instructor personal capacity refers to instructor personal technical knowledge and skills to utilize technologies in e-learning. Lack of this capability and incessant technology innovation may undermine an instructor both mentally and physically as they seek to execute their reform ideas.

Educators who have been trained as instructors have not necessarily been educated to teach in non-traditional classrooms. It cannot be assumed that they will have the required skills to confidently create an exciting and challenging online learning environment. For this reason many have found instructors to have fears and concerns about online teaching (Campbell, 1997, 1998; Murray & Campbell, 2000). As mentioned earlier in instructor personal attitude, many instructors lack competence and confidence in using new technology for teaching and this creates a certain level of anxiety (Campbell, 2001; Self, 1983). Thus, instructor lack of required personal technical knowledge and skills to utilize technologies in their e-learning is an important personal factor.

Some of the attitudinal barriers and enablers that influence instructor adoption of technology also affect their learning about technical knowledge and skills in e-learning. For example, Moses (2004) found that sometimes instructors have an aversion to watching themselves on video because they feel they look ugly. It is

probably a big barrier to use of multimedia. Simultaneously, several additional enablers may influence instructors to learn about technology. For instance, Brzycki and Dudt (2005) noted, “some instructors want to learn about technology not because they like to use it in teaching but because they perhaps have a personal project to accomplish with it, or because they want to monitor or participate in the technology-related activities of their students” (p. 633). Many instructors saw technology as a productivity tool because they consider PowerPoint, Word-processing, and electronic grading made their academic work more efficient and effective (Brzycki & Dudt, 2005).

In fact, most instructors have little or no formal training in the effective use of technological resources even if technical support is available (Barley, 1999). It is evident that training and a shift in teaching practices are key themes in literature for online instructors (Palloff & Pratt, 2001). This issue is discussed next in more detail as a university policy and practice impact on instructors.

### **Institutional support services**

In general, an successful educational reform is dependent on institutional support services and national and university policy decisions (Millett & Bibby, 2004). National and university policy impacts and influences have been discussed in Section 2.3.1. In this section, only the institutional administrative support for instructors will be discussed. This support includes administrators who could provide required e-learning resources, incentives and manpower in technical support, training and so on.

Administrative support was a critical factor to success in innovation in education and in securing and implementing e-learning (Brzycki & Dudt, 2005). The importance of administrative support was stressed by Hall and Hord (2001), who agreed, “while the ‘bottom’ may be able to launch and sustain an innovative effort for several years, if [the top] administrators do not engage in active ongoing support, it is more than likely that the change effort will die” (p. 13). Consistent with this, Olcott and Wright (1995) and Schifter (2000) identified institutional support for instructors, and for technical infrastructure and course development

needs as essential for effective program development. This kind of support can go some way towards addressing the psychological barriers that instructors face.

Time, systematic central and distributed support and incentives have been shown to be facilitators of effective technology use in teaching and learning (Gilbert, 2000). Time and support to learn new skills have been found to be important both as instructors begin to use new technology and in an ongoing way with the appearance of significantly new technology (Ali & Ferdig, 2002). Thus, continuous administrative support is necessary. Many institutions, however, fail to provide funding to create a systematic training program (Bunch & Broughton, 2002). Workshops alone could not bring technology into the classroom (Brzycki & Dudt, 2005). They need to be part of a comprehensive support system of help desks, one-on-one support, peer support, incentives, and direct assistance in developing modules, assignments, and activities (Brzycki & Dudt, 2005). This combination provides supportive organizational arrangements, training, consultation and reinforcement (Hord, Rutherford, Huling-Austin & Hall, 1987).

Multiple forms of support (Waddoups & Earle, 2002) and incentives (Wanda & Broughton, 2002) are needed to appeal to diverse instructor needs which can include recognition; release time; equipment; the chance to excel, travel, present and publish; leadership opportunities; cash; and tenure and promotion. Brzycki and Dudt (2005) found multiple forms of support need to be designed to meet diverse instructor barriers, needs, concerns, schedules, skill levels, and teaching styles. Among these are individual help, workshops, classroom mentoring, and instructional materials on a variety of skill levels and topics. Each form of support has its advantages and disadvantages. For example, Brzycki and Dudt (2005) suggested individual help fulfilled a variety of needs and student assistants were good support staff, saying,

Student assistants were able to reduce the management concerns of implementing technology by reserving and setting up computer carts, preparing materials, and making arrangements for videoconferencing. For technology novices, individual help kept their true competence level confidential, reducing anxiety and personal concerns. For more accomplished users, individual help made it possible to go beyond workshops and try out advanced techniques. (p. 629)

Brzycki and Dudt (2005) conclude that change facilitators need to offer multiple forms of support and incentives, tie incentives to desired outcomes, involve faculty in decision-making to secure buy-in, use faculty models, supplement technical support with peer support and well trained student assistants, and cultivate strong administrative support. These methods will help deal with the persistent concerns and barriers to technology diffusion. Thus, administrative support also will be investigated in this study.

Broadcasting university policy about e-learning practice and recruiting professional support staff can enhance instructors' engagements. Brzycki and Dudt (2005) suggested administrative support, incentives and program activities all need to be well publicized through multiple channels such as email, websites, and so on to capture and keep instructors' attention, stimulate their interest, explain, and receive feedback. The audiences for this publicity should include all relevant constituencies. Brzycki and Dudt (2005) also indicated choosing good professional support staff is important to the instructors, and student assistants and faculty peers can be effective supplementary support staff, by saying,

Professional support staff that can both use and teach technology must be able to communicate well and train instructors in a sensitive and non-threatening way. They must be familiar with faculty needs and able to envision academic applications of technology. Professional support staff can be effectively supplemented by student assistants and faculty peers. Undergraduate and graduate assistants, if well trained, can be successful support staff. Speaking from personal teaching experience in specific disciplines, faculty peers can provide authoritative models that give teaching with technology greater credibility. If peers advocate the value of an innovation, the buy-in of their colleagues is more likely. (p. 638)

In sum, administrative support is critical to success in innovation in education and or in e-learning. Instructors usually cannot commit institutional resources or gain commitments from potential institutional partners when they use new technology to implement their e-learning teaching. They need higher administrative support and intervention to resolve their needs and challenges. Multiple forms of support such as support staff, student assistant, training and incentives from the institution are necessary for instructors for a successful e-learning practice.

### **Technological issues and instructor experience of e-learning**

Instructor teaching via e-learning necessarily confronts technological issues. These include lack of access to required and up-to-date infrastructure or computer

technology, lack of access to the necessary e-learning system, and technical support problems, to name but a few.

Instructor, and student, lack of access to required and up-to-date infrastructure computer technology would lead to the unsuccessful e-learning practice (Brzycki & Dudt, 2005). Ali and Ferdig (2002) found that many institutions still struggled with the cost of keeping technology up-to-date such as for lab updates, improved networks, web-based course software, and video/data projection. Nearly half of the respondents in Adams' (2002) study still perceived availability of educational software, instructor computers, and student computers as a barrier to integrating technology into teaching. The economic downturn has exacerbated this problem (Green, 2000).

Instructors have begun to use universal Internet access, multimedia projectors, and campus networks, state of the art computer labs, wired and wireless campuses for teaching and learning because these have been implemented to a remarkable degree and become mainstream. However, recent literature continues to speak of barriers to technology implementation (Brzycki & Dudt, 2005; Levine & Sun, 2003; Murray, 2004; Scrimshaw, 2004) because few innovations are ever completely accepted and there is always another new technology on the horizon (Brzycki & Dudt, 2005). Each new technology regenerates similar barriers and concerns so that instructors evaluate some issues including time, administrative support, accessible technology, peer support, student technical capability and then see whether or not it is worthwhile to engage in e-learning practice (see Section 2.3.2).

Lack of easy access to the necessary e-learning system is important to instructor development of e-learning courses (Berge & Lin, 2001). The introduction of an instructional management system (e.g., IMS) with graphic interface will allow instructors not only to 'manage' the administration of their course, but also to put learning material into an interface with basic preset instructional and graphic design (Brzycki & Dudt, 2005). Institutional recognition of the need for more support to instructors in the development phase of online and multimedia learning environments is necessary. This is coupled with an increased institutional

emphasis on a coherent pedagogical approach to incorporating online technologies into whole program development. But these resources are often directed towards strategically chosen programs that enhance the institution's reputation for appropriate, competitive and quality delivery (Littler & Mahyuddin, 2001). The provision of an easy-access and reliable e-learning system is also a focus of the study.

The variety of technology tools and applications used at most colleges and universities also exacerbates technical support problems (Gilbert, 2000). An institutional standardization on certain hardware, software, and related tools may reduce instructional options but this may conflict with some interpretations of academic freedom (Brzycki & Dudt, 2005). The availability of appropriately skilled professionals may be diminishing as the demands for technical support on most campuses are increasing. In Fox's (2001) case study, he claimed that the instructor was fortunate in being offered competent and ongoing technical support to help him update, change and maintain his Web site. However, few instructors are likely to be given such support because not all university schools are capable of providing this kind of technical and financial support on an ongoing basis. In this study, these problems will be investigated.

Instructors may misuse of technology because they fail to see its real potential (Morton, 1996). Firstly, technology may be seen as a teaching tool to support current ways of teaching only. Secondly, technology may be used as an add-on element to the traditional subject-based and instructor-centered curriculum. Regarding computers as tools or add-ons can undermine the potential value of a computer-rich environment and prevent instructors from changing their pedagogy. Morton (1996) reminds us that the point of technology use is to create an environment for students to increase their academic success. Likewise, Stratford (2000) suggested computers should be regarded as a transformational tool to enhance teaching and learning rather than a handy tool to support traditional teaching methods. Stratford (2000) summarized the current use of computers in education into three models: computer-as-tutor, computer-as-tutee and computer-as-tool. Computer-as-tutor is often connected with behavioral or transmission-response ideas. It leads to low level use of technology applications,

such as drill and skill activities. In the computer-as-tutee model, the learning process can lack authenticity and, as a result, hinder the transfer of knowledge to the real world (Brown, Collins, & Duguid, 1989). In the computer-as-tool model, students participate in using computer applications to edit and present their learning materials. Stratford (2000) suggests that only if the pedagogy is transformed are the real strengths of technology utilized.

The use of a live video feed in a classroom setting can be a misuse of technology. Although video is valuable when demonstrating a concept, procedure, or operation, this application takes little advantage of the benefits of distance delivery. Sevilla and Wells (2000) suggest that to achieve the “anytime, anywhere” goal, it is better to make video viewing a separate assignment followed by a Web discussion based on the video. Sevilla and Wells (2000) also noted that many students have been unimpressed by the pseudo-transformation of teaching and learning. Screens are not good for reading where long dense text presented. All these concerns are also the focuses in this study.

### **Pedagogical issues and instructor experiences of e-learning**

Some pedagogical issues are involved and may affect e-learning practice. As is in other teaching and learning contexts, pedagogical issues encompasses factors ranging for the selection of course materials, the preparation of course materials, and provision of opportunity for interactions between instructors and students and amongst students and students. Matuga (2001) warns that the successful design and teaching of any course hinges not only on instructor personality, and educational philosophy but also the teaching approaches of the instructors. Studies reveal that most of instructors are ill-prepared to make the shift from the traditional face-to-face classroom setting to the online academic forum due to a general lack of understanding of what it entails to teach courses online (Care & Scanlan, 2001; Lichtenberg, 2001; Palloff & Pratt, 2001). The pedagogical issues related to instructor perceptions and experiences such as inadequate pedagogy or teaching approaches, instructor lack of knowledge and skills in pedagogy, subject content barrier, and improving quality of interactivity will be discussed in more detail.

The barriers hindering the development of e-learning or distance education are not only technological but also pedagogical (Levine & Sun, 2003; Moore, 1994). Levine and Sun (2003) asserted that although we have a fair knowledge about how to use technology, we do not know how to customize e-learning as a highly interactive medium of learning in order to meet the individual needs of students. Thus, current forms of e-learning often prove to be poor imitations. Moreover, the misconception of e-learning and misuse of technology will lead to a poor quality of e-learning production. Thus, the demand of adequate pedagogy is an important factor for the e-learning practice.

Instructor lack of knowledge and skills in pedagogy affect e-learning development. Levine and Sun (2003) stated that instructors are unfamiliar with the interactive and individualized nature of e-learning, uncertain about their own roles, and concerned about not only their students' well-being but also their own careers. Stratford (2000) noted that instructors often overlooked the importance of the change in pedagogy so that they could not differentiate the innovative integration of computer and adopting computers based on traditional teaching approaches.

Sometimes the subject content restricts what can easily be presented in e-learning. For example, many lab classes in the physical or biological sciences—as well as courses requiring significant human face-to-face interaction—will be difficult to convert to Web delivery (Sevilla & Wells, 2000). Some specialists only could attract small numbers of students. This is one reason why it is difficult to teach specialized courses by e-learning. One aim of this research will be to study the reality of university science education through e-learning practice and find what methods have or have not been used, and try to provide some suggestions to enhance e-learning practice.

Lack of interactivity and the limited scope of course offerings are the weak points of traditional distance education (Hülsmann, 2004). Hülsmann (2004) clarified how two types of e-learning (i.e., *type-i* and *type-c* option) can improve the quality of interactivity. The *type-i* option emphasizes the *information* aspect of ICT-based e-learning, and puts a premium on the use of multimedia and programmed “internal interactivity”. The *type-c* option emphasizes the *communication* aspect

of ICT and puts a premium on communication (both between instructor and students, and among peers). Thus, how to improve interactions among instructors and students in e-learning is a pedagogical concern for instructors in their development of e-learning courses.

The quality of e-learning courses also affects the learning outcomes. Forrester and Payne (2000) found e-learning to be unpopular with employees, with dropout rates as high as 80 percent and the cause was poor quality material mainly comprised of static HTML pages. They indicated this type of static reading is not effective because on-screen reading retention is 30 percent lower than reading from printed materials. Research suggests instructors need to employ more multimedia presentation methods such as simulations with games, sound or graphs or animations to design more attractive e-learning courses (Forrester & Payne, 2000). However, lack of effective methods for the evaluation of the quality of e-learning courses is also an important concern. Berge and Lin (2001) stated that a lack of research supporting the effectiveness of e-learning and a lack of effective evaluation methods for e-learning courses and programs are two main concerns.

Syllabus revision is a pedagogical outcome that is easy to analyze and requires only as much time as the individual instructor truly needs to spend (Brzycki & Dudt, 2005). Many universities regard syllabi as a contract between instructor and student. Learning objectives, delivery method, and assignments described in a syllabus can, therefore, give evidence of technology use and instructional design. This method is efficient because many instructors revise their syllabus each time they offer a course, and it does not require instructors to attend additional formal training unless needed. Therefore, instructors who are still struggling with simple e-mail operations should be required to take more training to enable them to make a transition from face-to-face instruction to online teaching or e-learning without sacrificing quality of education (Carneval, 2000).

### **Summary of instructor perspectives and experiences**

Four factors influencing instructor participation and involvement in e-learning have been discussed in this section. These factors include personal, institutional

support services, technological, and pedagogical issues. The personal factors may be crucial determinants that include personal will and capacity such as attitudes, motivation, views of teaching and learning, role overload, and personal capability of technical knowledge and skills. The institutional support services include support for course and professional development, and promotion issues. Technological issues include infrastructures and support. Pedagogical issues include course design and teaching approaches. In a word, instructors are most affected by their personal will and capacity in their use of e-learning but institutional support services, provision of access to required computer technology and pedagogical issues are also important factors in their e-learning context.

### **2.3.3 Student perspectives and experiences**

While there is a developing body of literature on e-learning and the needs of and obstacles to successful e-learning practice (Berge & Lin, 2001; Broadbent, 2003; Geisman, 2001; Stuart, 2004), there is less research that has sought out student perceptions and experiences of e-learning. Similar to instructors' perceptions and experiences, three factors may affect student learning outcomes and experiences even when institutions and instructors try their best to provide and improve the educational quality of e-learning provision. Student personal factors, technological issues, and student perceptions of effective teaching and learning in e-learning relating with course organization are discussed in this section.

#### **Student personal factors**

All teaching and learning, including that in courses delivered solely through or supported by e-learning, relies on significant student participation (Sevilla & Wells, 2000). What are the factors that influence their participation? Research indicates the range of student personal factors important to student experiences of e-learning include student learning attitude, learning approach, sense of learning community, student personal technical knowledge and skills, and perceptions of the convenience and flexibility of e-learning.

#### ***Student learning attitude***

Student learning attitude is an important personal factor in e-learning participation (Berge, 2005; Berge & Lin, 2001; Geisman, 2001; Spender, 2002). These have

been found to range from enthusiasm to utter fear and loathing (Geisman, 2001). Student learning attitude such as dependence – independence (Joughin, 1992), autonomy, and self-direction (Grow, 1991) may influence their learning approach. For instance, positive and active learning attitudes lead students to engage more in online activities such as threaded online discussion (Ellis & Llewellyn, 2004). Student perceptions of online forums in e-learning indicate they consider the online environment to be more equitable than face-to-face classes, particularly for quiet or reticent students (Ellis, 2003). Some students prefer asynchronous discussion as it allows them to make more considered responses, while others find a disadvantage in a lack of immediacy (Ellis, 2001; Tiene, 2000). Palloff and Pratt (2001) found those students who “need time to think and reflect before responding to questions and ideas” might be best suited to learn online.

Some qualitative research studies have identified student personality traits as influences on their participation in e-learning. Kim and Schniederjans (2004) found the five personality dimensions of extraversion, emotional stability, agreeableness, conscientiousness, and openness to experiences were related to student grade performance, although they found extraversion is the weakest factor and not a significant influence on student grade performance. These five personality dimensions may influence student engaged in various e-learning activities in different ways. For example, extraversion has traits such as sociable, gregarious, talkative, and active that is perhaps suitable for online interaction. The main benefits of e-learning are the individualized and self-paced learning processes so student personality traits need to be considered (Crabtree, 2006). This implies that student’s will to achieve (i.e. conscientiousness) and being responsible, trusting, tolerant and self-controlled are important personality traits in student learning attitudes which affect their participation and performance in e-learning.

Passive attitudes to learning may be a key obstacle to successful participation in e-learning (Berge & Lin, 2001; Spender, 2002). According to student responses to a questionnaire and interview about their expectations and preferences for the teaching and learning environment, Crabtree (2006) found many students prefer to take a passive learning attitude and considered instructors should provide them the

knowledge and entertain them in the learning process. Students with passive attitudes wanted more lecture notes and supporting handouts and expressed a preference for tutorials to go over the lecture notes to better ensure they could get good results or marks (Crabtree, 2006). In contrast, students who had an more active view of learning only considered they needed “a brief outline” and related links (rather than handouts) and felt that, ideally, tutorials should provide an opportunity for group work or whole class discussion (Crabtree, 2006). Moreover, Crabtree (2006) also found both groups of students recognized the need for a change in learning approach and the challenge of acquiring the necessary independent learning skills when using e-learning even although students who took an active approach to learning had accepted personal responsibility for their own learning.

E-learning, it seems, can benefit from and increase student motivation to learn and teach students the importance of self-discipline, learning accountability, and good time management skills (Daugherty & Funke, 1998). Tang (2000) indicated that the freedom that comes with being able to learn asynchronously via e-learning requires extra motivation and time management skills. Students need to be self-motivated and organize their own learning including making provision for the time, space and equipment necessary in their use of e-learning (Daugherty & Funke, 1998). In a word, an active and self-disciplined personal learning attitude is an important factor in the successful use of e-learning. Students benefit most when they have a positive and active learning attitude and take responsibility for their own learning. The nature and role of student attitude in student response to e-learning is a focus for this study.

### ***Student preferred learning approaches***

Student preferred learning approach is an important personal factor in e-learning practice (Berge, 2005; Berge & Lin, 2001; Geisman, 2001; Spender, 2002). Research on learning approaches suggests that a deep approach is more likely to lead to good quality learning than a surface approach (Marton & Saljo, 1997; Trigwell & Prosser, 1991). Students who are familiar with classroom-based methods and assume this is how e-learning occurs may be interested in only superficial learning to pass a course rather than to increase their understanding

and knowledge in the subject (Motteram, 2006). If in-class instructors use an approach that focuses on transmitting knowledge, students are more likely to adopt a surface approach (which simply seeks to memorize curriculum content) to learning. Students are more likely to use deep approach (which is associated with an emphasis on understanding and the application of knowledge) when instructors teach in e-learning through a more student-centered approach (Crabtree, 2006). Crabtree (2003) found that an enquiry-based approach, which is a particular type of student-centered approach, encouraged students to seek out information and, through discussion, to develop a better understanding of the subject of study. E-learning can utilize various forms of enquiry-based learning such as project-based learning and problem-based learning to improve student understanding and encourage deeper learning (Crabtree, 2003).

A preference for face-to-face social interaction can, for instance, be an obstacle to participation in e-learning (Crabtree, 2006; Fahy & Ally, 2005; Geisman, 2001). Some students prefer to study with peers or in a group face-to-face (Tiene, 2000). They like social interaction with an instructor and other students such as they might have in a classroom setting (Crabtree, 2006). Students report the level of instructor involvement strongly affects their level of interaction and participation (Kearsley, 2000; Khoo, Forret, & Cowie, 2003). Students consider regular instructor presence in an online forum, where he/she provides feedback, poses discussion topics and or provides comments to extend their ideas, can support their sharing of their experiences with one another (Kearsley, 2000; Khoo, Forret, & Cowie, 2003). Students in other studies have reported a desire for regular, clearly defined and planned periods of instructor interaction and claim this enhances their learning (Brown, Herd, Humphries, & Paton, 2005; Khoo, Forret, & Cowie, 2003). Student desire for social interaction can be met by using collaborative activities such as threaded discussions, collaborative work groups (online and offline), online chats, and live collaborative learning events (Shank, 2005). Research has found students particularly enjoy these types of activities and find participating and interacting in the online class discussions particularly useful for their e-learning (Ellis, 2003; Geisman, 2001; Khoo, Forret, & Cowie, 2003).

### ***Student sense of learning community***

Associated with a concern for social interaction, student commentary suggests that when studying online a sense of online community is important (Khoo, Forret, & Cowie, 2003; Shea, 2006). Students acknowledge they need emotional and social support for learning. Students recognize a safe, tolerant, respectful, supportive climate of learning is important because this can encourage them to overcome emotional barriers to participation such as shyness and the inhibition of writing and sharing their ideas with others in the course (Khoo, Forret, & Cowie, 2003). Conrad (2005), working with a group of learners engaged in online graduate study, noted that the growth of a sense of community was marked by increased levels of comfort, intimacy, self-reliance, and self-knowledge. She argued students' perceptions of online learning shifted away from technical considerations toward affective considerations and students also accepted the responsibility and credit for the creation and maintenance of their learning community (Conrad, 2005). Shea (2006), in his research with 2314 online students across thirty-two college campuses, found that for students, a strong sense of learning community was associated with a strong "teaching presence" and contributed to a sense of shared purpose, trust, connectedness, and learning.

### ***Student personal technical knowledge and skills***

Students can lack the technical knowledge and skills required in e-learning and this can hinder their use of e-learning (Berge & Lin, 2001; Geisman, 2001; Jones, Packham, Miller, & Jones, 2004; Spender, 2002). Berge and Lin (2001) and Spender (2002) indicated that courses offered via the newer technologies in which students can lack the requisite computing skills and writing ability can be obstacles to learning. Many students experience discomfort with learning new methods and tools in e-learning (Geisman, 2001) and or lack IT experience and skills (Jones, Packham, Miller, & Jones, 2004; Lao & Gonzales, 2005). In this case, lack of technical support and or instructor/administrative support for student use of e-learning can serve as an additional barrier (Daugherty & Funke, 1998). On the other hand, Baafi and Boyd (2001) and Tiene (2000) report that their students enjoyed the online courses because they already had a wide range of personal technical knowledge and skills in the use of computers and familiarity

with e-learning. The impact of this aspect is very much dependent on individual student background.

***Student perceptions of the convenience and flexibility of e-learning***

A number of researchers have argued that the convenience and flexibility of “any time, any where, any pace” access for students is a benefit of e-learning (Daugherty & Funke, 1998; Spender, 2002; Tiene, 2000). In terms of students’ attitudes and perceptions of online education, studies have shown that students in institutions of higher education, particularly graduate students, want convenience and flexibility in completing their academic goals (Lao & Gonzales, 2005). Advantages cited by students include their being able to view classroom lecture notes before or after the class and at their own convenience (BECTA ICT Research, 2004; Sanders, 2004; Spender, 2002). Daugherty & Funke (1998) found several students referred to their discovery of learning through the Internet, compared with the traditional classroom domain. They considered students had been able to expand their learning and knowledge beyond the limitations of knowledge found in the textbook and presented lectures. Also, the students appeared impressed by the variety, quality and flexibility of learning materials offered via the Web (Daugherty & Funke, 1998). Tiene (2000) found students responded positively to the asynchronous aspect of the online class discussions. Asynchronous online discussions allowed students to participate at their own convenience when they had the time to read the comments and the time to develop their own response. There was also time to think about the points made by their peers and time to decide how they felt about certain issues. This self-regulated, self-paced quality of the online discussion experience was one of its most attractive features (Tiene, 2000). In addition, students also find that easy to access resources via the Internet and the institution’s library databases rather than memorizing those resources (Spender, 2002) support their independent learning and enhance their learning (Hase & Ellis, 2001; Khoo, Forret, & Cowie, 2003). In sum, research suggests students appreciate the opportunities that online or e-learning offers for them to read, study and reflect any time, any place and at their own pace. They find this motivating and consider it enhances their learning. The benefits of e-learning for students will be investigated in this study.

### **Technological issues and student experience of e-learning**

The technology required to participate in e-learning cannot be taken for granted. Students learning via e-learning confront technological problems that include access a computer or facilities to connect to the Internet and reliable access to internet e-learning system (Raugust, 2004; Tiene, 2000) along with necessary hardware/software, high specification or quality of computer and related facilities, Web links or Internet, and necessary online services (e.g., wireless environment) for flexibility of time and place of learning.

#### ***Access a computer or facilities to connect to the Internet***

Students need to ensure they are able to meet the basic hardware and software requirements of any online course component and may even need access to computers and related facilities with reasonably high specifications if they are to take full advantage of the online component (Tang, 2000). Blended and fully online courses often provide information via Web links or on the Internet. To access this, students need to possess or be able to access the necessary hardware and software (Geisman, 2001; Raugust, 2004; Tiene, 2000). Participation in online discussions requires access to the requisite technology learning. In particular, some students may not have access to the necessary resources at home, so participating in an online discussion becomes quite problematic for them (Tiene, 2000; Wu & Turner, 2006), unless their place of study provides easy access. Tiene (2000) suggests as ICT technology becomes less expensive, and online services become more widely available at reasonable cost, more students will be able to participate in online discussion from their homes. He asserts these barriers are likely to become less and less significant, nevertheless this issue is of interest in this study.

#### ***Reliable access to internet e-learning system***

Even when student have access, network problems can make it difficult for students to log on, access materials or complete assignments in a timely manner (Berge & Lin, 2001; Daugherty & Funke, 1998; Spender, 2002; Wu & Turner, 2006). Such technical problems can be very de-motivating for students and can impede student learning, especially when the time for submitting assignments looms (Fredericksen, Pickett, Shea, Pelz, & Swan, 2000). The graduate students

surveyed by Tiene (2000) reported that often the university online system was overloaded making it difficult to connect with their university email or e-learning accounts. Added to this, the provision of course materials via electronic means can be very frustrating and time consuming for students when the network system is unstable or not reliable, especially when they are attempting to access multimedia that needs high speed access (Tiene, 2000; Wu & Turner; 2006).

While the distribution of broadband access has proceeded rapidly, there are still many students taking online classes by utilizing dial-up to access the Web (Wu & Turner, 2006). Accessing an online class at dial-up speeds hinders the delivery of sound, video, and graphics. This can lead to a divide between students who do and do not have access to broadband. Wu and Turner (2006) found bandwidth access impacted most on students when interaction was a major requirement in the course. The students who used dial-up spent less time (significantly less in the second iteration of the study) than students accessing the course via broadband (Wu & Turner, 2006). Therefore, Wu and Turner (2006) argued that if online courses are heavily student to student interaction oriented, the impact of the bandwidth utilized by those who access online courses via dial-up needs to be considered.

To sum up, students can not learn from instructors or others in e-learning without technology. They need easy access to high quality computers or facilities to connect to the Internet and reliable access to the Internet-based e-learning system. This study is focused on the online component of a blended learning course so technology is required to mediate between instructor teaching and student learning. The impact of student access to the requisite computer technology and e-learning system will be investigated.

### **Student perceptions of effective e-learning pedagogies**

Student participation in e-learning, whether it be as part of a blended or fully online course, is influenced by a range of personal factors and preferences, the nature of the technology involved and features of the pedagogy employed. The concern of online courses course organization with an emphasis on instructor presence and social interactions between students and instructors is challenging

and particularly important to establish a productive academic environment. This section briefly reviews what research there is on student perceptions of what constitutes effective e-learning pedagogies.

E-learning or web-based learning is not a “gift-wrapping” of traditional course materials online (Fischer, 2003). An effective learning environment consists of well-organized and complete orientation and syllabus information. This is essential to help orient students to the course, the instructor, and to what will be expected of them (Fredericksen, Pickett, Shea, Pelz, & Swan, 2000). A clear and coherent course structure is important to enable students to understand the overall aims of a course and has been shown to improve the quality of their learning outcomes (Fredericksen, Pickett, Shea, Pelz, & Swan, 2000; Khoo, Forret, & Cowie, 2003; Trigwell & Prosser, 1991). A well-organized online course structure is perceived by students as the first step in establishing an academic environment in which the instructor gives adequate and helpful feedback and makes clear the objectives, the assessment criteria and generally what is expected of students. The instructor also provides opportunities for questions and time for consultations, and makes an effort to understand students’ difficulties (Fredericksen, Pickett, Shea, Pelz, & Swan, 2000; Khoo, Forret, & Cowie, 2003; Trigwell & Prosser, 1991).

Through interaction with the instructors, peers, and course content, students have the opportunity to negotiate meaning and connect new concepts to previous knowledge (Shea, Swan, Fredericksen, & Pickett, 2001). Thus it would seem that, in terms of course design, courses that include ample opportunity for student-teacher interaction are preferable to those with limited or no interaction. For instance, Fredericksen *et al.* (2000) found students who do not have adequate access to their instructors feel that they learn less and they are also less satisfied with their courses. The inclusion of documentation outlining reasonable expectations of teacher-student interaction is also important because clearly instructors cannot be available twenty-four hours or at the whim of the students (Fredericksen, Pickett, Shea, Pelz, & Swan, 2000). As pointed out earlier, where interaction is integral to a course, instructors need to consider technology issues such as bandwidth (Wu & Turner, 2006). Concerning technology challenges (see Section 2.3.3), Wu and Turner (2006) suggest two different strategies for different

types of learning. Firstly, course organizers could consider providing only text but not video, audio and sophisticated graphics online for learner-to-content oriented type of class because audio/video and graphics need large bandwidth for access. Secondly, in order to minimize the number of postings, course organizers could group students into many discussion subgroups for those courses requiring a significant amount of interaction among students.

### **Summary of student perceptions and experiences**

The literature points to a range of factors as influencing student participation in e-learning. In this thesis, these factors have been grouped into three main categories of influence: student personal factors, technology factors and pedagogy. The evidence is that student having a positive and active learning attitude and accepting responsibility for their own learning is crucial for successful use of e-learning. Students learning via e-learning can confront technological problems that include issues of access a computer and other requisite facilities, and even when they have access this may not be reliable or efficient. The nature of course organization is important in enabling students to understand the overall aims of a course. Opportunities for interaction with peers and the instructor are also viewed as an essential aspect of any effective e-learning because students consider interactions improve the quality of their learning outcomes. In this study, e-learning is an online component of blended learning so it may need different learning attitudes and learning approaches to learn online via technology. Thus, the influences including personal, technology and pedagogy factors on student learning in e-learning will be investigated.

## **2.4 Views of learning relevant to e-learning**

Views about learning and ways of generating knowledge are important considerations in any study of learning, including tertiary students learning through a combination of face-to-face and e-learning. This is because how learning is viewed influences how we think about what learners learn, know, and understand and teaching approaches that might support this. Three broad views of learning will be discussed here as relevant to this study. These are (i) behaviorist views, (ii) constructivist views, and (iii) socio-cultural views. The behaviorist

view of learning influenced conventional education and research until at least the 1970s (Elton, 1997). Constructivist and socio-cultural views of learning are embedded in the current discussions of both science education (Duit and Treagust, 1998) and e-learning (Nardi, Jaworski & Hegedus, 2005). Here, the three views and their implications are summarized to argue that a view of learning as a transaction between personal constructive activity and the socio-cultural setting provides is the most useful for describing and analyzing e-learning practice for tertiary science education.

#### **2.4.1 Behaviorist views of learning**

Behaviorism derived from the stimulus and response theory of Skinner (Skinner, 1974). From a behaviorist perspective, knowledge is seen as a storehouse of representations (Hung, 2001) and learning as the process of gaining and storing that knowledge (Cowie, 2000). The goal of learning is to acquire knowledge and learning is evidenced by observable changes in behavior (Ertmer & Newby, 1993; Wall, 2004). An instructor's task is to break down the knowledge hierarchy into discrete skills and sub-skills and to transmit these to students (Davis, McCarty, Shaw, & Sidam-Tabbaa, 1993). In this view of learning, a student's mind is viewed as a container waiting to be filled with knowledge (Roth & Roychoudhury, 1994). Behaviorists consider the brain requires external stimuli or exercise in order to enhance its capacity and so they emphasize reinforcement in learning. With respect to the behaviorist view of learning, a student's prior knowledge and motivations are usually ignored and so this view fails to actively engage with individual cognitive processes and or social practices (Case *et al.*, 1996). Thus, it does not attend to the practical, social and personal attributes of students. Other criticisms of behaviorism are that it fragments knowledge, it focuses on extrinsic motivation through rewards, and it fails to identify the uniqueness of people. Nevertheless, a behaviorist view of learning is of interest in this study because university instructors, including science instructors, while they may be highly professional in the scholarship of their discipline, tend to lack professionalism in the scholarship of teaching. Research suggests instructors traditionally perceive that "what is taught" can be directly translated to "what is learnt" (Elton, 1997). Many instructors adopt and value didactic forms of instruction consistent with a transmission or behaviorist view of learning (Roth & Roychoudhury, 1994).

Given research indicates teachers tend to assimilate technology into their current teaching practice, (Hennessy *et al.*, 2007; Rakes, Fields, & Cox, 2006) it seems likely that instructors will adopt e-learning instructional approaches that replicate face-to-face didactic forms. Whether and why instructors, and students, consider such approaches as effective will be considered in this study.

#### **2.4.2 Constructivist views of learning**

In contrast to behaviorism, a constructivist view of learning postulates knowledge is uniquely “constructed” by individuals during the learning process (Osborne & Wittrock, 1985; von Glasersfeld, 1993, 1995). Constructivists see learning as an active, rational, individual, self-regulatory and somewhat idiosyncratic process (Salomon & Perkins, 1998) in which the learner actively builds up his/her personal internal (mental) representations and develops understandings of reality through experience and interaction with the outside world (Anderson, Greeno, Reder, & Simon, 2000; Driver, 1989; Osborne & Freyberg, 1985; Osborne & Wittrock, 1985). Thus, in the constructivist view, learning is more than rote memorizing of information that has been transmitted passively from an information source, whether a teacher or instructional media such as books or videos and so on.

Across those who advocate a constructivist view of learning there are those who emphasize personal aspects and those who emphasize social aspects. Personal constructivism emphasizes cognition as an individual activity undertaken “in the head”. The construction of meanings or knowledge is thought to involve assimilation and or accommodation of knowledge (Piaget, 1950). The emphasis is not on the interactions of the individual with the environment (including other social beings) but more on how the mind constructs knowledge. Research on student science learning shifted to a cognitive perspective in the mid-1970s when disciplines relevant to science education, such as the philosophy of science, sociology, cognitive psychology, and pedagogy, encompassed the notions of constructivism (Duit & Treagust, 1998). The personal constructivist view of learning predominated in science education in the 1980s. Based on this view, the instructor’s role is to provide students with opportunities and incentives to construct their own knowledge (Sunal, Sunal, Sundberg, & Staples, 2002; von

Glaserfeld, 1992), to introduce new ideas, and provide support and guidance for students to make sense of the world for themselves (Fosnot, 1996; Zumbach, Schmitt, Reimann, & Starkloff, 2006). Instructors cannot, however, “force” students’ constructions (von Glaserfeld, 1993, p. 32). Research in science education, for instance, has revealed learners that learners do not always develop the understandings their instructors intend. They interpret experience and construct new knowledge based on their prior knowledge and experiences and the knowledge they construct may not be consistent with current scientific understandings (Ausubel, 1968; Churach & Fisher, 2001; Osborne & Freyberg, 1985).

Social constructivism arose from a desire to attend to the social aspects of knowledge construction (Duit & Treagust, 1998). It is usually traced to Vygotsky’s work (see for example Vygotsky, 1978) which was grounded in his concern to understand the social context of cognitive development and particularly, the role of language in the development of higher cognitive functions (Hodson & Hodson, 1998; Maturana & Varela, 1987). Social constructivists view the internal construction of knowledge and understanding as driven primarily by social interaction with the outside world via talk and activity around shared problems and tasks. In this process, instructors have a central role in leading students to new levels of conceptual understanding by interacting and talking with them (Hodson & Hodson, 1998). Their role is one of the discussion leader who poses questions, seeks clarifications and promotes dialogue (Good & Brophy, 2000; Hodson & Hodson, 1998). In a word, social constructivism focuses mostly on knowledge as socially constructed “in the world”.

Very few studies were found on the design of online or e-learning that incorporated a constructivist view of learning, especially studies on supporting tertiary students’ science education. Churach and Fisher (2001), in a study of the effects of student Internet usage on constructivist classroom environments, assert that science classes that have higher student Internet usage seem to be more constructivist in nature and Internet usage seems to be much more social than one may imagine. They noted students construct their ideas and understanding for new Internet learning experiences from, and in relation to, their existing experiences on

using network and technologies. They found the alert and motivated learner with appropriate background knowledge faced only a small degree of perplexity about technology use so they suggested the foremost role of an instructor today should be to teach students how to learn. Instructors needed to provide learning experiences that enabled students to critically appraise the quality of their background knowledge and find ways to help engage students in the emotionally uncertain experience of sustained critical self-reflection, evaluation, and re-construction (Churach & Fisher, 2001). The explosion of technology requires students to become active learners and classroom teachers to become co-learners (Loader, 1991). That means the responsibility for learning shifts to the learner who turns to technology for content, freeing the teacher to focus on the process of learning and interpersonal relationships (Davis & Botkin, 1994). Seen this way, the focus of science teaching and learning shifts from what the instructor has taught to what the student has learnt and these two are not necessarily the same. E-learning involves instructor and student activities online (e.g., provision of e-content and supplementary references, or collaborative projects) mediated by the use of technologies which help student construct their knowledge via personal discovery online and share their experiences with their peers and instructors. Thus it is known that constructivism is relevant to this study.

Research suggests that a majority of university instructors or school teachers, especially those with constructivist views of learning, use a combination of teaching techniques and modes of presentation such as computer-based multimedia presentation, drawings, transparencies, video tapes, lectures, and discussions in their e-learning courses (Christensen, 2003; Churach & Fisher, 2001; Farres & MacDonald, 2006; Keefe, 2003; Lim & Hang, 2003; Osman, 2005; Pettit, 2005; Salomon, 1993, 1997; Zhang & Ge, 2006). For example, Pettit (2005) suggests the concept of constructivism is suited to the design of online discussion and seems effective in improving online discussion. Pettit (2005) suggests instructors need to keep participant interests and concerns in mind by learning from, and or building on, the knowledge and experiences that students reveal during the online discussion. A combination of teaching techniques and modes of presentation have been suggested, such as running a discussion for a limited period, providing a purpose, moderating the discussion and using e-mail to remind

learners to participate, and look for ways to blur the distinction between the online and face-to-face modes. The social interaction between instructors and students and the student sense of learning community in e-learning are features of social constructivism and they can help students construct their knowledge via talk.

Considering e-learning practice in tertiary science education, Cohen (2000) in the preface of the book *Innovations in science education and technology*, indicates the need to expand and improve science education is an educational imperative and an enormous challenge. She comments:

Successful reform of science education requires careful orchestration of a number of factors which take into account technological developments, cognitive development, societal impacts and relationships, organizational issues, impacts of standards and assessment, teacher preparation and enhancement, as well as advances in the scientific disciplines themselves. (p. vii)

This suggests successful reform in science education involving e-learning needs to consider many influences such as technology, policy, and instructor and student personal factors.

Personal and social constructivism has been discussed in this section. However, e-learning involves the use of technology which is expensive and therefore its establishment necessarily involves more than just teacher and student interest and action. This leads to the need to consider the wider social, cultural and technological system in which e-learning is embedded, a broad perspective that is consistent with socio-cultural views of learning. The next section discusses socio-cultural perspectives on learning theory.

### **2.4.3 Socio-cultural perspectives of learning**

Socio-cultural views of learning are increasingly being applied by educational researchers endeavoring to understand and enhance teaching and learning in the classroom (Henderson & Scott, 2008; Salomon & Perkins, 1998;), including the science classroom (Cobern, 1998; Cole, 1995) and science e-learning (Lim, Hung, Wong, & Hu, 2004; Lim, Nonis, & Hedberg, 2006). The socio-cultural perspective regards knowledge as distributed and shared rather than as being the sole property of individuals (Duit & Treagust, 1998; Bell, 1999).

From a socio-cultural approach to cognition, higher mental functioning and human action in general are seen as mediated by tools (or technical tools) and signs (or psychological tools). Learning is conceptualized as involving the use of a variety of tools by participants who are situated in a particular socio-cultural setting (Lim, 2002; Lim & Chai, 2003). While current conceptualizations of socio-cultural theory draw from the work of Vygotsky (1986) it is worth noting that advanced technologies such as computers were not available when Vygotsky was writing. Computers, multimedia and the Internet or text-based resources such as online books or articles used interactively in an e-learning environment can act in the role of a scaffold (Salomon & Perkins, 1998; Fisher, Higgins & Loveless, 2006). They can provide information about the learning content and or assist in the management of such information (Lim, 2002, 2003; Saljo, 1999). Salomon and Perkins (1998) describe social mediation by cultural scaffolding as something that occurs when an individual learner is helped to construct meaning by the use of cultural artefacts such as books, videos, articles, and other resource materials. In their view, calculators or computers can also be used as tools to handle information (Salomon & Perkins, 1998). Artefacts such as these can allow learners to acquire knowledge from the accumulated wisdom of a particular culture or discipline (Saljo, 1999) and implicitly embody shared cultural understanding (Perkins, 1986). More specifically, Saljo (1999) uses a socio-cultural perspective on the human-technology link to interpret learning as the use of tools (p. 147). In his view, learning is not only inside the person but also in his or her ability to use a particular set of tools in productive ways and for particular purposes (see also Fisher, Higgins, & Loveless, 2006; Wertsch, 1991, 1998). Fisher, Higgins and Loveless (2006) noted the affordances of the technologies can be viewed as tools in expressing and developing instructor dimensions of being “ready, willing and able” (p.3) to utilize technologies in learning and teaching.

Depending on the instructional activities in use in e-learning, Hung (2001) indicate ICT tools play different mediating roles in the instructional process: informative tools (e.g., sounds, graphics, or video), situating tools (e.g., simulation, games), constructive tools (e.g., webpage editing software), and communicative tools (e.g., email, electronic bulletin boards, teleconferencing, or

chat). Instructors can utilize these tools for different purposes and or for different types of students in their e-learning instructional design. For example, when issues need to be discussed, instructors can provide collaborative generic environments such as a multimedia online discussion forum or video-conferencing to enable communicative and social constructivist processes between students. Similarly, students could be engaged in a problem-task context through using social communicative or constructive tools.

As ICT enters the socio-cultural setting it can trigger changes in activities, curriculum and interpersonal relationships in the learning environment (Salomon, 1993; Shulman & Shulman, 2004). The positive effects of these changes in the use of ICTs were considered to change student learning attitudes and improve student learning outcomes (Lim, 2004; Windschitl & Sahl, 2002). For example, a primary motivation given for integrating ICT in education is that it can provide students with more autonomy to construct their own knowledge and engage in cognitive operations, autonomy that may not be possible in a traditional classroom (Lim & Chai, 2003). However, Lim and Chai (2003) argue that the learner autonomy provided by ICT tools may, or may not, be taken up and ICT is not a panacea to learning in schools. ICT, like any tools in learning, can be used well or poorly and it needs care and experience in its use. Salomon (1993) notes, “No tool is good or bad in itself; its effectiveness results from and contributes to a whole configuration of events, activities, contents, and interpersonal process taking place in the context of which it is being used” (p.189). Recent research studies on learner autonomy in the ICT-based learning environment have pointed to the social and situated nature of learner autonomy and the collaborative mutual influences between learners and experts or the public (Little, 2001; Littlemore, 2001). It cannot be assumed that students will automatically take up the learner autonomy provided by ICT in the learning environment (Lim & Chai, 2003). Learner autonomy can only be understood as a social process. Therefore, the design and organization of activities online must provide support and guidance for students when they are given control of their own learning, otherwise students may easily get lost in the navigation of the Internet (Lim & Chai, 2003). E-learning in this study also may need student active and independent engagement

online, so the factors for hindrance and possible strategies to overcome hindrances are also a focus of this study.

Many of the issues related to the three broad views of learning set out above will be considered in considering e-learning practice from the perspective of a range of participants. This study will especially consider in what ways instructor and student perceptions and experiences of effective e-learning teaching and learning practices are consistent with the different views of learning as a means to consider how these practices might be made more efficient and effective.

#### **2.4.4 The view of learning that underpins this thesis**

In considering views of learning for e-learning, Hung (2001) argues that it is not necessary to discard ideas from earlier paradigms. Hung (2001) suggests instructors may need to adopt different approaches based around different learning theories depending on the instructional context and their learning objectives. In his terms, instructors need to be “pedagogical engineers” (Hung, 2001). This view is adopted in this study. Each of the three perspectives (behaviorism, constructivism and socio-cultural) is of potential interest in this study because of the focus on exploring the factors influencing e-learning development and elaborating strategies for enhancement of e-learning practice. University instructors tend to utilize and value didactic forms of instruction consistent with a transmission view of teaching and a behaviorist view of learning but this does not preclude student knowledge being uniquely constructed by individuals during their learning process as suggested by a constructivist view of learning. Added to this, recent developments in computer-mediated tools and instructional technologies have provided supportive, socially oriented environments rather than individual-centered ones (Hung, 2001). In recent times, collaborative tools such as email and discussion forums have emerged supplementing and or replacing tutorial and drill and practice software that tends to be individualized and closed-ended. These more open-ended environments enable interaction, and people can communicate and co-construct or exchange knowledge with one another. This shift is in line with a socio-cultural view of learning. Furthermore, e-learning, because of its dependence on technology, necessarily involves the active participation of a range of people in addition to instructors and students,

leading to the need to consider the social, cultural and technological system in which e-learning is embedded. Lim (2002) noted, “Research studies in ICT need to shift their attention towards the whole configuration of events, activities, contents, and interpersonal process taking place in the context of ICT is used” (p. 411). This also may be the situation in e-learning practice. Within the socio-cultural setting of a university, e-learning may lead to changes in the activities, curriculum and interpersonal relationships in the teaching/learning environment and consequently be affected by the very changes it causes (Salomon, 1993). This means a view of learning as a transaction between personal constructive activity and interaction between participants in a socio-cultural and technological setting is likely to be the most useful for describing and analyzing e-learning practice for tertiary science education.

## **2.5 Towards a model for understanding e-learning implementation**

In this section the case is made for the use of models to describe and explain complex situations in education. A range of relevant models for educational reform, teacher development, and instruction and learning both with, and without, ICT are described and critiqued. The section concludes with a proposal for a model that might be used to describe and account for the range of factors that influence e-learning as part of blended learning.

### **2.5.1 The nature and role of models**

Models constitute an attempt to represent reality. They provide a systematic description of a system, theory, or phenomenon that accounts for its known or inferred properties. As discussed earlier in Sections 2.2.2 and 2.2.3, ICT and globalization have not only impacted the worldwide economy growth in the last decades but also included educational change (Edwards and Usher, 2000; Fullan, 1991, 2000, 2001; Gilbert, 2004; Hargreaves, 2003). Modern education is experiencing unprecedented levels of change because globalization and the ‘information economy’ change the way people do many things such as how governments frame education policy and teachers do their work (Fisher, Higgins, and Loveless, 2006). In this context, teachers are often subject to ongoing

requirements to absorb the implications of new policies and implement new methods and approaches (Kington *et al.*, 2003). Simultaneously, school policy makers and administrators need to be concerned about these far reaching social changes. However, policy makers, administrators and teachers are not only vital as agents they also undergo change themselves (Fullan, 2001; Hargreaves *et al.*, 2001). Fullan (1991) found that people do not have a clear and coherent sense of the reasons for educational change, what it is and how to proceed thus much confusion and unwarranted and misdirected resistance can occur in the face of reform. This is problematic because with globalization change in education is now better thought of as a constant condition than an event (Fisher, Higgins, and Loveless, 2006; Fullan, 2000; Goodson, 2003; Hargreaves *et al.*, 2001; Hargreaves, 2003; Loveless and Ellis, 2001). A number of educational researchers are turning to models to represent this dynamic reality and to systematically describe change phenomenon.

A model can be a theory or means to explore or understand the various dilemmas in, and help people to find the ways to deal with change. Fullan (2001) uses a model of four logical types of change situations based on authority position and relation to the change effort to explain why change attempts often fail and what can be done about this. He indicates planners or decision makers of change often introduce change without providing a means to identify and confront the situational constraints and without attempting to understand the values, ideas, and experiences of those who are essential for implementing any changes. Fullan (2001) notes successful change is possible in the real world if decision makers consider the pre-implementation issues of whether and how to start and what readiness conditions might be essential before starting the change. He suggests ten “do” and “don’t” assumptions as basic to a successful approach to educational change. However, Fullan (2001) also indicates a model may not answer all the questions to do with change, such as where to start the change, or describe the change system or phenomenon completely and clearly. No one can explore or understand all the various dilemmas and know what is best for the change. Thus, the theory of educational change is essentially a theory of unanswerable questions: no one knows for sure what is best (Fullan, 2001). This implicates people in probing and understanding the meaning of the multiple dilemmas they face

deciding what to do. How to enhance existing e-learning practice is the focus of this study so it seems a model is needed to address the multiple dilemmas, and to describe what can be done to promote change.

A model can be used to better understand what influences the change. de Dios Jiménez and Salas-Velasco (2002) use a theoretical education demand model (i.e., binominal logit model) to describe what determines students' educational choice and how their educational choice process takes place in practice. Based on a comparison of different points of view, de Dior Jiménez and Salas-Velasco concluded student educational choices are a function of the educational success of their parents and high family earnings. Moreover, educational research itself can be an educational change. For example, Moll & Diaz (1987) investigated the school performance of minority students in a bilingual program that featured an instructional model. They found change can be a goal of educational research because they often create various circumstances for children to learn better such as conducting the strategic connection between school and community to promote educational change. These two studies illustrate model use to help understand the factors influencing change and why change is needed.

A model can be used to better understand the process of change and to promote educational change. Working in science education, Bell & Gilbert (1996) proposed a model to describe the process of teacher development at a time of educational change and reform. They found there were three aspects of development for the teachers involved in their research: social development, personal development and professional development. In their model, social development concerns collaborative ways of working to renegotiate and reconstruct what it means to be a (science) teacher. Personal development indicates each individual teacher needs to construct, evaluate and accept or reject for himself, or herself, any new socially constructed knowledge about what it means to be a (science) teacher, and to manage the feelings associated with changing their activities and beliefs about the science education. Professional development recognizes that teachers not only need to use different teaching activities but also need to develop new beliefs and conceptions related to activities when they work to change their practice. This model reveals three aspects of

teachers' professional development are important for the instructional change indicating the need to focus on the teacher in context. Educational change, including that following the introduction of new ICTs, does not exist in isolation. Changes in individuals, schools and in government policy as well as others in society are of concerns (Fisher, Higgins, and Loveless, 2006). Educational change is a process of coming to grips with the multiple realities of the people who are the main participants in implementing change (Lighthall, 1997). For instance, whereas government or university administrators are the decision makers of change, teachers and students are the implementers of change. Thus, large-scale reform must simultaneously focus on local development (e.g., the individual) and the larger system transformation (e.g., policy and social interaction) (Fullan, 2000).

A model can be used to guide the further study of characteristics by informing decisions about who should participate in a study. It also can provide a focus for the data collection by drawing attention to particular aspects of reality. This however, means that the researcher needs to keep in mind any limitations and be open to the perspectives and issues that might not be highlighted and that the participants might wish to address. A model can be used to bring together the perspectives of those involved in a research study. It also can be used as a tool for relating findings from the data to the concerns and issues in the reality of the participants leading to informed recommendations for change. This is the approach adopted in this study.

### **2.5.2 Models in education**

No models were found that had been developed to describe e-learning when this is part of blended learning in tertiary education. However, a number of models have been developed to describe and explain traditional classroom reform and reforms involving the use of ICT in primary and secondary education. As discussed earlier in Section 2.3, e-learning employs various ICTs to deliver course content to students and is seen as an alternative teaching tool to traditional classroom teaching. E-learning practice relies on multiple groups of people working collaboratively. Thus, e-learning as part of blended learning in this study is conceptualized as an educational reform and a nested sociocultural activity. Some

reform models relating to sociocultural approaches with, or without, ICT use are described next.

Lim (2002) and Lim and Hang (2003) adopted a sociocultural approach towards the study of ICT integration in Singapore schools. They used activity theory (Cole, 1995; Engestrom, 1987) as framework to demonstrate the intimate mechanisms that link ICT, cognition and the sociocultural settings. In essence, they propose activities consist of processes at both the individual and the social level and include mediating tools (e.g., ICT) and artifacts that link the process together. Lim (2002) argued ICT cannot be studied in isolation but must be studied within the broader context in which it is situated. For them this situation included five different levels of context or activity systems: the interacting components of the activity system, the academic course of study, the school, the country's education system and the society at large. Each level of context or activity system consists of various combinations of the interacting components. The interacting components are the subject (individual student), the object of the activity (high order thinking skills in their case), the mediating tools (ICT and non-ICT tools), the community (classmates, teachers, and ICT staff), the division of labor (roles of participants), and the rules (general and specific rules). Changes that are initiated by any of the components of an activity system may impact on the components of the other activity systems (Cole, 1995; Lim, 2002). Thus, the model of activity system is dynamic. There is ongoing construction and re-construction between its components (Lim and Hang, 2003). This study indicates change from ICT integration in school needs to pay attention to the ongoing various combinations of interacting factors such as individual student, classmates, teachers, ICT staff, tools and rules associated with ICT use. Lim (2002) and Lim and Hang's (2003) studies focused on the student learning activity and they addressed the activity system for 'successful' and 'unsuccessful' integration of ICT. They provided four important insights into the integration of ICT in schools. These were ICT is one of the mediating tools for interaction; other people must be taken into account simultaneously with the individual student as constituents of the activity system; institutionalized activities are more robust and enduring than individual goal-directed activity; and activity systems needs to consider the history and

developmental phases of the ICT integration processes. Lim's work directs attention to the broad context for e-learning.

Fisher, Higgins, and Loveless (2006), in their review report of research and projects on 'teachers learning with digital technologies' used a number of models, including that of Shulman and Shulman (2004), as frameworks to express the features of professional knowledge and learning and also to reflect the characteristics of learning environments, settings and experiences involved in ICT use. Shulman and Shulman (2004) propose a 'nested' formulation placing individual reflection at the center of three 'layers': individual, community and policy (p. 268). Their model focused on how ICT can support teacher learning and the characteristics of 'accomplished' teachers. This model implicates teachers themselves as individually more or less inclined towards professional learning, which requires vision, capability, motivation, reflection and willingness to participate in a professional community. Shulman and Shulman (2004) note ICT can play a role as a tool in supporting teachers in gaining and sustaining a communal orientation in their professional learning (Engestrom, 1999; Wertsch, 1998). For instance, digital video can enable teachers to capture, observe and review critical moments in their own practice leading to knowledge building (Olivero *et al.*, 2004). ICT communication tools such as emails, shared databases, online conferencing, discussion forums and VLEs (virtual learning environments) can support the co-construction of ideas, knowledge and understanding. Teachers can also reflect on their practice within a wider community by engaging in reflective analysis of materials and experiences with colleagues and mentors. In a word, ICT can support teacher professional development by reducing individual isolation and supporting sharing experience and by fostering reflection and influencing the development of practice (Barnett, 2002). Similarly, teachers in e-learning practice also need to be ready, willing and able to engage with mix use of ICT (e.g., video of lessons, emails, discussion forums, and video conferencing) for their e-teaching within their professional community. How this happens is a focus in this study.

Zhao, Pugh, Stephen, and Byers (2002), from an ecological perspective, identified 11 factors as impacting on the implementation of ICT innovation in schools. Their

model clustered these factors into three interactive domains: the teacher, the innovation and the context. Firstly, they indicated the teacher is the key innovator of classroom technology use and his/her technology proficiency, pedagogical compatibility with technology and social awareness of the organizational and social culture of the school affects the success of classroom technology innovations. Secondly, they noted the success of classroom technology innovations varied with distance from school culture, existing practice and available technological resources, and the degree of dependence on other people and technological resources. Success was less likely when the required people and resources were beyond the innovator's immediate control. Zhao and colleagues suggest that more successful innovations usually had a lower degree of distance, dependence, or both, however, the relationship between success and either distance or dependence was not always direct and could involve complex interactions between various aspects of these two dimensions. Furthermore, they noted the characteristics of innovations (distance and dependence) interact with those of the innovator (pedagogy, technology proficiency and social awareness) and with contextual factors (the human infrastructure, the technological infrastructures and the social support). The context for successful technological innovations was linked to organizational arrangements to support technology integration in the classroom such as a flexible and responsive technical staff or a supportive and informed administrative staff, clear institutional policy and procedures related to technology issues, easy provision of adequate technological facilities and peer support. The study concluded the teacher plays a more significant role than the other domains: when the teacher was strong in terms of technology proficiency, pedagogical proficiency with ICT use, and social awareness then an innovation had a better chance of success even when the innovation had a high degree of distance and dependence, and a less-than-supportive context. Building on Zhao, Pugh, Stephen, and Byers (2002)'s work, Zhao and Frank (2003) also used an ecological model to identify and correlate factors affecting technology uses in schools. Their research indicated that innovations cannot be implemented without regard to the internal social structures of schools and the other external social and political pressures or forces that school face. However, they noted these forces can potentially be absorbed and transmitted through collegial ties within the school because teachers were strongly

influenced by help from colleagues (p. 830). Furthermore, teachers' levels or types of technology use varied along with their help from different colleagues who also had various levels or types of technology use. They concluded the distribution of technology implementation is likely a function of the distribution of social relations within the school although it was also shaped by external factors. These two studies reiterate the importance of both the teacher and the wider context.

The difference between Internet-based learning environment and traditional learning environment has gradually emerged. Researchers suggest constructivist epistemology can better elaborate the Internet-based learning environment (e.g., Chou & Tsai, 2002; Chung & Tsai, 2005) and constructivist theory can be applied in Internet-based instruction (e.g., Yakimovicz & Murphy, 1995; Tsai, 2001a). Chung & Tsai (2005) used a Constructivist Internet-based learning environment survey (CILES) instrument to explore students' preferences towards constructivist-oriented Internet-based learning environments. They identify the person (learner), the machine/system and the activity are three components of Internet-based learning environments. They indicate the learner plays the central role in the environments which involve the relationships of person-machine (exterior) and person-activity (interior) dimensions. However, some researchers suggest learning environments in terms of shared perceptions between students and teachers are defined as learning occurs within the social-psychological context so both students and teachers perceptions need to be explored (Fisher & Fraser, 1983; Fraser, 1998; Fraser & Walberg, 1991; Tsai, 2003). Therefore, Lee and Tsai (2005) developed a model illustrating the components of Internet-based learning environment (i.e. new framework for improvement-CILESI questionnaire) to assess high-school students' and teachers' preferences towards Internet-based learning environment by integrating some important scales already used in Chung and Tsai's (2005) CILES instrument together with three new scales. Furthermore, based on the suggestion of Wen *et al.* (2004) and Tsai (2004), Lee and Tsai (2005) assert that the features or perceptions regarding the Internet-based learning environment should be further categorized into five aspects (i.e., the technical, content, cognitive, metacognitive, and epistemological aspects) with six scales (ease of use, multiple resources, student negotiation, reflective thinking, critical

judgment, and epistemological awareness) to investigate student and teacher preferences. They also suggest developers of the Internet-based learning environments need to create a favored Internet-based learning environment by paying attention to the differences between student and teacher preferences and other factors. This implies the wider context in which multiple people involved in the educational change associated with various theories and models needs to be concerned. As has been argued in the previous section a sociocultural view of learning is considered the most potentially useful way of thinking about the whole system of e-learning practice, particularly when the research aims to enhance that practice.

Any innovations including educational change with, or without, the use of ICT in schools may face barriers or challenges in the reform. While the above studies developed models for ICT use other studies have identified barriers and enablers to the use of ICT in teaching (e.g., BECTA, 2003; Butler & Sellbom, 2002; Cox, *et al.*, 1999; Guha, 2000; Mumtaz, 2000; Preston *et al.*, 2000; Pelgrum, 2001; Snoeyink & Ertmer, 2001). Mumtaz (2000) identifies a number of factors as influencing teachers' decisions to use ICT on the basis of an extensive literature review. The factors included: access to resources, quality of software and hardware, ease of use, incentives to change, support and collegiality in a teacher's school and national policies, commitment to professional learning and background in formal computer training. These factors reveal a relationship between the institution, resources and the teacher. The school as an institution often gives teachers little time and limited supportive resources to manage and familiarise themselves to use ICT (Robertson *et al.*, 1996; Rosen & Weil, 1995). However, school assistance in terms of support, finance, training and facilities only can encourage ICT use; actual uptake ICT relies on teachers' personal feelings, skills and attitudes to ICT (Cox *et al.*, 1999; Pedretti *et al.*, 1999). The range of factors suggested to help teachers to integrate ICT includes providing more power and prestige to teachers, situated learning, collaborative reflection, long-term collegial interaction, and so on (Carney, 1998; Hruskocy *et al.*, 2000; McDougall & Squires, 1997; Veen, 1993). However, Mumtaz (2000) highlights the role of pedagogy (i.e., teachers' theory about teaching) and suggests that teachers' beliefs about teaching and learning with ICT are central to its integration. How ICT fits

into pedagogy depends on teachers' perception of ICT as changing the nature of their subject and the way it is understood. It also depends on how they see it as a tool for teaching as yet another artefact in the classroom (Moseley & Higgins, 1999). Mumtaz (2000) notes teachers need to be given evidence that ICT can make their lessons more interesting, easier, and more fun for them and their students. Thus for the successful implementation of ICT teachers, the school and policy makers need to consider in the change process.

BECTA (2003) identified individual or teacher-level and institutional or school-level barriers and the complex interrelationship between the two levels of barriers. Teacher-level barriers include lack of time, self-confidence in using ICT, knowledge necessary to enable teachers to resolve technical problems, motivation to change, and personal change management skills, and negative experience with ICT, fear of embarrassment, and so on. School-level barriers include lack of access and quality to ICT equipment and ICT related resources; lack of technical and administrative support; lack of institutional support through leadership, planning and the involvement of teachers as well as managers in implementing change; lack of training differentiated according to teachers' existing ICT skill levels; lack of training focusing on integrating technology in the classroom, and so forth. Put another way, the teacher-level barriers can be grouped into three aspects of teacher's attitudes towards ICT: self-confidence with ICT, perceived relevance of ICT, and innovativeness (Fabry & Higgs, 1997). School-level barriers are related to lack of available equipment, resources, and support. However, these two levels of barriers influence each other in complex ways. For example, although attitudes partly depend on personality (Guha, 2000), teachers' previous negative computer experiences can affect their perceptions of ease of use and relevance of ICT, reducing their confidence, and increasing anxiety. The anxieties can be fear of embarrassment when using computers (Russell & Bradley, 1997) and fear of losing professional status through a downgrading of traditional pedagogical skills (Fabry & Higgs, 1997). In this study of the use of ICT in e-learning practice attention will be paid to these two levels of barriers in e-learning teaching and learning.

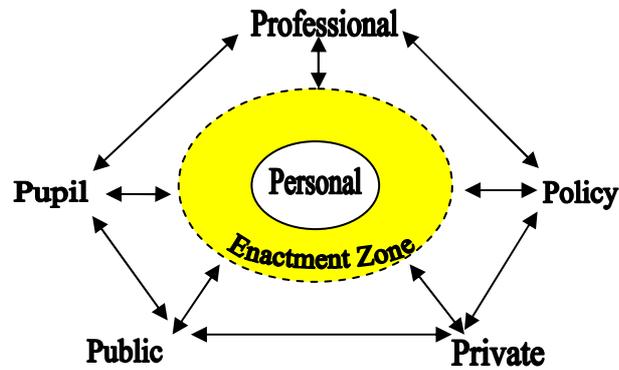
Other researchers have categorized barriers to ICT use as external or first order and internal or second order barriers (Snoeyink & Ertmer, 2001). First-order barriers include lack of equipment, lack of reliability, lack of technical support and other resources-related issues. Second-order barriers include both school-level factors such as organizational culture and teacher-level factors such as beliefs about teaching and technology and openness to change. Snoeyink & Ertmer (2001) note external (first-order) barriers often can reflect or even mask internal (second-order) barriers. For instance, even in well-resourced countries, teachers who used ICT were likely to complain about a lack of equipment (Guha, 2000; Pelgrum, 2001) because a lack of equipment can be an excuse for resisting the change with ICT use in creative and innovative ways (BECTA, 2003). Teachers' beliefs about the relevance of ICT to their subject can magnify or reduce the effect of practical difficulties when they encounter (Ertmer *et al*, 1999). Moreover, teacher perceptions of difficulty in using computers may be to do with lack of confidence on the hardware or software itself (Snoeyink & Ertmer, 2001). Thus, it seems impossible to separate first-order from second-order barriers, or barriers at the teacher level from those at the school or policy level. This indicates that when exploring influences on the use of ICT or e-learning it is important to identify the interior personal teacher-level and school-level barriers and also need to pay attention to the external complex interrelationship among teacher, school, technology, and other related resources.

E-learning practice, as part of blended learning courses, can be seen to be an educational reform based on ICT technologies (see Section 2.2.3). Teachers in the e-learning practice of this study need to make decisions about changing their instructional approaches, because they are not required by the university to use e-learning (Section 1.2.3). E-learning practice in this study was initiated by the government (Section 1.2.2) and instructors are often blamed for the problem of under-use (Section 1.3.1). The models proposed by Spillane (1999) and Millet and Bibby (2004) seems appropriate for describing e-learning practice as an educational reform because these two models are focus on the individual teacher making decisions for instructional change within their professional community and the wider context. Working in the context of mathematics instructional reform, Spillane (1999) developed a multifaceted model to explain why some teachers

seem able to change in times of educational reform but others do not. He proposed a six P's model to describe the reform of classroom teaching. This is shown in Figure 2.1 below.

Figure 2.1

*Enactment zone and teachers' incentives and opportunities to learn and change*



(Spillane's model: 1999, p.168)

Spillane indicated the central person in the reform process, the teacher, is influenced by their personal zone of enactment and by external influences and constraints of various types. A personal zone of enactment is an area of potential for development and also the space where the individual makes sense of reform or change initiatives in an essentially social process. The outer section of the pentagon identifies the external factors. The external factors Spillane identified were the policy, professional, pupils (students), public and private sectors within and beyond the teacher's working environment. These five outer P's can be considered as factors which might support teachers learning about reform practices and or as providing incentives or discouragements for teachers to learn about and change their practice.

The six P's model describes the complex context of external factors that bear on teacher personal enactment of reform. The policy sector refers to government or institutional policies. E-learning is a focus for policy development by governments worldwide. It is also a focus for development in many universities. This suggests that in this study, national, university, and department policy are areas worthy of consideration. The professional factor refers to formal associations and or informal contacts among educators, which can have an

important influence on teacher practice (Huberman, 1995; Little, 1993; McLaughlin & Talbert, 1993). Formal and informal professionals outside the university, such as colleagues at other universities, Ministry of Education officials and professional discipline associations are relevant for this study. The third P represents pupils (i.e., students) and the influence pupils' responses have on teachers. McLaughlin and Talbert (1993) indicate pupils, especially teachers' perceptions of pupils, have an important influence on teacher's practice in instructional reforms. It is anticipated this will be the case in this study. The fourth P symbolizes the public sector and has to do with parent and community concerns. Government policy for e-learning practice usually has a goal of the cultivation of people who can adapt to the current information age (see Section 2.2.2) so people in the community or the public are potential source of influence on change in this study. The fifth P represents the private sector and includes textbook and curriculum publishers and also business and industry. E-learning is one kind of e-business, so private publishers or enterprises may be influences in this study. In sum, all the above five P's sectors are external factors influencing teacher personal enactment of reform. They are potentially important influences on teachers in e-learning practice.

The sixth P represents the personal resources that teachers have for learning about practice. Spillane (1999) indicates some teachers notice many opportunities for learning while others notice few. He suggests teachers need to notice opportunities for learning or change in their environment if they are to make changes. He noted this noticing is not automatic but depends on teachers' personal resources such as their knowledge, beliefs and dispositions, as well as on the policy, professional, public and private environment. He noted teachers' personal resources are important when they process new information and ideas about practice: the policy and professional sectors can only work in and through teachers' existing knowledge, beliefs and convictions. Thus, the personal sector is at the center of Spillane's model. The five external influences are mediated in and through teachers' personal resources. This implies that the policy, professional, and other sectors do not determine what teachers learn about reform practice because their influence on practice is mediated through teacher beliefs, knowledge and dispositions. The two-way arrows that link the central P to the other five P's

in the model represent this dynamic, two-way, relationship. The line that forms the circle is broken to indicate that enactment zones can vary from one teacher to the next. Spillane (1999) conjectures the extent of teacher revision of practice will depend on the characteristics of a teacher's zone of enactment. He argues that teachers' enactment zones vary on a continuum from individualistic to social, in enabling teacher to change the core of their practice. He argued that teachers' enactment zones vary on a continuum from individualistic to social because reforms depend not only on teacher's individual capacity but also their interaction with external incentives and opportunities. Spillane noted social enactment zones can be accomplished through collaboration with knowledgeable others and with material resources or artifacts and tools that support learning. This implies e-learning instructors might construct ideas about reforms from their own resources and also through social processes with people and materials in their enactment zones where these external incentives and opportunities are mobilized by policy, professional, private and other factors. This will be explored in this study.

Some research studies (e.g., Macnab, 2003; van den Berg, 2002) have used the Spillane's (1999) teacher's zone of enactment to explain why in the curriculum reform process certain teachers change their practice and others do not. Macnab (2003) used a survey on teaching and learning mathematics in Scottish schools to examine the process of curriculum change in the classroom. The results of the survey showed that the process of curriculum change involves both a central direction and local influences (e.g., teacher's resistance and student's attitude). van den Berg (2002) reviewed a number of scientific schools of thought and research results and identified the importance of identifying the existential attributions of teachers. He indicated teachers appear to interpret norms, opinions, proposals, and suggestions in an active manner, but they are influenced by discussions with colleagues, with this leading to a change of classroom practice. In other words, a teacher in a reform not only needs to keep his or her own professional identity but also needs to cooperate professionally and maintain positive relations with colleagues. This implies a review of any reform needs to consider individual teacher interpretations of situations.

Some research studies have used Spillane's (1999) 'zone of enactment' to develop 'systemic understanding of patterns of practice in classroom where teachers are trying to enact reform' (Spillane and Zeuli, 1999, p.20). They have tried to understand the importance of teacher's zone of enactment in educational technology integration in schools (Militello, 2003). Other studies have used Spillane's (1999) model to address the theories of teacher change (e.g., Spillane, 2002) and examine multiple research methods (e.g., survey or case studies) in a large-scale reform (e.g., Brian Stecher and Hilda Borko, 2002; Spillane, Halverson, & Diamond, 2004). Together, this research indicates Spillane's concept of teacher's enactment zone with its associated social dimension is worthy of consideration in the study of educational change. It is a focus in this study.

Millett and Bibby (2004) drew on Spillane (1999), along with the work of Leithwood, Jantzi & Mascal (1999), to theorize their study of primary teachers at a time of reform in primary mathematics education in England. They introduced the notion of a situation to extend Spillane's model. Millett and Bibby (2004, pp. 2-3) describe a situation as pertaining to the whole-school context based on the view that "whole-school characteristics play a major role in distinguishing between success and failure in initiating, implementing and sustaining reform". They emphasized the situation or immediate school environment contains both pupils and the professional community of colleagues with whom each individual teacher works closely. More distant, but still exerting influence, are the external professionals, policy makers, the public and aspects of private enterprise outside the situation. In this study the notion of a situation is explored in the context of e-learning in blended learning.

### **2.5.3 A model for exploration in this thesis**

Although many of the aforementioned models have shifted attention away from the study of single variables and onto the whole configuration of events, activities, contents, and interpersonal processes that occur in the ICT-use context. No one model clearly identifies all the factors affecting e-learning implementation. For instance, Lim (2002) and Lim and Hang (2003) use activity theory but activity theory has not operationalised in ways that answer many of the research questions

to do with the possible roles of ICT in education (Kaptelinin, 1996). Furthermore, Lim and Hang (2003) model has the Singapore's Ministry of Education at the highest level of the activity system that forms the broad context of the classroom. They do not consider society at large. However, as study of e-learning practice in the Taiwanese context not only needs to be concerned with the influence from the government but also that of the wider society because there is a social demand for flexibility of learning and educational services in Taiwan. The notion of a particular "situation" or "context" for reform is addressed by Millet and Bibby (2004). Spillane (1999) and Millett & Bibby's (2004) models clarify all the participants who need to be involved in educational change. This is important in a study of e-learning as part of blended learning because e-learning practice relies on the support of administrators, technical support people in addition to teachers.

Many of the research studies detailed above considered the relationship of the institution, the teachers and the innovation (ICT use) (BECTA, 2003; Mumtaz, 2000; Zhao & Frank, 2003; Zhao, Pugh, Stephen, and Byers, 2002). They all indicated teachers need to make decisions about their instruction with ICT. Spillane provides a nuanced model that clearly articulates the role of the teacher as a key decision-maker in instructional reform. Spillane's (1999) model uses the notion of an individual teacher zone of enactment to explain why, at a time of curriculum reform, certain teachers change their practice and others do not. The enactment zone identifies the space within which teachers can make change. If teachers are able to make sense of the necessary change Spillane's work suggests teachers will be self-motivated to enact any change: the value of the enactment zone is that it identifies teacher will and capacity for change. This is important in this study because teacher use of e-learning is voluntary.

Further, Spillane (1999) and Millett & Bibby's (2004) models consider the whole practice of educational reform. Other models have not focused on the full process. For example, Bell and Gilbert (1996) focus on (science) teacher professional development, Lim and Hang (2003) focus on student learning activities and Mumtaz (2000) focused the barriers teachers encountered. When the goal was to describe and explain to propose ideas to reduce the problem of under-use in university e-learning practice it was thought that the model used needed to

describe and account for the full range of factors that influence e-learning as part of blended learning. The Spillane (1999) and Millett & Bibby (2004) models were developed to describe and explain reforms in traditional classroom teaching. Neither placed emphasis on the role of computer technologies as teaching tools. Instructional reform in e-learning practice needs to be concerned with the technology involved. The university e-learning practice in this study was promoted by the national government and uses multiple technologies. This study sets out to test, and refine the Spillane and the Millett and Bibby models in the context of e-learning as part of blended, exploring in more depth the influences on teaching and learning practice.

## **2.6 Chapter Summary**

The main focus of this literature review has been to identify what are the initiatives, benefits, impacts/challenges and related influences of e-learning practice from political, managerial, instructor and student point of view. Drawing on the literature, three significant domains for university e-learning practice are proposed. These domains are technological innovation and education, the practice of e-learning and science education, and perspectives on learning, e-learning and science education. For each domain, key enablers and constraints on e-learning practice were identified. The literature indicates ICT has accelerated the emergence of an information society and knowledge economy and this has impacted on the educational environment through the implementation of e-learning systems. E-learning has altered, and will continue to affect teaching and learning context in tertiary education so this study is intended to contribute to a better understanding of the existing e-learning practice for university science education.

A view of learning as a transaction between personal constructive activity and interaction between participants in a socio-cultural and technological setting has been proposed as likely to be the most useful for describing and analyzing e-learning practice as a component of blending learning courses in tertiary science education. Instructors and students are affected by their personal will and capacity in their use of e-learning. E-learning practice not only requires a good ICT

infrastructure but also relies on the active and collaborative involvement of a number of other people. Institutional support services, provision of access to the required technologies and pedagogical issues, and other factors in the wider context are also important factors in the e-learning context.

A range of relevant models for educational reform, teacher development, and instruction and learning both with, and without, ICT have been explored. Although the models in relation to ICT use tend to view ICT as a mediating tool and seem to be appropriate for e-learning practice they do not clearly identify the broad range of participants (e.g., administrators and technical support people) and factors (e.g., external professionals and private commercial products) that might impact on practice. When the goal is to develop some solutions to reduce the gap and solve the problem of under-use for the university e-learning practice, Spillane (1999) and Millett & Bibby's (2004) models appear appropriate for exploring existing e-learning practice with the aim of its enhancement. Thus, this study will explore a model to describe and account for the full range of factors that influence e-learning as part of blended learning for particular Taiwan tertiary science e-learning.

The research aim for this study is to examine and understand effective teaching and learning in science via e-learning that is part of blended learning courses in a Taiwanese research-oriented university. The research has three main goals:

- 1) A better understanding of existing e-learning practice in general at NRU. An investigation will be undertaken of the existing situation from the perspective of administrators, technical support people and experienced online instructors and their students regarding the benefits of teaching and learning in the e-learning context. This will better inform the researcher of key aspects, prospects and challenges to teaching and learning in the e-learning context.
- 2) An in-depth investigation of the perspectives and experiences of instructors and students from the College of Science to ask why they do, and do not, use e-learning and what they see as the benefits and challenges.
- 3) The development of a model that might be used to assist governments and universities to consider the full range of influences on e-learning practice in a (Taiwan) university context.

Internationally, many issues regarding the effective implementation of e-learning for the production of high quality education have begun to be raised. Research has

highlighted some of the emerging issues regarding the impacts/challenges of e-learning practice on institutional administrators, instructors and students. However, very little research has been undertaken in Taiwanese tertiary institutions on the enablers and barriers from the political, economical, psychological, pedagogical and technological perspectives of institutional administrators, instructors and students for e-learning. In order to be able to advocate enhanced e-learning strategies and practice in university science education in Taiwan, this research needs to explore the factors that influence e-learning practice at a political, institutional, instructor, and student level.

In the next chapter, Chapter 3, the methodology used to generate data on administrator, support person, instructor and student experiences and perceptions with respect to e-learning practice is outlined.

# Chapter 3 Research methodology

## 3.1 Introduction

The range of methodologies and methods used in educational research will be outlined in Section 3.2. The interpretive methodology used in this research will be more fully explored in Section 3.3, including multiple perspectives, multiple data generation methods, data analysis, issues of trustworthiness, and ethical considerations. Section 3.4 describes the specific research design and methods used for this current study. Section 3.5 summarizes the main points of the chapter.

## 3.2 Methodology and methods for educational research

The ontological and epistemological presumptions of the researcher influence educational research design and the interpretation of findings (Bryman, 2001; Hitchcock & Hughes, 1995). Three paradigms—positivist, interpretive and critical theory - have been identified in the literature, they reflect different ontological and epistemological positions (Carr & Kemmis, 1986; Cohen, Manion, & Morrison, 2000).

### 3.2.1 Methodological paradigms for research

A paradigm is a systematic way of thinking about the world, about knowledge, and about doing research. It is considered to be a “net that contains the researcher’s ontological, epistemological and methodological premises” (Denzin & Lincoln, 2003, p. 33). It presumes consistent positions on ontology, epistemology, the stance of the researcher, and what counts as truth. The research paradigm demands not only how research should be done, but also what should be studied, and how results should be interpreted (Bryman, 2001).

While positivism focuses on objectivity and the construction of laws to predict human behavior (Cohen, Manion, & Morrison, 2000; Denzin & Lincoln, 2003) and critical theory research is proposed for considering how human lives are mediated by systems such as racism and sexism (Lather, 1992), interpretivism focuses on understanding the participant perspectives (Cohen, Manion, &

Morrison, 2000; Patton, 2002). As this research intends to obtain a better understanding of the existing e-learning practice in a natural setting at a NRU from the perspective of five stakeholder groups, the most appropriate methodological stance is interpretive.

### **3.2.2 The characteristics of quantitative and qualitative methods**

The choice of methodology often affects the methods selected for the research. The chosen method needs to provide data commensurate with the methodological approach. The positivist approach favors methods such as experimentation, observation and surveys that can provide quantitative data for statistically examining correlations and quantifying confidence from which to draw conclusions. The interpretive approach favors methods such as interviews and participant observation that can provide qualitative data that allows meaning to be examined and interpreted. This dichotomy between positivist-quantitative and interpretive-qualitative is not, however, absolute (Ary, Jacobs, & Razavieh, 2002). Many researchers (e.g., Patton, 2002) advocate the use of both qualitative and quantitative research to address the different aspects of a research question (Neuman, 2002) and to provide richness of data (Schwandt, 2003).

The quantitative and qualitative methods have their own advantages and disadvantages. Whereas quantitative methods use objective, standardized measurement and statistical analysis of numeric data to understand and explain phenomena (Ary, Jacobs, & Razavieh, 2002), qualitative methods allow the researcher to study human behaviors in depth and detail and do not have any constraints on searching data to fit into limited predetermined analytical categories (Patton, 2002). Whereas the quantitative method is beneficiary to generalized findings from large samples to explain the general phenomena, the qualitative method has the flexibility to suit the diversity of reality. Thus this study will adopt both quantitative and qualitative methods and an interpretive paradigm as the basis for its research methodology to capture the breadth and richness of participants' experience in a natural context.

### **3.3 Interpretive methodology for research**

The core of the interpretive methodology is to understand the subjective world of human experience (Cohen, Manion, & Morrison, 2000), where the stress is on “the understanding of the social world through an examination of the interpretation of that world by its participants” (Bryman, 2001, p.264). The aim of interpretive research is to understand participant intentions, motivations, actions and reasons (Robottom & Hart, 1993) so that a detailed specific situation or view of the topic can be presented (Ary, Jacobs, & Razavieh, 2002). This methodology also sits well with the notion of socio-cultural learning based on participants’ experiences of the social and cultural environments in which they are situated. An interpretive paradigm allows the use of open-ended and rigorous questions to help consideration of all answers and their distillation into a better understanding.

The main task of an interpretive researcher is to understand the multiple realities in a specific context. Participants are viewed as helping to construct “reality” with the researcher (Robson, 2002). The joint construction of meanings and actions is continuously negotiated and influenced by the research context (Denzin & Lincoln, 2003). Thus, the need to gain a deeper understanding of different situations through both researcher and participant eyes is crucial, particularly as reality is viewed as multi-layered and complex.

Interpretive research involves a process of deliberate inquiry (Cohen, Manion, & Morrison, 2000) and it is conducted in a natural real-world setting (Bryman, 2001; Patton, 2002). The researcher employs multiple, usually qualitative, data generation methods that allow multiple perspectives to be acquired (Robson, 2002). The research process is often responsive and flexible because data generation and analysis are ongoing and interact in a hermeneutic cycle (Guba & Lincoln, 1989). Researcher and participant perceptions and understandings of events may change the focus of inquiry and the methods used for data generation (Erickson, 1985). Tentative assertions are developed through continually constructing and reconstructing sets of meanings and actions and serve to inform further data generation and analysis (Bryman, 2001; Cohen, Manion, & Morrison, 2000). They are compared with further data for confirmation, negation or

modification to yield insight and understanding of people's behavior (Cohen, Manion, & Morrison, 2000).

By adopting an interpretive paradigm, this study seeks to explain and explore what leads to effective learning outcomes by understanding the systemic interaction between key players in e-learning practice. This approach is both value and context dependent. Identifying emergent themes from the data collected is emphasized instead of observing data from intentionally pre-selected categories. Inductive descriptions and interpretations of how the participants make sense of the teaching-learning process in the e-learning context underpin the research investigation. In this study, the researcher investigated five different layers of participant perspectives to examine the situation and gain a deeper understanding of the e-learning context within the university and the wider community.

The main considerations in planning and conducting interpretive research are multiple perspectives, multiple data generation methods, data analysis, issues of trustworthiness, and ethical considerations. Each aspect will be discussed in the following sections.

### **3.3.1 Multiple perspectives**

Within interpretive methodology, people are viewed as intentional participants in the activities of their communities (Cohen, Manion, & Morrison, 2000) and all their perspectives on events or situations are of interest (Erickson, 1985). There is a commitment to recognize the existence of multiple realities and interpret or reflect the research context from multiple views of participants (Bryman, 2001; Patton, 2002). This allows the researcher "to take advantage of the interplay, or triangulation, of multiple perspectives both to enrich and validate the interpretation of data" (Nuthall & Alton-Lee, 1993, p. 801). Attending to multiple perspectives not only provides a unique opportunity to make the "familiar strange" (Delamont, 1992) but also improves the ecological validity of the study. It assists in ensuring that variables present in the 'real world' are noted by the research process (Banister, Burman, Parker, Taylor, & Tindall, 1994).

Personal background, beliefs, attitudes and perceptions of the researcher can influence the interpretative research process (Erickson, 1985; Robson, 2002) because they are directly involved in the data generation and analysis (Bryman, 2001). Although an interactive process is shaped by the personal history and construction of both participants and the researcher (Denzin & Lincoln, 2003), the researcher is still a decision-maker of the reported 'story' (Stake, 2003). Ongoing critical and reflective examination of researcher biases and assumptions is important in undertaking the research process (Bryman, 2001). E-learning practice as an activity involves five cohorts of participants who contributed to this research project: administrators, technical support staff and student assistants, instructors, and students.

### **3.3.2 Multiple data generation methods**

Multiple data generation methods are often used to increase the credibility or trustworthiness and interpretability of the data generated from multiple sources (Maykut & Morehouse, 1994; Robson, 2002). Each method can reveal different aspects of reality and it has its own strengths and weaknesses (Cohen, Manion, & Morrison, 2000). No method is completely neutral and without restrictions, so use of only one method in the study is considered more vulnerable than the use of multiple data generation methods (Patton, 2002).

Triangulation, or the integrative use of multiple sources of data, allows the display of multiple, refracted realities (Denzin & Lincoln, 2003) because it helps the researcher to "map out, or explain more fully, the richness and complexity of human behavior by studying it from more than one standpoint" (Cohen, Manion, & Morrison, 2000, p. 112). It can also reduce researcher bias, respondent bias and reactivity (Robson, 2002). There are several types of triangulation: methods (e.g., combination of qualitative and quantitative methods), data source (e.g., provision of one sort of data from multiple participants or several sorts of data from a participant), investigators (the use of more than one researcher), theories (e.g., views of data from the perspective of more than one theory), time (e.g., involvement in a cross-sectional or longitudinal manner) and space (e.g., performance of the research in different places or across cultural boundaries) (Cohen, Manion, & Morrison, 2000; Patton, 2002). The use of different methods

is the most frequently offered strategy in educational research (Cohen, Manion, & Morrison, 2000). However, a different data source can not always be expected to yield essentially same result (Patton, 2002). Inconsistencies in the findings can offer a chance for deeper insights rather than being viewed as a weakness of the research credibility. The current study has adopted a combination of qualitative and quantitative methods to gather data from multiple cohorts of participants within a natural context. The case study design, questionnaires and interviews will be described below.

Case study is a holistic, intensive description and analysis of a single unit or bounded system such as an individual, group, community or event (Cohen, Manion, & Morrison, 2000; Merriam, 2001). It involves methodical planning, encompasses the systematic collection of evidence, and investigates the relationships or processes of variables (Cohen, Manion, & Morrison, 2000). Case study is concerned with depth rather than breadth and is often conducted in natural settings as close to the real world as possible to ensure ecological validity, and emphasizes multiple data sources (Cohen, Manion, & Morrison, 2000). In educational situations, the case study is often concerned with the understanding of educational action to enrich the thinking and discourse of educators (Bassey, 1999). People who wish to do something can be guided by the findings of the case study because individual perspectives, personal constructs, and explanations of situations in the case study are sought and the particular meanings that the participants give to their subjectively structured world are considered significant (Cohen, Manion, & Morrison, 2000). Case study offers a chance to obtain sufficient details to unravel complexities of given situations and examine how parts affect each other (Denscombe, 1998).

The research reported here is a case study because this approach can penetrate situations in ways that are not always susceptible to numerical analysis (Cohen, Manion, & Morrison, 2000). One of the strengths of a case study is that it can observe effects in real contexts and recognize that context as powerful (Yin, 1994). Case study is effective for investigating and reporting on the complex, dynamic and unfolding interactions of events and relationships in a unique occurrence. It is able to capture unique features that may hold the key to understanding the

situation that could be lost in larger scale data, such as a survey. The case study in this study is based on the integration of questionnaires and interview approaches. The complementary data collection processes from different cohorts of participants can provide depth and breadth in identifying and analyzing the barriers and processes affecting the e-learning practice. The strength and weakness of questionnaires and interviews are described below.

### *Questionnaires*

The questionnaire is an economical, reliable and widely-used instrument for collecting research-relevant information (Cohen, Manion, & Morrison, 2000) from a large number of individuals who all respond to identical questions. A questionnaire is often used to identify propositions and discern patterns of association (Bryman, 2001). It is comparatively straightforward to analyze (Wilson, 1996). Questionnaires can be administered in person or mailed if the researcher is far away from the participants (Cohen, Manion, & Morrison, 2000). Questionnaires may have some limitations such as lower response rate, no chance to explore answers more deeply and not permitting respondents to raise additional questions which could lead to a fuller understanding of the questions posed (Mitchell & Jolley, 1988). Cohen, Manion, & Morrison (2000) suggest that a researcher should be satisfied with a response rate of 50%. Lewin (2005) suggests that follow-up strategies, for instance, following up a mailed questionnaire with another mail-out, can increase the response rate. In order to accurately represent the target population, the sample should be selected carefully and sometimes whole the populations are surveyed rather than a sample (Robson, 2002).

The wording of questions in a questionnaire should be simple, clear, unambiguous and free of bias because this strongly affects the usefulness of the findings (de Vaus, 1991). Questionnaires can contain either structured closed questions or unstructured open questions or both. Closed questions such as multiple choices questions or rating scales could force the respondents to select response(s) from a list, so the list of responses must cover all the possible responses and items in the list needs to be mutually exclusive (Dawson, 2002). Closed questionnaires are best for a large sample size because they are easier to be analyzed but they do not allow the respondent to add any qualifications or explanations to the given

categories (Cohen, Manion, & Morrison, 2000). Alternatively, open word-based questionnaires are more appropriate for a small population and when the range of responses is unknown (Cohen, Manion, & Morrison, 2000). They may be difficult to code and classify (Baker, 1999). Lewin (2005) advises not to use too many open-ended questions because it will take much time for respondents and it may be off-putting. In this study, questionnaires for instructors and students contained both closed multiple-choice questions, rating scales and open-ended questions.

In order to help the researcher understand the meaning of the questionnaire items to the respondents and improve the wording of the items, a pilot is important. This can help check the clarity of items, the instructions and layout, and the appropriateness of response categories for closed questions (Cohen, Manion, & Morrison, 2000; Robson, 2002). Piloting can be carried out by friends or colleagues (Dawson, 2002). If anything other than minor changes are made, a further pilot should be carried out and evaluated (Robson, 2002). Follow-up interviews with a cohort of respondents can inspect whether or not the questionnaires measure what they are supposed to measure (Baker, 1999). In this study follow-up interviews were carried out with some of those e-learning instructors responding to the questionnaires.

### ***Interviews***

The interview is a conversation between the interviewer and interviewee (or group of interviewees) with a purpose (Denzin & Lincoln, 2003; Maykut & Morehouse, 1994; Merriam, 2001). Interviewers enable participants to express their perceptions and discuss their situations or interpretations from their point of view (Cohen, Manion, & Morrison, 2000). The participants can use natural language to express themselves so that in-depth information may be gathered directly from their own words (Burns, 2000; Cohen, Manion, & Morrison, 2000; Johnson & Christensen, 2000). Interviews are based on the view that knowledge is constructed between participants so data are generated rather than collected (Patton, 2002). The interview can reveal rich materials although it is subjective, time-consuming, and difficult to classify and analyze the responses (Bell, 2005). Interviews have various purposes such as enable the researcher to explore the

motivations and explanations for participant's behavior which is often hard to be observed directly (Patton, 2002; Robson, 2002).

As Burns (2000) said, "Displaying empathy and acceptance, conveying respect and creating an ethos of trust" (p.427) is needed in the interview context. The researcher tried to build trust and rapport with participants and make the atmosphere comfortable so that participants could feel able to talk freely about their points of view (Bogdan & Biklen, 1982; Johnson & Christensen, 2000). For instance, the researcher stressed that she was looking for the interviewee's perceptions rather than the right answers (Leach, Driver, Scott, & Wood-Robinson, 1995). Thus, the participants could feel comfortable to respond the interview and feel it was acceptable if they did not have the answer to a particular question. This could minimize any negative impacts on participant confidence as a result of the interview. In the interviews, the researcher generated insights into the participants' perceptions, opinions, and attitudes and the participants also elicited unfamiliar aspects for the research (Drew, Hardman, & Hart, 1996; Lee, 1999). It is good for the researcher to collect detailed information because participants have the chance to clarify questions while the interviewer probes answers and prompts participants to clarify their responses in detail (Best & Kahn, 1993; Johnson & Christensen, 2000). As Hutchinson (1988) said, "Interview permits researchers to verify, clarify, or alter what they thought happened, to achieve a full understanding of an incident, and to take into account the 'lived' experience of participants" (p.125). In qualitative and interpretive studies, interviews can vary according to the context and purpose of the interviews from unstructured through semi-structured to highly structured (Cohen, Manion, & Morrison, 2000; Fotana & Frey, 2003; Powney & Watts, 1987).

An unstructured or informal conversation interview (Patton, 2002) is the most open-ended interview approach and often controlled by the participants (Powney & Watts, 1987). Although it offers the researcher maximum flexibility to explore all appropriate like information (Patton, 2002), different data gathered from each interview makes the analysis of findings become more difficult (Robson, 2002). This type of interview is suitable for inductive research that does not pre-set any categorizations for the inquiry (Fotana & Frey, 2003) or where the researcher does

not know enough about the phenomenon or situation to ask relevant questions. It is susceptible to interviewer biases and reflexivity is crucial (Patton, 2002).

Since an unstructured interview is spontaneous and loosely structured, it will be flexible and explorative of the beliefs and perspectives of participants (Bogdan & Biklen, 1982; Cohen, Manion, & Morrison, 2000; Johnson & Christensen, 2000). The quality of an unstructured interview depends on the social interactions of interviewer and participants; thus, there will be the need for subtlety in for keeping track of the interview as well as giving freedom for participants to express themselves (Burns, 2000). Thus, leading questions will be avoided in this interview in order not to direct the responses (Herman & Bentley, 1993) and the interview will be only controlled minimally to ensure the focus of the topic (Burns, 2000).

A very formal, highly structured interview is often controlled by the interviewer (Powney & Watts, 1987). The interviewer asks all respondents the same series of pre-determined questions by using same words in the same sequences (Fotana & Frey, 2003). This type of interview is useful for multiple researchers, multiple sites or data collection at different times (e.g. before, during or after an intervention) because it can avoid the interviewer biases and ensure the consistency of the project (Patton, 2002). Although its data still can be open-ended while the respondents supply their insights in answering questions (Patton, 2002), the interviewer cannot pursue unanticipated topics or issues which are not written in the interview questions (Bryman, 2001). Thus, this interview relies most on the questions which were framed beforehand by the researcher.

A semi-structured interview, or interview guide approach (Patton, 2002) contains both elements of the above. It is based on a set of pre-determined, more or less structured, questions from the researcher but permits some flexibility in the order or wording of the questions across a number of participants (Robson, 2002). It can ensure that systematic data are collected from the same basic lines or inquiries of each person interviewed and allows exploration of individual issues or new insights as they arise and has freedom of tailoring an interview to the particular participants or workplace (Fotana & Frey, 2003; Patton, 2002). Its data is

comprehensive although its flexibility might lead to various responses and lack of the critical or remarkable themes. This type of interview was appropriate to obtain each participant cohort's experiences and perceptions of e-learning practice for this study.

A semi-structured interview approach was employed in this study and it was relatively open-ended but guided by some specific open-ended questions (Bogdan & Biklen, 1982; Burns, 2000). The guided questions were only used as a protocol (Johnson & Christensen, 2000). Using a semi-structured interview, participants were probed for valid responses but they were still allowed great flexibility and freedom for making responses (Burns, 2000). Because of having an interview protocol, using a semi-structured interview could help to collect comparable data across participants (Bogdan & Biklen, 1982; Cohen, Manion, & Morrison, 2000).

Individuals and groups may be interviewed. Individual interviews are the most common form in the semi-structured and unstructured interviews (Denscombe, 1998) because they are relatively easy to arrange and only one person's ideas need to be grasped and only one person needs guidance through the interview. Individuals can express their own opinions or views and specific ideas are located with specific individuals. Individual interviews can also be kept confidential. In contrast, group interviews are harder to manage and the opinions expressed may be those most acceptable to the group. Group interviews are suitable to explore how group members discuss certain issues, how they respond to each other's views and the joint construction of meaning (Bryman, 2001; Denscombe, 1998).

Interview is a powerful tool to collect both qualitative and quantitative data in depth (Cohen, Manion, & Morrison, 2000). It has higher response rates than self-completion questionnaires because participants are likely to be more involved and motivated (Patton, 2002) although errors may occur due to respondent biases or lapses in memory (Robson, 2002). The wording and sequencing of interviewer questions may have impacts on the results (Fotana & Frey, 2003), but the respondents are still in favorable positions to express their thoughts or perspectives in natural situations (Bryman, 2001). The audio-tape technology for recording interviews is often used (Cohen, Manion, & Morrison, 2000). The

semi-structured individual and group interviews are adopted in this study because they have flexibility in the conversation, open dialogue about the key issues of interest, and some control in systematic data collection. More details of purposes in using semi-structured interviews are discussed in Section 3.4.

The quantitative and qualitative findings from multiple cohorts of participants provided cross-method triangulation. Triangulation purposes include to enhance validity, as findings are corroborated, and to offer some consistency across methods due to confidence in the meaning of data. Comparisons of all participants' perspectives provide a complementary purpose which can examine ideas from different angles to see things from different perspectives. Without triangulation and complementation, the data could be open to misinterpretation. The researcher could gain deep insights into participants' perceptions and experiences via equally emphasizing quantitative and qualitative data. When the researcher sought to examine administrator, instructor and student perceptions of e-learning practice, the interviews led to the generation of rich qualitative data. In contrast, quantitative data was used to explain the prevalence of some of the phenomena occurring in this study.

### **3.3.3 Data analysis**

Data analysis is to find patterns in data and then develop ideas to explain these patterns (Bernard, 2000). Data analysis is an ongoing research activity where results from early data analysis guide subsequent data generation and collection efforts (Maykut & Morehouse, 1994; Merriam, 2001). Data collected requires transfer into readable forms for analysis, such as transcribing and translating interviews. Translation is also an issue of concern while aiming to develop a questionnaire in a different language for the participants of the study and still preserving the same ideas across linguistic boundaries (Scott & Fisher, 2004). It is often hard to keep very accurate translation (Hui & Triandis, 1985) because it cannot neglect the possibility of cross-cultural conceptual equivalence (e.g., non-equivalence on an abstract level) and construct-related evidence for validity. Each item of translation needs to be suitable to the local context.

Data analysis is a time-consuming and highly challenging task, especially in qualitative analysis. The challenges include making sense of a massive amount of data, reducing the volume of information to a manageable size, identifying significant patterns and constructing a framework for the essence of what the data reveal (Patton, 2002). Coding may be used to identify sources, to preserve anonymity and to reduce the tension between “maintaining a sense of holism of the interview and the tendency for analysis to atomize and fragment the data” (Cohen, Manion, & Morrison, 2000, p.282).

There are several stages in qualitative analysis: generate meanings, classify and order these meanings, and then interpret the meanings (Cohen, Manion, & Morrison, 2000). Raw data in qualitative analysis are often transformed into written words rather than numbers as the units of analysis and they are categorized and reorganized to identify themes. Themes and issues from the literature may assist in this process. Once organized themes had emerged from the qualitative data, the interpretation is employed to search for meaning (Patton, 2002) and it is the final and most critical phase of the analysis process (Bernard, 2000). Appropriate interpretation can capture the authentic meanings behind the themes (Huberman & Miles, 1994) and offer significance to particular outcomes and put patterns into an analytic framework (Patton, 2002). Considering how to report the substance and sequence of the findings requires rethinking the data and may expose the researcher to understandings and new insights (Maykut & Morehouse, 1994). Through interpreting the data, coherent answers to major descriptive questions are composed and the research is written up. This specific description of events and people provides sufficient details to the reader to identify whether the researcher’s interpretation of the phenomenon is reasonable and relevant for other situations (Denscombe, 1998).

In quantitative analysis, univariate and bivariate analysis are often employed. Univariate analysis analyzes a single variable at a specific time but bivariate analysis investigates relations between pairs of variables. Quantitative raw data are frequently transformed into a set of frequency distributions. Frequency distributions provide clues about how to break down variables (Bernard, 2000) and their numbers of occurrence and percentages represent a measurement of

responses. In bivariate analysis, the cross-tabulations and Chi-square tests display and describe the relations between pairs of variables. These techniques are used for both the quantitative interview data and the questionnaires. The Statistical Package for the Social Sciences (SPSS) and Microsoft Excel software are two appropriate and useful software tools for the quantitative analysis of this study.

### **3.3.4 Issues of trustworthiness**

Traditionally, validity and reliability are two important criteria to evaluate the quality of research (Cohen, Manion, & Morrison, 2000; Merriam, 2001). Within the positivist paradigm, reliability is a precondition for validity (Lincoln & Guba, 1985). Reliability refers to the consistency and replicability of the study or the extent the findings could be replicated across time, methods, and samples (Cohen, Manion, & Morrison, 2000; Guba & Lincoln, 1989; Merriam, 1988). The positivist view of validity indicates the results are accurate or reflect reality (internal validity), and are generalizable (external validity) (Bryman, 2001; Robson, 2002).

Due to the difficulties in obtaining replicable data from a complex social context, Guba and Lincoln (1989) propose that interpretive research needs to be trustworthy and trustworthy research needs to have credibility, transferability, and dependability and confirmability. These criteria are used to ensure the data generation and analysis is reasonable and justified. Several techniques verify the trustworthiness of qualitative research. These include using multiple methods for data collection or triangulation and peer debriefing for enhancing credibility; working in depth (thick or rich description) to enhance transferability; and establishing an audit trail to enhance dependability and confirmability (Guba & Lincoln, 1989; Lincoln & Guba, 1985). Using methods and source data triangulation (see Section 3.3.2) is an effective technique to shed light on a theme or perspective and enhance the credibility of the study (Cohen, Manion, & Morrison, 2000; Guba & Lincoln, 1989). Peer debriefing allows a researcher to discuss tentative hypotheses with a disinterested peer who can pose questions and suggest alternatives or uncover concepts and assumptions that may have been “implicit within the inquirer’s mind” (Lincoln & Guba, 1985, p. 308). These two techniques can be used to increase credibility.

In qualitative research, the sample selection is more often purposeful than random so the user of the findings needs to decide if they apply to their own situation (Merriam, 2001). The researcher must provide the rich or “thick description necessary to enable someone interested in making a transfer to reach a conclusion about whether transfer can be contemplated as a possibility” (Lincoln & Guba, 1985, p. 316). In this sense, a highly detailed description of the context for the research and of the data itself, often including extensive segments of verbatim transcript in the case of interview data, are provided by the researcher to enhance transferability which shifts validity from the researcher to the reader (Lincoln & Guba, 1985).

The notion of dependability is that given a clear description of how data was gathered, open acknowledgement of the context, and the findings are acceptable within that context (Lincoln & Guba, 1985). However, it does not mean the same results would be obtained in the same setting a second time and different researchers may interpret their data quite differently but no less reliably (Kvale, 1996). In order to enhance dependability, Lincoln and Guba (1985) suggest the researcher needs to establish an audit trail to describe how data were collected, how categories were derived, and how decisions were made throughout the study. Moreover, triangulation such as multiple methods of data collection and analysis or training and practice of the researcher are ways to improve the dependability or reliability of the research (Merriam, 1988). Conformability concerns the influence of the researcher on the data so it is an appropriate way to describe the objectivity of a naturalistic qualitative study (Lincoln & Guba, 1985).

The techniques described above, which include triangulation of multiple methods and multiple perspective of participants, peer debriefing, thick description, and audit trail, were adopted to improve trustworthiness of this study. In sum, the trustworthiness of a study depends on the eyes of the reader, and the researcher only can persuade the reader through careful use of techniques to check the validity (credibility and transferability), reliability (dependability) and objectivity (confirmability) for both naturalistic/qualitative and positivistic/quantitative research.

### **3.3.5 Ethical considerations**

Ethical considerations are important in educational research because it involves human participants and the meanings constructed for the research arise out of the trust and rapport developed between the researcher and the participants. The main ethical concerns include following areas: access to participants, gaining informed consent and avoiding deception, the right to privacy and confidentiality, and protection from harm (Cohen, Manion, & Morrison, 2000; Fotana & Frey, 2003). Access to participants indicates recruitment of the individual participants and access to the location of the participant group(s). Gaining informed consents implies potential participants have been invited and fully informed of the process of the research and they are free to choose whether or not to participate in and throughout the study (Cohen, Manion, & Morrison, 2000). In general, informed consent must be recorded in writing or on tape (Baker, 1999). Deception should be avoided in data presentation (Bryman, 2001). The right to privacy is associated with not only protecting the identity of the participant but also with the confidentiality of the data collected from that participant. This is often achieved by storing and reporting data under codes and pseudonyms (Cresswell, 1998). The researcher has a responsibility to care for participants and ensure there is no potential which could be caused to them and their communities by any part of research.

To sum up, the main considerations in an interpretative methodology include multiple perspectives, multiple data generation methods, data analysis, issues of trustworthiness, and ethical considerations. The next section discusses how these considerations were addressed in the current research design.

## **3.4 The current research design**

An interpretive paradigm with a socio-cultural view of learning was adopted as the basis for the research methodology because the intention was to capture the richness of participants' experience and to understand the social reality as constructed by administrators, technical support people, instructors, and students (Cohen, Manion, & Morrison, 2000). This section sets out the research design for

this study. It includes details of the participants, how data were generated, the data analysis, how trustworthiness of data and interpretations were ensured, and ethical considerations.

### **3.4.1 Participants and data collection strategies in the study**

E-learning is an activity that involves five cohorts of participants within the university. The participants include administrators, technical support staff, student assistants, instructors from a number of colleges that had, and had not, designed and implemented e-learning courses and e-learning students. Thus, new analytical approaches were used to explore their perceptions and experiences about organizational relationships, financial operations, instructional costs, faculty work, faculty roles and responsibilities, student participation patterns, and so on. Informed consent was gained for all these participants (see Appendices A – I).

An informal approach via email and phone call were first made to the Vice President of NRU for permission to undertake the study. A meeting was held with the Vice Principal in November, 2004 at NRU in Taiwan to gain informed consent from him. He received an information sheet describing the project in detail and seeking permission from him to approach participants at university for this research (Appendix A). Then, the Dean of the Office of Academic Affairs, the Director of the Computer Center, the Dean of each College whose instructors were involved in e-learning, and the Heads of the Physics and Life Science Departments were approached to invite their department to take part. Permission to approach their staff was gained from them. They also received an information sheet describing the project in detail and their informed consents were obtained (Appendix B).

The Dean of the Academic Affairs and the Director of the Computer Center were invited to take part in this study themselves and informed consent (Appendix C) was gained from them for this. After getting permission from the Dean of Academic Affairs, the Group leader of the Teaching Information in the Office of Academic Affairs was invited to be interviewed. He received an information sheet outlining the study and the informed consent was obtained (Appendix D).

The participating technical support people include technical support staff and student-assistants who provided their technical support to instructors using the university e-learning system. After getting permission from the Director of the Computer Center, two technical support staffs in the Computer Center were invited to be interviewed (Appendix E). Moreover, four e-learning instructors who had assistant support from the university recommended interviewing their student-assistants. They received an information sheet outlining the study and the informed consent was obtained (Appendix F).

Two sets of instructors who used and did not use e-learning involved in this study. According to the information from NRU e-learning system on September, 2004, 150 instructors who were involved in e-learning practice were invited to complete a survey for instructors in January, 2005. An information sheet outlining the study and the questionnaire (Appendix G) was given to the instructors. Completion of this survey was taken as consent to use the data in the research. For the interviews, the researcher mailed and emailed the interview invitation letter attached with the questionnaire simultaneously. The researcher checked the returned questionnaires to find out who has agreed to be interviewed by completing the contact information and then invited them to participate via phone call and email. Twenty-seven e-learning instructors including six e-learning instructors in the Science College agreed to be interviewed and have been sent emails containing the general aims of the interviews for this research and a time schedule. An information sheet for interview was sent to them and their informed consent was gained (Appendix H).

The researcher also sent emails to invite all non-e-learning instructors in the Physics, Chemistry and the Life Science Departments to be part of the study and then selected from those volunteers to be interviewed. The criteria for selection were based on the instructor's interests, subject content and their teaching experiences. The researcher invited those selected non-e-learning instructors in person and then gave an information sheet outlining the interview and their informed consent was gained (Appendix I).

Through notices from seven voluntary participating e-learning instructors, students enrolled in the participating instructor's course were informed about the study and invited to participate. 480 students were invited to complete the survey for students in January, 2005. An information sheet outlining the study and the questionnaire (Appendix J) was given to the students in class time. Completion of this survey was taken as consent to use the data in the research. At the same time, with the notice about the study from participating e-learning instructors, thirty-three students enrolled in the participating e-learning instructor's course were invited to take part in focus group interviews. These students were invited from different instructors' classes. More than half of these participating students were taught by instructors with student assistant support and nearly half of students whose instructor did not have student assistant support. They were in eight focus groups. The students who agreed to be interviewed were given an information sheet containing the general aims of the interviews for this research and a time schedule. Their informed consent was also gained (Appendix K).

All questionnaires were administered in January, 2005 and all interviews were held in February, 2005 at NRU in Taiwan. The researchers allowed the respondents to mail or fax back their consent form. Follow-up thanks emails helped the researcher to arrange the interview schedule with the respondents. Follow-up phone calls were made to confirm the interview time and address any concerns. Before the date of the arranged interview, the researcher checked the time, date and place with the respondents again by phone. Table 3.1 summarizes the participants, data collection methods and time line for this study. Data for the study are generated and described in detail in the next section.

Table 3.1

*The participants, data collection methods, and time line*

<b>Participants</b>	<b>Data collection methods</b>	<b>Time</b>
3 administrators	Interview	Feb/2005
2 technical support staff	Interview	Feb/2005
10 student assistants in five groups	Interview	Feb/2005
69 e-learning respondent instructors	Questionnaire	Jan/2005
33 e-learning instructors in total:		
● 6 science instructors	Interview	Feb/2005
● 21 non-science instructors		
● 6 science non-e-learning instructors	Interview	Feb/2005
376 e-learning respondent students	Questionnaire	Jan/2005
33 e-learning students in eight focus groups	Interview	Feb/2005

### **3.4.2 Data generation methods used in the study**

Data were generated through questionnaires and interviews for this study. They are described in more detail below.

#### ***Questionnaires***

The questionnaires for instructors and students were designed and then piloted (by four instructors and six students in Taiwan and New Zealand) to check for the validity, reliability and practicability of the questions. All of the volunteers who pre-tested the questionnaires provided helpful suggestions for clarifying the intention of the questions, justifying the inclusion of certain questions, eliminating ambiguity, ensuring there were no offensive or sensitive questions, and designing the questions so that they were easy for participants to understand and complete. To minimize the inaccuracy of translation, the researcher used both Mandarin and English in the instructor questionnaire but the student questionnaire only used Mandarin for simplicity. Two instructors who were familiar with English and Mandarin helped to check all the translations of questionnaires.

In order to fully reach the selected population, the researcher mailed and emailed the invitation letter and the attached questionnaire in Microsoft Word format file simultaneously. The researcher allowed the respondents to complete the questionnaire either through the mail or by email. Follow-up emails helped improve the response rates. The researcher had sent out the questionnaires (see Appendix J) to 150 e-learning instructors by postal mail and email. Simultaneously, e-learning instructors were also asked to help distributing the questionnaire (see Appendix K) to their students. Seven e-learning instructors have helped to give 480 copies to their students. In total, 84 instructors and 399 students have returned their completed questionnaire either an electronic Word file or a paper questionnaire. However, of these, 15 instructors indicated they did not like to answer the questionnaire because 9 of them had just enrolled on the system but they did not really use it and 6 of them had used it before but they did not have any e-learning experience within these three years. Similarly, 23 students only answered the first section of the questionnaire but did not answer the remaining sections. For reliability and validity reasons, the researcher did not

count those respondents. Therefore, the total valid respondents are 69 instructors and 376 students. An overall response rate for instructors is 46% (=69/150) and for student responses is 78% (=376/480). Where instructors and students did not respond to specific questions, but had otherwise completed the questionnaire, their responses were recorded as 'missing'.

Both questionnaires contained a mix of closed, quantitative and open-ended, qualitative questions. The closed, quantitative questions included multiple choice questions and 5-point Likert rating scales (strongly agree to strongly disagree) that provided numerical data. In order to get more in-depth responses from the participants, some open-ended questions were used. Both quantitative and qualitative data received from the questionnaire were put onto computer disks for further analysis using a statistical software package (e.g., Excel and SPSS). The researcher read through all the qualitative data to develop the coding categories and identified by using different colors to highlight the patterns. Through several readings of the data, the qualitative responses were coded and categorized in an interpretive manner and were also quantified. Five areas in the questionnaire are explored for this study: background of e-learning respondent instructors and students, instructor and student e-learning experiences and general perceptions, factors influencing their use of e-learning (e.g., personal, policy, technological, and pedagogical factors, etc.), perceived benefits and challenges of e-learning practice, and suggested strategies to enhance e-learning practice, especially for science education.

### ***Interviews***

With the written permission of all the participants, each interview was audio taped and lasted 60-110 minutes. Open-ended and leading questions were mutually employed in the interviews in order to allow freedom of expression and lead to increased focus on the study. All participants felt happy and were enthusiastic to be interviewed, and each provided extensive information and suggestions. Each interview was transcribed verbatim by the researcher. All transcripts were verified by two other people who volunteered but with no contractual interest in the study. Based on the cohorts of participants, four sets of interviews are described below.

### ***Administrator interviews***

The interview started with the Dean of the Academic Affairs and the Director of the Computer and Network Center being asked to describe their general perceptions of and future plans for the e-learning policy context at NRU, the criteria of a successful e-learning practice, then moved into a discussion on their views of e-learning benefits and challenges, factors influencing instructor and student use of e-learning, and possible strategies for enhancing university e-learning practice.

The interview with the Group Leader of the Teaching Information in the Office of Academic Affairs helped gain his practical experiences of e-learning implementation such as the incentive pay for teaching hours, instructors' concerns about the evaluation of the workload, the challenges faced in their support services and their perceptions of the ways technical support could be improved for curriculum design, and so on. This group leader is also one of the MOE inspectors, so he provided much information concerning about the national e-learning policy, its evaluation system, and the development concerns of other universities and institutions as references. All the questions of administrator interviews were summarized in Appendix L.

### ***Technical support people interviews***

Two sets of technical support people were interviewed. Firstly, the interview with technical support staff could gain their ideas of the challenges faced in their support services and their perceptions of the technical support for improving the curriculum design, and so on. Secondly, the student assistants were asked about their perceptions of university support policy for e-learning, how they supported their instructors in e-learning courses development, and what they saw as benefits and challenges of e-learning practice. This interview obtained the instructor needs with assistant support while developing e-learning courses. All the questions for technical support people interviews are summarized in Appendix M.

### ***The instructor interviews***

Two sets of instructors were interviewed which included instructors who used and did not use e-learning. In the interview, twenty-seven e-learning instructors were

asked to describe why they used e-learning, the factors they associated with effective teaching and learning, what made for effective e-learning; what challenges they and their students faced in e-learning, their perceptions of why their colleagues did not use e-learning, and the issues around using, or not using, university technical support. They were also asked to suggest strategies to enhance e-learning practice, especially for science education. Simultaneously, six non-e-learning instructors who were in the College of Science were asked why they did not use e-learning, what they saw as the benefits and challenges, and what the encouragements for their use of e-learning are. The same questions were asked of each instructor, but as the interviews were open not all instructors discussed the questions in the same depth. The questions for instructor interviews are given in Appendix N.

#### *The student focus group interviews*

The respondent students were invited to be interviewed as a group due to the provision of a natural, comfortable situation. The students could share their experiences with their peers and reflect on the same e-learning courses. In the focus group interview the students were asked to describe why they used e-learning, the factors they associated with effective teaching and learning, what strategies used by their instructors made for effective e-learning; what challenges they and their instructors faced in e-learning, and the issues around using, or not using, university technical support. They were also asked to suggest strategies to enhance e-learning practice. The same questions were asked to each focus group, but as the interviews were open not all groups discussed the questions in the same depth. All the questions for student focus-group interviews are summarized in Appendix O.

#### **3.4.3 Management and coding of the questionnaire and interview data**

There are several stages in quantitative and qualitative analysis. Before doing the analysis, the researcher managed and coded all the data from the questionnaires and interviews. The quantitative data for closed questions in the questionnaire and the quantitative interview data were put into the Excel and SPSS files where can use the univariate and bivariate analysis to analyze a single variable and

investigate relations between pairs of variables. The qualitative responses from open-ended questions in the questionnaire were typed verbatim into the computer in Mandarin and then the researcher translated all those qualitative responses in English. The translations of responses were verified by two other people who volunteered to check its validity and reliability. All the participants' responses for each question had Mandarin and English versions. Each version of responses was saved in separate working sheets in Excel or SPSS files. The researcher coded those responses by identifying the question number and instructor number or student number (see Table 3.2). Through several readings of the data, the researcher identified the patterns based on the literature. Some responses were counted in two or more categories. Although the qualitative responses were categorized in an interpretive manner but they were also quantified. Raw data in qualitative analysis were transformed into numbers as the units of analysis and they were categorized and reorganized to identify themes.

Similarly, the qualitative responses from the interviews were transcribed verbatim by the researcher and the transcripts were verified by two other people who volunteered to check its validity and reliability and by the researcher through a comparison with the audio tapes and notes from the interview session. Although it is often hard to keep very accurate translation (Hui & Triandis, 1985), the researcher has tried her best to keep each item of translation suitable to the local context for validity. All data collected and reported was coded to provide a reference to the data and to protect the anonymity of the data source. Table 3.2 summarizes the code regulations for questionnaire and interview transcripts.

Table 3.2

*The code regulations for questionnaire and interview transcripts*

Category	Code	Meaning of code
Interview	AAi	Administrator A interview (in total, 3 administrators, from A to C)
	TAi	Technical support staff A interview (in total, 2 staff members, from A to B)
	SeiAi	Science e-learning instructor A interview (in total, 6 instructors, from A to F)
	SneiAi	Science non e-learning instructor A interview (in total, 6 instructors, from A to F)
	NSeiAi	Non-Science e-learning instructor A interview (in total, 21 instructors, from A to V)
	SgAi1	Student group A interview first person (in total, 8 groups/33 students, from groups A to H)
	SsAi1	Student assistant support group A interview first person (in total, 5 groups/10 students, from groups A to E)
Questionnaire	QI.n1.n2	Questionnaire for Instructor. Question number. Instructor number (in total, 32 questions for 69 instructors) (e.g., QI.1.1, QI.32.69)
	QS.n1.n2	Questionnaire for Student. Question number. Student number (in total, 21 questions for 376 students) (e.g., QS.1.1, QS.21.376)

In this study, all the participants' interviews were coded. For example, (AAi) noted Administrator A interview. (TBi) was Technical support staff B interview. (SeiCi) indicated Science e-learning instructor C interview. (NSeiDi) was Non-Science e-learning instructor D interview. (SneiEi) indicated Science non e-learning instructor E interview. (SgAi3) refers to Student group A interview third person. (SsFi2) indicated Student-assistant support group F interview second person. For the questionnaire, the responses of open-ended questions for instructor and student questionnaires were also recorded verbatim. These were coded as (QI.n1.n2) and (QS.n1.n2), where Q refers to questionnaire for instructor (QI) and student (QS) and the first number (n1) refers to question number in each questionnaire and number 2 refers to respondent from whose questionnaire the data is drawn. For example, (QI.10.25) indicated Instructor 25 answered the tenth question in the questionnaire for instructors. (QS.12.376) noted Student 376 answered question 12 in the questionnaire for student.

All information gathered will be stored safely and no record of participants' identity will be stored with the raw data. Data will be held for three years and then destroyed in a secure manner.

#### **3.4.4 Data analysis procedures used in the study**

SPSS and Microsoft Excel were the two statistical data analysis software packages used in this study. All the quantitative data including quantified data from open-ended questions in the questionnaires and interviews were graphed as histograms, and a set of frequency distributions, cross-tabulations and Chi-square tests were calculated where appropriate. All percentages in the quantitative data analysis are rounded to the nearest full percent, therefore totals do not always add to 100% in the results.

Before starting to analyze data, the researcher checked the data set for errors. In order to prevent messing up analyses, the researcher initially spent the time checking for mistakes which may have occurred when entering data. Firstly, the researcher was primarily looking for values that fell outside the range of possible values for a variable. To check for errors the researcher also used SPSS to inspect the frequencies for each of variables. This included all of the individual items that

make up the scales. There are a number of different ways to check for errors using SPSS. For instance, in checking categorical variables (e.g., familiarity with national and university e-learning policy) for errors, the researcher used the “Descriptive Statistics--Frequencies” function to check minimum and maximum values, and the number of valid and missing cases. In checking continuous variables (e.g., age) for errors, the researcher used the “Descriptive Statistics-Descriptive” function to check minimum and maximum values, mean, and standard deviation. Secondly, find the error in the data file if some ‘out-of-range’ responses were found (e.g., a 3 for gender or for yes/no), the researcher used “Data Editor-Find” or “Descriptive Statistics-Explore” functions to find the errors in the data file. And then, errors were corrected before these scales were calculated. The data were then further interrogated by looking for differences between the means of a number of variables, difference significance being examined using the Chi-square test for more than two independent sample distributions (Muijs, 2004; Wiersma, 1995). Difference in significance was also examined using differences in percentage of agreement, this being defined as the combination of the strongly agree and agree ratings on the Likert scales.

The interviews were transcribed in Mandarin and then translated into English. In order to ensure the veracity of this translation, two colleagues who knew both Mandarin and English verified the transcripts of a small sample of the interviews. The constant comparative method was used to analyze the transcripts. The comparisons lead to tentative categories which were based on the literature review and the information that came out of this study. The researcher read the transcripts and manually highlighted the quotes that fitted into categories. Similar views and issues raised by participants during their interviews and in open-ended questions in the questionnaire were clustered together allowing overriding themes and sub-themes to emerge that were synthesized in experience. The major themes discussed in the interviews and questionnaires were identified and are presented in this study.

The researcher used complementary data collection processes (Shulman, 1986) to provide depth and breadth in identifying and analyzing all participants’ data. In this study, the integration of questionnaire and interview approaches offered the

researcher an opportunity to develop a complete analysis from a holistic perspective of participant engagement in e-learning (Gall, Borg, & Gall, 1996). The researcher compared, triangulated and synthesized all the results from the questionnaires and interviews based on the research questions and five cohorts of participants. The administrator and support person perceptions of e-learning based on the interviews will be presented in Chapter 4. The instructor and student perceptions of e-learning which are synthesized all the findings from the questionnaires and interviews will be presented in Chapters 5 and 6 respectively.

### **3.4.5 Trustworthiness techniques used in the study**

By using multiple methods (questionnaires and interviews) and five cohorts of participants for data collection and analysis, the researcher was able to identify the important elements of the multiple realities of the participants (Section 3.3.2). Thick description of the research setting, the individual contexts and the individual participants is provided. Further, the notion of dependability is clearly identified by describing how the participants were selected and by describing the participants (Section 3.4.1 and Section 3.4.2), and by describing the contexts from which the data arose (Section 1.2 and Section 4.2). An audit trail of how the data was treated is described in Section 3.4.3 and Section 3.4.4.

As Muijs (2004) said, “It [validity] asks the question: are we measuring what we want to measure?” (p.65) Thus, for the content and criterion validity checks, the researcher used a panel of experts in the field who judged the instrument as well. The panel of experts included the advisors of the researcher, the staff who worked for e-learning at the university, and colleagues. The researcher followed a pre-developed theoretical framework and also used SPSS to statistically measure whether there was a relationship between the measurement and those factors using techniques such as the correlation coefficient. For the construct validity check, the researcher designed an instrument which contained several factors rather than just one. For example, the researcher used different aspects of factors (e.g., perceived benefits and challenges, enablers and inhibitors, and differences between F2F instruction and e-learning) to explore and verify the factors influencing instructor and student use of e-learning. The extent to which the data fit that theory is called

'construct validity' (Muijs, 2004, p.82). The researcher also asked her advisors to check the theoretical knowledge of e-learning, based on the literature reviews.

Reliability determines the quality of measurement instruments and it refers to the extent to which test scores are free of measurement error (Muijs, 2004). The researcher checked internal consistency reliability because the instruments have more than one items. The researcher first determined that the six P's subscales she hypothesized exist and are measured by the variables she thought they would be, testing construct validity. The internal consistency reliability refers to whether all the items are measuring the same construct (Muijs, 2004, p.82). For example, instructors were asked about their teaching methods, equipment used, effective strategies in e-learning teaching, and pedagogical concerns and all these four issues referred to pedagogical factors influencing their development of e-learning courses. In general, more items means higher reliability, but it is not necessary to take this to extremes because respondents can get bored. For most attitude type scales, somewhere between four and ten items will lead to sufficient reliability.

The questionnaires that had been completed by the instructors and students were used as the basis for interview questions; they were asked to explain why they had given the particular responses. This provided a more detailed description of the thinking behind the responses, and was intended to check the dependability of their responses.

Furthermore, in quantitative research the researcher often wants to generate from a sample of the study to the population. Thus, the researcher had calculated the probability (i.e., the statistical significance of difference) that the relationship would occur if there was no difference in the population. If this probability is less than 0.05 (5 per cent), the researcher would say that the finding is statistically significant. For example, the researcher checked the relationship between the instructor familiarity with university support policy (e.g., student assistant support) and their teaching methods (e.g., video of lessons and online discussion) with the null hypothesis that there is no difference in the teaching approaches of instructors who were or were not familiar with university e-learning policy. Similarly, the relationship between instructor ability in using e-learning and their age or position

was also inspected. These investigations would increase the generalizability of the study.

### **3.4.6 Ethical considerations**

This study follows the University of Waikato Human Research Ethics Regulations 2000. The ethical guidelines of the study and ethical approval to carry out the work were granted by the Human Research Ethics Committee of the Center of Science and Technology Educational Research at the University of Waikato. The ethical issues of informed consent, confidentiality and potential harm were addressed in the study in an ongoing manner.

All participants were reminded that their participation is voluntary and all information would be kept confidential. Their written informed consent was obtained at the beginning of the study, without coercion (see Section 3.4.1). Exploitation of the relationship between researcher and participants was prevented (see Section 3.4.2). Participants' privacy and confidentiality were respected through the use of coding (see Section 3.4.3). Confidentiality was a particular concern as the research was conducted in a relatively small country area and in a specific national university, where most of the people in education know each other. The researcher was a lecturer in the university so she knew many of the participants and the participants also knew the researcher. Thus, demonstrated confidentiality and acknowledged the aims of the research was important for the development of the trust needed to support open discussion with the participants. Some participants tested the meaning of confidentiality by asking the researcher what other participants had discussed with her and what other participants had said. Attention was also paid to whether the inclusion of specific details might serve to identify participants to the wider community.

Participants' right to decline and the right to access their information were explained. Participants own their raw material collected while the researcher owns the analysis of the data. The information collected from this research was strictly confined to the use of academic study.

### **3.5 Chapter summary**

This study employed an interpretive methodology and used the qualitative and quantitative methods with the notion of socio-cultural learning to understand the participants' experiences and perceptions in a natural social context. Data were collected through questionnaires from the instructors and students and through semi-structured, tape-recorded, individual and group interviews from the administrators, technical support people, instructors and students. The data collected in this study was confined only to those participants who were invited to take part in this study. It was assumed that all participants cooperated to honestly report their experiences during the interviews and in the completion of the questionnaire to reflect on their experiences and perceptions. The data were analyzed by diagramming the issues that participants said would influence the future of e-learning practice at the university in Taiwan and through coding the transcripts of interviews and open-ended questions, and the data analysis of questionnaires.

The trustworthiness of the study was enhanced by use of multiple perspectives, and triangulation with alternative questionnaire and interview data sources. Verification was achieved through volunteer member checks and use of statistical data analysis packages, by using different theoretical lenses, and through discussions with other researchers or experts. Ethical concerns were addressed through informed consent and confidentiality at all times. Based on the research questions on different cohorts of participants and literature review, the data analysis that emerged from the study provided the framework for the following three chapters. These are administrator and support person perception of e-learning (Chapter 4); instructor perceptions of e-learning (Chapter 5); and student perceptions of e-learning (Chapter 6). A summary of the findings in relation to the e-learning literature are described in Chapter 7. A model proposed for effective e-learning practice in Taiwan university context, and implications and suggested conclusions are addressed in Chapter 8.

## **Chapter 4 Administrator and support person perceptions and experiences**

### **4.1 Introduction**

This chapter outlines the findings from interviews with three administrators and twelve e-learning support people (two technical staff and ten student assistants in five groups). The student assistants were often graduate students. Data were generated through interviews. It is reported in three sections: the perceptions of university administrators, the perceptions of university technical support staff, and the perceptions of student assistant for e-learning support. The purpose of these sections was to allow the researcher to interpret the research findings as to describe the characteristics of e-learning context in Taiwan and provide possible enhancement strategies for e-learning practice.

### **4.2 Perceptions of administrators**

Three administrators in the administrative and technical division were interviewed: the Dean from the Office of Academic Affairs, the group director from the Office of Academic Affairs, and the director of the Computer Center. The Office of Academic Affairs is responsible for managing university academic affairs including distance teaching and e-learning practice. The Computer Center provides all university technology and e-learning systems and technical support for instructors and students. E-learning practice is promoted by these two divisions. The three administrators were asked to describe what they knew about the national and university e-learning policy, their perceptions of the benefits and challenges of e-learning, their perceptions of the factors influencing instructor use of e-learning, their ideas for possible changes and the ways they might improve e-learning practice, especially for science education in e-learning.

#### **4.2.1 Perceptions of the national policy for e-learning**

The three administrators were each familiar with the national e-learning policy. All three considered the national e-learning policy had influenced university

e-learning practice. Administrator A remarked, “E-learning is a trend. The MOE and NSC (National Science Council) maximize its practice to all the people and also initiated many e-learning related research projects at all levels of educational institution and enterprise (AAi.1.2.6).” Administrator C noted:

The government has a five-year National Digital Content Development Plan to promote and integrate e-learning development. This plan includes aspects such as promoting e-learning development both in technology and courseware design, and the protection of copyright. (ACi.1.3.2)

The administrators indicated that, in 2001, the MOE had defined e-learning for on-campus university students as electronic/online assisted instruction. Students could take certain distance education or e-learning courses from other universities for credit so long as the credits did not exceed one third of their total graduation credits. In 2005, in order to enhance e-learning practice, the MOE increased the distance or e-learning course-credits to half the total graduation credits. They noted this had encouraged instructors and students to use e-learning. Simultaneously, the administrators noted the MOE allowed universities to provide some credit certificates or degrees for on-the-job training or continuing education via e-learning. Businesses and other enterprises promoted the development and use of e-learning as an efficient and cost effective way to improve staff work capability.

All three administrators noted many universities perceived this e-learning capacity building model could be applied to their staff and also could improve instructor and staff ICT knowledge and skills for enhancing e-campus development. Administrator B remarked, “E-learning could improve instructor and staff information technology ability for the improvement of e-campus development. The university needs to inspect and learn how to apply the business enterprise e-learning practice model on campus” (ABi.1.2.8).

Two administrators indicated the national government provided technologies infrastructures and technical support for university e-learning development so the MOE evaluated the performance of university e-learning practice. However, they just counted on the greater numbers of courses provided online and no guidelines

for effective pedagogy. In this setting, instructors were left to be responsible for developing their own e-learning pedagogy.

#### **4.2.2 Perceptions of university policy for e-learning**

The administrators considered NRU did not have a detailed and well-defined policy for e-learning implementation. There was no documented university vision or goals for e-learning practice, no senior e-learning person dedicated to coordinating its development, no cooperation policy between university departments or other universities, and no evaluation system for e-learning courses. They expressed a desire to help the university to set up such an e-learning policy. But, based on the national e-learning policy, the university had initiated its own e-learning policy and development. The university provided many e-learning facilities and incentives to encourage instructors to develop e-learning courses such as multimedia facilities, awards, extra pay, technical staff support and student assistant support. Administrator C described this:

The university has provided many computer technology and related multimedia facilities in the Computer Center. The instructors could borrow it to use. If they face any difficulties or problems, they could ask the student assistant or technical staff to help them. In addition, the instructors also could apply for student assistant support from the university. (ACi.1.5.6)

Three administrators indicated NRU had a responsibility to provide distance teaching and e-learning because the MOE required NRU to provide this support for other university's students and public people in continuing education. They noted the university still emphasizes teaching because every year MOE evaluated the performance of distance teaching and e-learning in university educational practice although NRU defined its goal as a research-oriented university. Administrator A remarked, "NRU is one of the MOE's chosen universities for broadcasting 'distance teaching' courses to other universities and the community. E-learning and distance teaching were two important items in every year's MOE evaluation of university educational practice" (AAi.1.2.7). This administrator also noted that NRU had many instructors and resources to provide this support so enhancing e-learning practice was necessary. He remarked:

No matter synchronous distance teaching or asynchronous e-learning instruction, we must know how to strengthen its usage in many various fields. Our university has lots of resources such as many instructors in many different colleges and many good conference rooms. We do not have any difficulties to initiate many different kinds of courses for our students or staff, but other universities may have difficulties in providing some courses for

their students and staff. Therefore, those universities require our support in distance education or e-learning. I think our university should enhance our e-learning practice more. (AAi.1.3.3)

Three administrators remarked e-learning and distance teaching could be integrated with face-to-face instruction to improve instructor and student teaching and learning quality. They pointed out that e-learning or distance teaching and F2F each had their own advantages and disadvantages. For instance, e-learning allowed students more flexibility in learning, but with F2F instruction students could more easily ask questions and interact with instructors and peers. However, administrators were emphatic that e-learning could not replace traditional F2F instruction. Education was not just knowledge transfer but also involved social interactions among instructors and students. Thus, university followed the national e-learning policy to treat e-learning as online assisted instruction for on-campus students. But, students were allowed to take a maximum of half of the total credits for graduation in distance or e-learning courses. This policy encouraged instructors and students in their use of e-learning.

#### **4.2.3 Perceptions of the benefits and challenges of e-learning**

In this section the benefits and challenges of e-learning for the students, instructors, and university as described by the three administrators are discussed.

##### **Benefits for students**

All three administrators noted the main goal of education was to improve student learning outcomes so any teaching approaches beneficial to this should be implemented widely. The three administrators considered a well-designed e-learning course could both motivate students and improve their learning outcomes. Synchronous and asynchronous interactions via online discussion, email, bulletin boards or online Q and A were thought to be attractive to students, although they acknowledged a timely instructor response was important. The administrators considered the provision of videos of lessons and other audio-video products could help students preview and review the course materials thereby improving their learning outcomes. They also noted some instructors provided online references or quizzes, assignments so their students could do more practice to improve learning outcomes.

### **Benefits for instructors**

As to the benefits for instructors, the administrators each agreed instructors could easily update course materials for reuse in the next round of the same course although the initial creation of e-content needed much time and effort. They considered this situation had the potential to reduce teaching loads and improve teaching skills and quality. They considered e-learning could improve instructor personal technical knowledge and skills in research, teaching approaches and course design. Administrator C remarked:

E-learning can improve instructor personal technical knowledge and skills for their teaching or research such as searching for reference papers or websites for students or their research. Instructors can view and emulate other instructor's e-learning courses. Then, they will learn and re-consider their own course design and teaching approaches. Moreover, e-learning lets them easily update their course materials and reuse them for next time for the same course. This also will reduce their teaching load. (ACi.1.6.1)

### **Benefits for the university**

Concerning benefits for the university, three administrators agreed e-learning was seen as a tool that not only could help university to increase its competitiveness and reputation but also could make or save money by way of selling e-content and a lower educational cost per student per course. They noted the trend of e-learning pushed the university to compete and or cooperate with other institutions, both nationwide and internationally. They said if the university provided distance teaching or e-learning support to other domestic universities or business enterprises, the university would become well known. Cooperation with businesses for staff training and consultancies were seen as strategies that could increase the university reputation whilst serving as a source of income. Cooperation with international institutions was seen as another way to increase the university reputation and competitiveness. The university was under pressure to become internationally well known, so ways were needed to increase its reputation. Administrator B explained:

E-learning can increase our university reputation and competitiveness. If our e-learning courses develop well, domestic and international institutions will adopt our courses, especially those in south-eastern Asian countries. We have had some cooperation projects with south-eastern Asian countries such as Malaysia. We have provided many kinds of distance and e-learning courses for credit classes, non-credit classes and continuing education in the field of business management. E-learning in our university seems to be an important extension of our university educational system. (ABi.2.1.5)

Administrator A also indicated e-learning could save money for other universities by reducing the need to run specialist courses. He remarked:

Usually when a university does not have many colleges and does not have instructors to teach particular courses then it will request our university to provide some e-learning or distance courses for their students. It is beneficial for those universities because they do not need to spend much money to employ instructors to teach those courses. Moreover, their students also can get high quality of instructors teaching just as NRU students have. (AAi.1.6.8)

Similarly, three administrators indicated e-learning had the potential to make money for a university, although under the current educational system this was not possible. They said everyone in the university including administrators, staff, instructors and students could not ignore e-learning was a growing trend and once the university organization changed, the university could make money from e-learning courses. They also noted all administrators, staff and instructors needed to prepare to adapt to this e-learning trend and develop a good e-learning environment for the students, community and enterprises. Instructors, especially, are key people in the development of e-learning so instructors needed to change their perception and attitude to e-learning. Administrator A remarked:

The university perhaps can make more money from e-learning practice for its ongoing development. Although currently we cannot make money by selling our e-learning course materials or providing TOFEL or GRE courses to the students, the community people and enterprises, once the university organization changes then we can earn more money by selling e-courses and providing a good e-learning environment for the community and enterprises. Moreover, e-learning is a growing trend so everyone needs to change his/her perceptions to adapt to it and prepare a good environment for e-learning development. Especially, instructors are key people in the development of e-learning so their perception and attitude to e-learning are important. (AAi.4.3.6)

This also implied all university administrators, staff and instructors should be well prepared to face the university organizational change and to make money for the university by providing necessary practical courses via e-learning to the students, community or enterprises.

Simultaneously, three administrators also indicated e-learning practice was a good way to foster good relationships with the community and enterprises. They noted the instructors could develop well-designed e-learning courses not only for the campus students but also for the community or for the enterprises' staff training. This implied e-learning implementation was a good way to foster a positive public

relationship with the community and enterprises or external institutions and the instructor would become a good public relations agent.

### **Challenges for the university and instructors**

When administrators were asked about the challenges of e-learning practice, they noted the university had a limited budget. Two administrators indicated the budget for providing infrastructure, technology and related multimedia facilities was not enough. As Administrator A noted,

The main challenge is the lack of a budget for network infrastructure and personnel costs. As you know technology changes very fast and all the network technology in our country depends on the development of the National Telephone Company. When they update to new technology, then the university also changes the network infrastructure and equipment. Therefore, we need a huge budget to update related facilities and it also takes much time and effort to update. (AAi.2.8.2)

Three administrators also indicated that currently the university did not have enough technical support staff to help instructors to develop e-learning courses. Administrator B suggested the departments and colleges needed to change the responsibilities of teaching assistants so they spent more time helping instructors with e-learning teaching.

#### **4.2.4 Perceptions of factors influencing instructor and student use of e-learning**

All three administrators noted university instructors had academic freedom so the university could not force them to use e-learning, rather it needed to use encouragement. Thus, they noted that changes instructor personal perceptions and attitudes towards e-learning teaching were important. Furthermore, two administrators considered some courses and subjects were not suitable for e-learning development. One administrator asserted that non-science and non-engineering related colleges could more easily develop e-learning courses because the course content was more text based and did not involve experiments and formulae. Administrator C noted that although science e-learning courses could use animations, simulations, and/ or videos to demonstrate proofs and experiments, he considered students learnt best by ‘doing’, not just ‘viewing’. He asserted:

It is necessary to let students operate the experiments in person although some experiments may be dangerous. The university needs to train them [students] to have practical experiences. They can not learn by viewing alone but need to learn by doing. (ACi.3.1.2)

All three administrators noted the university needed to find better ways to meet this challenge although simultaneously they reported not all experiments had to be conducted by students in person. Thus, they suggested each college or department needed to inspect course and subject attributes and prepare a development plan for e-learning practice. They indicated the evaluation of online course materials provided and the interactions in online discussion would help them audit how e-learning teaching approaches were applied in different e-learning courses and investigate the effects of these on student learning outcomes. Thus, how to enhance the e-learning practice to be more effective was an important issue for them, particularly for science e-learning.

Two administrators indicated the opinion from the public community people, media (e.g., TV newspapers), and student parents could influence student use of e-learning. They said the community people, public media or student parents would encourage the public people or their children to view e-content or to uptake e-learning courses when they consider e-content could be effective supplementary resources and could improve student knowledge and skills. Thus, they said the university e-learning practice needed to consider the public opinions from the public community, media and even the student parents.

The next section will describe the necessary changes and possible enhancement strategies for e-learning practice and science e-learning envisaged by the administrators.

#### **4.2.5 Necessary changes and enhancement strategies for e-learning**

In order to obtain administrator perceptions on how to improve e-learning practice, the three administrators were asked what changes needed to be made from institutional, managerial, and instructor perspectives and what they saw as possible enhancement strategies. Necessary changes will be described first and then the possible enhancement strategies.

### **Necessary changes**

Three administrators suggested some changes needed to be made from institutional, managerial, and instructor perspectives. These included organization structural change; changes to the perception of e-learning held by administrators, staff and instructors; re-consideration of the e-learning support and evaluation system; promotion of individual college e-learning development plans; and the development of a good relationships and cooperation amongst administrative, technical support, instructors and students.

### ***Organization structure change***

The administrators considered the university should set up a high level dedicated e-learning practice organization or development center. They suggested the recruitment of an e-learning specialist and or the assignment of a dedicated high level person, such as the vice-president, to manage the integration of university resources and to prepare a well-designed e-learning development. This dedicated person needed to coordinate and conduct all matters pertaining to e-learning practice. Administrator C remarked:

The university should assign a high level person such as vice-president or a dedicated expert to conduct and manage the university e-learning practice. This leader must have authority to integrate all university resources and coordinate all matters pertaining to e-learning practice. No one or any division in NRU current e-learning practice has the authority to integrate all university resources and to conduct e-learning development plan. The leadership in enhancing e-learning practice is very important. (ACi.2.3.7)

### ***Changes in perception of e-learning for administrators, staff and instructors***

As mentioned earlier in the potential benefits for university (see Section 4.3.3), three administrators noted no one could ignore the e-learning trend and all administrators, staff and instructors needed to change their perceptions and attitudes to adapt to e-learning, particularly, many of the instructors. They said the instructors' attitude that the university focused on research outputs with a lesser focus on teaching was a misconception or misunderstanding of the university goal/vision, because, while university was defined as research-oriented, the emphasis was on both teaching and research. They said the MOE evaluated each instructor's teaching performance and each department or college also assessed instructor teaching, research and service for the purpose of promotion. Administrator A remarked:

There are some misunderstandings between university and instructors. Although the university has defined its goal to be research-oriented, the university still assesses instructor performance in teaching, research and service. Each department or college sets a certain percentage on each of these three aspects for faculty promotion. (AAi.4.6.9)

### ***Re-considering the e-learning support and assessment system***

When administrators were asked why the university had ceased to provide student assistant support and money awards to instructors, the comment was made that it was always the same instructors who applied for e-learning support and that some of these instructors still used the old version of e-learning course materials with only a minor change for their new classes. They also noted perhaps the support policy was not well defined and did not have a good evaluation system to assess instructor e-courses, so they needed to re-adjust the e-learning policy and establish a new e-learning evaluation system. As Administrator A remarked:

Maybe we did not define and broadcast e-learning policy very well. Moreover, we did not have a good enough evaluation system to assess instructor e-courses, so we decided to quit support and money awards. Currently, the focus of our main effort is to constitute a good assessment system. Once we establish that we will discuss and find an adequate approach to enhance e-learning practice. That's why we temporarily quit all kinds of supports because university needs to have more time to adjust its e-learning policy and strategies for e-learning implementation. (AAi.5.1.2)

### ***Promoting the development of individual College e-learning plans***

Two administrators suggested each college should develop their own e-learning development plan and that this should include details of which courses were suitable for e-learning development; plans of who would do any development; when they would do it, and how many courses would be completed annually. They noted the distribution of the university budget could depend on the percentage of e-learning courses completed in the colleges or departments. They suggested the university could use a budget provision as an incentive to encourage more college instructors to teach in e-learning. Administrator A remarked, "We plan to use various incentives to attract instructors to use e-learning and persuade all colleges promote their own e-learning development plan to enhance e-learning practice. If they have more completed e-learning courses, they can get an increased budget from the university" (AAi.5.2.7).

### ***Good cooperation among all participant groups***

Furthermore, the administrators all agreed that effective e-learning practice required administrators, technical support people, instructors and students to cooperate, to act as a team. The administrators are responsible for creating strategies for e-learning practice. The instructors and students in the colleges or departments are the e-learning development users. The technical support people provide technical support. As Administrator B remarked, “No one in this team should shirk their responsibility in e-learning practice. On the contrary, all participants must have a good relationship to communicate and cooperate for the improvement of e-learning practice” (ABi.5.2.5). The consensus was that successful e-learning practice relies on good communication and cooperation amongst all participants.

### **Possible enhancement strategies for e-learning practice**

The three administrators indicated that perhaps it would be difficult to demand that all instructors be involved in e-learning teaching. They all suggested the following as strategies to increase the use of e-learning: a certain percentage of college or department courses must provide e-learning content; an incentive policy to develop e-learning practice needed to be implemented and more seminars held to demonstrate the benefits of e-learning and the nature of effective e-learning courses. Their plan was for more experienced instructors to demonstrate their e-learning courses and explain how to design an e-learning course as a means to motivate other instructors to engage in e-learning. They considered peer coaching would overcome psychological barriers and help instructors to try e-learning.

Furthermore, they reported that although the Computer Center and the Office of Academic Affairs could help solve technical problems, many instructors still did not know how to design or develop e-learning courses. Two administrators reported the provision of better technology and technical support was important to instructor development of e-learning.

Administrator A noted from the administrative perspective, the Office of Academic Affairs should create e-learning policy and support strategies to

encourage instructors to use e-learning, such as the provision of administrative support staff or awards. Furthermore, they reported e-learning policy must clarify the budget for staff and facilities for e-learning practice, such as a budget for employing technical support staff and a budget to buy equipment. They indicated that if e-learning practice had no support from the university, then practice would decline. Moreover, they noted if there was no support for instructors there would be no incentive for them to teach in e-learning because they would not be paid for their extra time and effort. They indicated all of these factors needed to be set up through the university e-learning policy. Administrators A and B noted this was the responsibility of the Office of Academic Office and they needed to enact the related rules and initiate the relevant budget for staffing and facilities.

Two administrators indicated that for technology and technical support the university should integrate the resources from the Computer Center and other departments such as the Department of Computer Science and Information Engineering and the Department of Engineering Science to help the instructors develop their e-learning courses, and indicated college cooperation was very important in the implementation and enhancement of e-learning practice. Administrator A remarked,

If the Office of Academic Affairs constitutes the e-learning policy, the university still needs to invite the college deans and some specialists to discuss and establish it. This policy must fit each college, the Computer Center and the instructors. The university needs their cooperation and the Office of Academic Affairs is only a service division for the colleges and instructors. Moreover, the Office of Academic Affairs conducting the development of e-learning practice may be better than other divisions because it is more authoritative. For instance, if the College of Engineering were to conduct it, other colleges may not follow their direction and strategies. (AAi.6.2.4)

To reduce instructor teaching load, three administrators suggested the university should collapse smaller classes into one large class which might have more than 200 students. They also recommended the university provide better audio/video classrooms for instructors teaching the large class. They noted this might help the instructors to reduce their teaching load because they would not need to teach the same topic a number of times. Moreover, they suggested a department or college could arrange for three or four instructors to cooperate for this large class in e-learning. This would provide instructors more chance to share their teaching

experiences with each other. Simultaneously, this would improve their teaching quality and efficiency.

Possible enhancement strategies for science education in e-learning were the same as those for other colleges and included providing more seminars, demonstrations, and workshops to motivate science instructors to use e-learning. The College of Science also needed to have a well-detailed development plan, to audit their courses, and based on the course attributes, to design their own e-learning courses. The three administrators suggested that instructors might need to meet together and discuss how to divide into groups to cooperate to develop the science e-learning courses.

### **4.3 Perceptions of technical support people**

This section describes the perceptions of two university technical support staff in the Computer Center. One was responsible for e-learning system design and maintenance; the other for broadcasting e-learning concepts and providing technical support for instructor use of e-learning. These two technical support staff were asked to describe national and university e-learning support policy, technical support services provided by them, their perceptions of the benefits and challenges of e-learning practice, their perceptions of factors influencing instructor use of e-learning, necessary changes from an institutional, managerial, instructor and student perspective, and possible enhancement strategies for science education in e-learning.

#### **4.3.1 Perceptions of the university support policy for e-learning**

The two technical support staff indicated the university encouraged instructors to use e-learning by providing funding awards, pay for extra teaching hours, student assistant support, and technical staff support. They reported the university treated e-learning as an online 'assisted instruction' tool and this would mislead the instructors in the value of e-learning practice. They indicated the role of Computer Center was to supply the technology including hardware and software, answer inquiries about technical knowledge and skills, design e-learning systems and develop the e-campus, and provide technical support for all campus staff,

instructors and students. They pointed out their main tasks were to design and maintain the e-learning system, to provide technical support, and promote e-learning and its benefits to instructors and students.

The two technical support staff reported the university did not like outsourcing its e-learning system but preferred university technical staff to design and maintain the university owned e-learning platform. They said the university lacked the budget to buy the e-learning system from external professionals and to employ more staff to maintain that system. Technical support staff B said, “University does not have enough money to buy external professional e-learning system and it also requires some staff to maintain that system. Thus, I need to design and maintain university e-learning system by myself” (TBi.1.1.8). They also noted that the functionality of the e-learning system and technical support policies or strategies was influenced by changes in computer technology, the MOE assessment system, the university e-learning policy, and instructor and student feedback. All these changes required a larger budget to buy up-to-date computer technology and more manpower support to update the system functionality and provide support services. However, the university did not provide budget and manpower support for this update. Technical support staff A noted, “University e-learning system and support services needs to be updated all the time but the university did not increase the budget and manpower support for this. All the e-learning tasks are needed to be done by two of us” (TAi.1.2.3). This implied budget and manpower support were two concerns in the e-learning practice.

### **4.3.2 Technical support services provided**

The two support staff reported training courses, seminars, demonstrations, online e-learning related information, and operation manuals had been provided to improve e-learning practice. They provided training courses and seminars to beginner and intermediate instructors to demonstrate how to use the university e-learning system. They demonstrated the functions of the e-learning system and publicized e-learning and its benefits. Staff A remarked:

We provide many seminars to broadcast e-learning concepts, benefits and to demonstrate e-learning system functions. Usually many instructors or student assistants attend the seminars. Some participants came from other universities. Sometimes we also provide one-to-one support at an instructor’s office if instructors still have problems. (TAi.1.3.4)

The support staff indicated e-learning related information, such as new course design methods or software, reference websites, Q and A, and instructor experiences, were provided online in bulletin boards. They considered e-learning a form of assisted instruction, so different instructors might have different needs for the presentation of their specific course materials. They noted instructors from Department of Foreign Language in College of Liberal Arts required a better quality of audio-visual facilities and functions to show how to speak well; instructors from the College of Science required more disk space to store their video files or demonstrations.

The two support staff noted they got much feedback and information about the actual e-learning practice from instructors and students. For example, when they helped instructors and student assistants in using e-learning system, transferring video of lessons onto system, managing the discussion forums and so on, instructors and student assistants often talked about their perceptions, experiences and expectations of e-learning. The two support staff also noted instructors and students could write their experiences, perceptions, feedbacks, and comments on the e-learning system. Furthermore, they provided many seminars to broadcast e-learning benefits and new knowledge of e-learning and technology use, they communicated with instructors about the development of e-learning courses. They indicated these were very important for the enhancement of e-learning practice.

#### **4.3.3 Technical staff perceptions of the benefits and challenges of e-learning**

This section sets out technical staff perceptions of the benefits and challenges of e-learning for instructors and students. The challenges technical support staff faced are also described.

##### **Benefits for instructors and students**

The two technical staff reported that the university provided e-learning courses to on-campus students and off-campus students who came from continuing education, with the Computer Center providing support for all colleges in the university. They said e-learning practice is a good way to implement the teaching and learning cycle and improve instructor and student teaching and learning. They

noted the instructors must provide complete and well-designed course materials online and respond immediately to student questions, whether students were on campus or off-campus. They also indicated e-learning could help students obtain well-managed course materials and immediate responses from their instructors or peers. Staff A remarked, “The instructors provide knowledge or skills to students and students accept knowledge or skills and then give their feedback to instructors about their learning, which instructors must then respond to. This could improve student learning outcomes, especially for those off-campus students” (TAi.1.6.8). They also reported e-learning teaching could help instructors keep and maintain their course materials and student academic records online easily. Staff B said, “E-learning provides disk space to store instructor course materials and student academic records online for a long time so instructors can easily to manage them in e-learning system because it provides many useful functions such as online submitting and grading functions” (TBi.1.7.9). This implied e-learning could improve instructor teaching and their teaching quality and efficiency. They both noted e-learning was a better tool for interaction between instructors and students, and a very beneficial teaching approach for student learning because students could learn any time, any place and at their own pace. Staff A highlighted, “E-learning can benefit students to learn more flexibly and students can ask questions or interact with their instructors and peers at their convenience. Instructors also could respond or interact with students online” (TAi.2.3.7). Staff B also said, “Students can learn at any time, any place and at their own pace in e-learning and they can interact with their instructors and peers via email, bulletin board, online discussion or chat room. E-learning provides a beneficial approach for instructor teaching and student learning” (TBi.2.4.1). They both asserted these e-learning benefits needed to be broadcast to instructors and students to encourage them to use e-learning more and communicate better with each other.

### **Challenges for instructors and students**

Both of the technical staff pointed out that a stable and reliable e-learning system was needed, especially when many students went online to hand in their assignments or reports and do exams at the end of a semester. Staff A noted, “Students and instructors always require us to provide a stable and reliable e-learning system especially when many students want to hand-in their

assignments/reports and do exams online at the end of a semester because they faced unstable system and low-speed network problems” (TAi.2.5.4). This implied easy access to the required technology and e-learning system was a challenge for instructors and students. For science instructors, they noted it could be difficult to express abstract science concepts in text format and develop experiment simulations. They also pointed out science instructors and students might have difficulties. Staff B said, “Science instructors might have difficulties to design simulations for science experiments and express abstract science concepts in text format, especially when they need to type in formulae and science symbols. Perhaps students also have this typing difficulty” (TBi.2.5.9). This implied technical knowledge and skills could be challenges for instructors and students in the e-learning practice.

They also noted instructors faced some challenges in their development of e-learning courses such as video-recording of lessons and video file transferring because it required high technical skills, high quality of audio/video facilities and much time to do it. Staff A said, “Some instructors came to learn how to video-record lessons and do the video file transfer from us. Sometimes they complained of the shortage and poor quality of audio/video facilities when they borrowed audio/video facilities from the Center to record their class teaching” (TAi.2.8.8). “Instructors also complained video file transfer took them much time, so they expected someone could help them with this” (TAi.2.8.9). Staff B also noted, “Many student assistants came to our office to transfer video files for their instructors, these students often said it took much of their time and effort” (TBi.2.9.2). This indicated capacity in technical skills, high quality of technology and extra time were required for development of e-learning courses and perhaps instructors needed a student assistant to do all tedious tasks for them.

### **Challenges for technical support staff**

The staff commented that while they tried to provide a well-designed functional e-learning system and technical support for instructors and students, their efforts were sometimes challenged or misunderstood because of a limitation of network resources and or university e-learning policy. For example, a hyperlink function was provided for instructors for online reference websites or databases, but

students could not access these references due to legal property issues, but, students learning from online references depended on their instructors providing them. They commented students expected the university to provide better support services for their e-learning. They said these better support services could be related to high quality of computer technology and network. Staff B noted, “Some students complain the network bandwidth and speed is not large and fast enough to download the images of online references or database so they expect the university can provide better computer technology and network for them” (TBi.3.1.6). Staff A also said, “Some students require high quality of audio/video facilities to record class of lessons because the voices and images of audio/videos are not clear. They also expect university can provide fast and large enough network to download the video files” (TAi.3.7.2). Both of these technical staff also noted some students expected they could review VOD at home and some students expected university could provide wireless network environment for their e-learning. However, they said they had been challenged by these students and the university might not fulfil all these requests if the university did have enough budget for updating those required technology and facilities.

These two staff indicated they also had been challenged in their support services although they mainly followed the university e-learning policy and technology trend. They reported the Computer Center was only a technical support division and needed to coordinate with university implementation strategy, and the Center did not have the authority and the budget to decide all e-learning matters and buy all e-learning technology and facilities so it affected their support services for instructors and students. They noted ICTs changed fast everyday and everyone needed to improve their technical ability to adapt to this information age, especially for themselves. They said they needed to actively update e-learning system functions and be familiar with all related up-to-date multimedia facilities in their support services. However, they said this took them much time and effort and they could not insure they could satisfy everyone’s needs because different instructors and different students had different requests. For instance, they noted there were many kinds of audio/video facilities and software for video recording and video file transfer so they needed to familiarize themselves with all of them and suggest to the university to provide some of these facilities to instructors and

students. However, they said they were often challenged by having to say that they did not have high quality of technical knowledge and skills in their support services although they had tried to provide their best services for each instructor and student.

Both staff indicated the management of e-learning system would have problems, especially with instructor self-established websites. They said administrators preferred the university e-learning system to act as an entrance point so that instructors and students could easily and freely connect to any domestic or international website. Thus, Staff B reported he provided a web-editing function to help instructors to establish their own webpage and links to their course materials or references. However, both staff noted some instructors and students complained this function was not easy to use and requested staff to make this connection for them or suggested deleting this function, although some instructors and students appreciated its provision. They noted they were troubled by these complaints because they just followed the commands of administrators. They also noted they were troubled with those websites which were set up by instructors' student assistants. They indicated the challenge was that instructors did not have reliable skilled student assistants to continuously maintain their own website or course materials. Moreover, Staff A reported some instructors with their own website were interrupted or bothered by their colleagues because those instructors provided their own website source codes to their colleagues and they were requested to maintain their colleagues' websites. This situation also bothered their management of e-learning system and influenced their support service because instructors often required their help to establish or maintain their websites but they did not have much time and effort to support for this.

Lack of adequate resources also was another challenge for technical support staff. The staff worried that current disk space was not enough to save all instructor e-learning courses for many years because instructors usually saved all their course materials and student academic records each year and have many copies in the e-learning system. They reported the majority of instructors were afraid they could lose their course materials so they often backup all their files not only in university e-learning system but also in their own personal server, department

server. However, instructors did not manage their course materials well and did not know how to backup their course materials online, although e-learning system had provided a good backup function for instructors to keep their course materials and student records such as grading and online discussion. They noted there was a misunderstanding between them and instructors about backup of their course materials on the system. Staff A noted, “Some instructors misunderstand the backup policy and did not know how to properly backup their e-content on the system, so instructors often complain they did not have large enough disk space to save all their course materials online for a long time” (TAi.4.1.3). Therefore, they reported that more time and effort were needed to explain the backup function and teach instructors how to backup their e-content. They also noted the university needed to have a new ‘paid-by-user’ strategy in order to collect some money from users to buy more disks. Simultaneously, they said the university needed to restrict instructor use of disk space by counting their course credit-hours, otherwise they would complain the university did not provide enough disk space. This implied provision of enough disk space might be a hindrance to e-learning practice.

#### **4.3.4 Perceptions of factors influencing instructor use of e-learning**

This section describes technical staff perceptions of factors influencing instructor use of e-learning. Many of the factors the two technical support people saw as influences were consistent with their perceptions of the benefits and challenges of e-learning for instructors (Section 4.4.3). These included that e-learning could improve instructor teaching, their teaching quality and efficiency, and their interactions with students. They also noted easy access to required technology and e-learning system, capability of technical knowledge and skills, high quality of technology and facilities, and the amount of time required also influenced instructor use of e-learning. The additional influences they discussed in response to a direct question on influences were to see instructor have strong personal will to use e-learning, or having e-learning related projects or perceived benefits for their future tasks, or having student assistant support for their e-learning courses.

Both technical staff noted they did not like the university requirement that all instructors must use the university e-learning system, although some universities

did have this requirement. They noted many instructors did not use e-learning because instructors thought e-learning was time-consuming and required high technical literacy. Instructor's personal perception and attitude to the e-learning was also seen as an important factor for instructor use of e-learning so they would like to encourage the instructors by broadcasting the e-learning benefits and helping them to develop their e-learning courses. They indicated that instructors with higher technical ability often did not come to seminars. They noted the purpose of seminars was more to teach beginner instructors to use e-learning but they also provided various seminars for different levels of ability. Both reported instructors at the university usually had a good capability for learning new knowledge or skills, especially if instructors had a strong personal desire to learn something. Staff A indicated that e-learning ability had no relationship with instructor age. She noted personal motivation to learn how to use e-learning was similar to personal motivation to gain other knowledge. She remarked it depends on individual instructor desire and attitude:

The most important factor is instructor personal will. If they want to use e-learning they can learn better and faster. Some instructors told us they just need three weeks to learn how to use e-learning system and try to put some course materials online. (TAi.1.6.7)

Staff A also indicated whether instructors had an e-learning related project and any benefits for their future job were two influences to motivate their use of e-learning. She noted, "If instructors had a strong personal will, an e-learning related project, or any perceived benefits for their future job, instructors would develop e-learning courses well no matter what the university gave them student assistant support or not" (TAi.4.2.6). She indicated student assistant support from the university was not a significant influence on those instructors in their use of e-learning because those instructors would overcome this barrier if they still liked or needed to use e-learning. For instance, those instructors might have funding to employ a student or project assistant to help them do all e-learning chores. However, they pointed out that some assistant professors or lecturers without student assistant support from the university might have problems because they did not have any projects or funding to get their own student assistant support. Staff A noted those assistant professors or lecturers might quit their use of e-learning because they could not afford the time and effort to develop e-learning. Meanwhile, she noted that although those instructors did not use e-learning

currently, it did not mean they would not like to use it in the future. This implied an instructor's personal view of its value and support was an influence on e-learning practice, so it was worthwhile to encourage its use.

The two technical staff suggested four reasons why few science instructors used the university e-learning system. They noted instructors in College of Science were often well known and so might rely on their personal reputation. They often had a high level of technical ability and so could establish their own e-learning website on their own server for their e-learning courses. They pointed out that science courses and content could be difficult to present in an e-learning format because of the need for formulae and science symbols. Finally, they noted student personality and learning attitudes could also be an influence on instructor e-learning teaching. They considered science students were likely to prefer to learn by doing experiments and in the laboratory.

#### **4.3.5 Perceptions of enhancement strategies for e-learning practice**

The two technical support staff were asked to give suggestions on possible enhancement strategies for e-learning practice from institutional, managerial, and instructor perspectives. They suggested the following as strategies to increase the use of e-learning: university higher level of administrators must make a decision on university e-learning goal and development strategies; the MOE or university should have a better assessment system to evaluate e-learning practice and must give weight to the quality of an e-learning course; administrators and instructors must change their personal views and attitudes to adapt to this e-learning trend and information age; and the university needed to provide more training courses and seminars to help improve instructor technical capability and understanding of e-learning in order to increase their personal will to use e-learning.

The technical support staff noted that the university goals for e-learning practice, and subsequently how they thought about enhancing e-learning, would be different. The main administrator aim was to improve the academic quality of teaching and learning and also to make money from e-content sales. They considered NRU did not need to increase its reputation by selling e-contents or by opening e-learning courses to the public. They argued the university needed to

investigate the e-learning market and run the e-learning practice as a business if administrators wanted to put e-learning courses on to the market. This suggested that university higher level of administrators must make a decision on university e-learning goal and development strategies.

Both staff indicated the MOE or university should have a better assessment system to evaluate e-learning practice and must give weight to the quality of an e-learning course. They said the good quality of e-learning courses must be taken into account as part of successful e-learning practice. They noted many universities made a large number of e-learning courses online and presented quantitative data about e-learning practice whenever the MOE came to assess e-learning practice. However, they noted those data did not show the real situation of successful e-learning practice. For instance, Staff A reported those large numbers of e-learning courses included course outlines but nothing else. This suggested an appropriate assessment system for evaluating e-learning practice was necessary and important.

Both technical staff indicated successful e-learning practice depended on who was responsible for implementing e-learning. They reported administrator and instructor personal views and attitudes to e-learning were very important in the e-learning practice. They noted the national e-learning policy did not have definite goals, so no university in Taiwan had well-defined goals for their e-learning practice. Staff A noted the requirement from MOE forced each university to implement e-learning on campus. She noted administrators would encourage instructors to give great effort to e-learning teaching if administrators treated e-learning as a general teaching method. However, Staff A indicated e-learning was a new teaching tool like using the whiteboard, overhead projector or PowerPoint file in their teaching. She noted this is a natural and necessary change in the current information age and all people needed to adapt to this perception. This implied that the changes of administrator and instructor personal views and attitudes to e-learning were necessary and might be a good strategy to improve e-learning practice. The support staff said that while they tried their best to help instructors develop their e-learning courses, instructor personal motivation and personal technical skills were more important than a well-designed e-learning

system. They noted instructors appreciated the provision of technical support from university staff and student assistants and suggested courses and seminars to help improve instructor technical capability and understanding of e-learning as a possible enhancement strategy.

#### **4.4 Perceptions of student assistants**

This section describes the perceptions of five groups of student assistants. Ten student assistants in five groups were asked about their perceptions of the university support policy for e-learning, the support services they provided for instructor e-learning development, and their perceptions of the benefits and challenges of e-learning practice. Their responses will be discussed in the following sections.

##### **4.4.1 Perceptions of university support policy for e-learning**

Based on the previous university support policy for e-learning, each instructor could apply for a student assistant for each e-learning course they taught. Four different instructors applied for this student assistant support for their six e-learning courses. There were two groups (Group A and Group B) which each have three student assistants working for one instructor to support her three e-learning courses. Another two groups, (Group C and Group D) with two student assistants each, worked for two instructors to support their two e-learning courses. One student in Group D did not come to the interview at the arranged time but his peer knew what he did and responded for him. The remaining one group (Group E) only had one student assistant to support one instructor for one e-learning course. These five groups of student assistant support people reported each group was paid about US\$170 per month for fifteen hours per week. If each group had more than one student assistant, the group members shared this monthly wage. They commented the wages were not very good because they always worked for longer than the fifteen hours. A student in Group E noted she needed to work extra time at night or in the weekend as she said, "I spent more than fifteen hours per week to do all e-learning chores. Sometimes I worked extra time at night or in the weekend" (SsEi1.2.6.8). Three of the five groups noted their instructors tried to find additional funding for them. They argued the university should pay them

depending on the course attributes and the instructor to student ratio (class size) because they needed to spend more time and effort to manage student academic records if there were many students in the class. There were usually more students in basic core courses to care for than in advanced courses. As a student in Group B noted,

Our instructor teaches a compulsory basic core course named 'Computer Aided Design' in our department and there are about 150 students in the class. Except video-recording classroom teaching and transferring audio/video files online, I need to spend more time and effort to manage student academic records and online discussion, and so forth. Another student in another group needs to design and maintain e-learning server and websites. Our instructor had three e-learning courses so we have six student assistants and we are divided into two groups to take care of all e-learning chores. We shared the monthly pay but it was too little for us so our instructor tried to find additional funding for us. (SsBi1.1.3.5)

Three support groups also indicated that they required a high level of technical knowledge and skills and wanted wages similar to those of a teaching assistant in the laboratory. A student in Group A noted, "We need to have high level of technical knowledge and skills to design and maintain e-learning server, website and online student evaluation of e-learning courses. So we expect university can pay us higher wages as those of a teaching assistant in the laboratory" (SsAi2.1.4.7).

The students in the five groups had learned the required e-learning technical knowledge and skills mainly from their department senior student assistants, and sometimes from university technical support staff in the Computer Center. A student in Group A noted, "Department seniors demonstrated how to maintain the e-learning website, operate e-learning facilities, and manage student academic records for us" (SsAi3.1.2.5). They all reported they could get the help they needed from their department seniors or university technical support staff and so they were satisfied with the technical support they received from the university.

#### **4.4.2 Support services provided**

Each of the five groups reported they provided the best support they could so that their instructors needed only to concentrate on e-learning teaching, and not worry about e-learning related technical problems. As support people they completed many kinds of e-learning related tasks such as the creation of an e-learning course webpage, creation and analysis of online class evaluation data, maintenance of the

e-learning website or server, video-recording class lessons, video file transfer online, creation of course materials online, and managing student assignments, reports, tests and or online group discussion. Each person in a support group had their own tasks, these depending on the instructor's teaching approach and e-learning course design. For instance, in Group A, three student assistants were responsible for creating and maintaining the course e-learning system and, in Group B, three worked as class teaching assistants. The latter three student assistants helped their instructor to video-record class lessons, transfer video files online, create and input course materials online, and manage student academic records such as collating and grading student assignments, reports, tests and online group discussion. Similarly, the other two of these five groups (Groups C and D) reported they had two members as support for each e-learning course and shared their tasks similarly to the two groups of student assistant support staff described. The remaining one group (Group E) had only one student assistant who did all the tasks for her instructor. This student said, "I spent much time and effort to do all e-learning chores such as video-record class of lesson, transfer video online, manage student academic records and solve all technical problems" (SsEi1.2.6.7). Student assistants in Group B and Group D noted they also provided two office hours per week to support student inquiries.

In sum, all five groups noted that instructors needed at least two support staff if they video-recorded class of lessons or used video-conference teaching and or used their own e-learning website. They reported one student assistant helped the instructor to set up e-learning related facilities for video-recording, video file transfer online and or maintenance of e-learning website. Simultaneously, another student assistant helped the instructor to manage student academic records and online (group) discussion, especially when the class had many students.

#### **4.4.3 Perceptions of the benefits and challenges of e-learning practice**

Five groups of student assistant support staff noted in e-learning it was beneficial for instructors to adjust their teaching approach, teaching progress and course materials based on student feedback from online class evaluation data. They pointed out this adjustment would improve instructor and student teaching and

learning quality in e-learning. Moreover, they noted e-learning could provide better interactions among instructors and students via bulletin board, email, and online discussion. Three student assistant support groups reported their instructors provided well-designed webpage and course materials, online assignments/tests, online discussion, chat room and collaborative assignments. However, they found the chat room did not receive good feedback. They also noted some instructors and students faced some challenges, such as some students did not know how to access e-learning courses and interact with their instructors and peers in online discussion. A student in Group B said, “In the beginning of semester class we need to teach all students how to access e-learning courses and interact online. But, some students still always had many troubles in their access and or interactions” (SsBi2.5.3.1). Another student in this group remarked that instructor and students faced the challenge of typing Mandarin characters or formulae online. He said, “Typing Mandarin characters and or formulae online is difficult for some instructors and students, especially in online discussion and online assignments or tests. They need to improve their technical skills in this” (SsBi3.3.4.1). This implied instructor and student personal technical capability and skill was a challenge to their use of e-learning.

The five student assistant support groups noted flexibility of e-learning might adversely affect the learning outcomes of those lazy and passive students. A student in Group D noted, “Some lazy and passive students consider they can review online course materials at any time and any place so they may not attend class. This will decrease their learning outcomes because usually they do not review all course materials before exam” (SsDi1.2.5.7). Two groups of student assistants noted only F2F instruction might be suitable for those lazy and passive students because they might learn something in class. Therefore, they indicated student learning attitude was very important in the e-learning practice. The following section will describe their perceptions of factors influencing instructor and student use of e-learning.

#### **4.4.4 Perceptions of factors influencing instructor and student use of e-learning**

Many of the factors the five groups of support students saw as influences were related to their perceptions of the benefits and challenges of e-learning for instructors and students (see Section 4.5.3). These included that e-learning could improve instructor and student teaching and learning and their quality; e-learning could provide better interactions among instructors and students via bulletin board, email, and online discussion; e-learning provided students with flexibility of time and place of learning; lazy and passive student learning attitude might influence their will to use e-learning and decrease their learning outcome; and instructor and student lack of personal technical capability and skill could hinder their use of e-learning. The additional influences they discussed in response to a direct question on influences were that university e-learning support policy encouraged instructors and students to use e-learning; a well-designed and complete e-learning course influenced students to review and learn course materials; incentives provided by instructors motivated students to engaged in e-learning activities; and course attributes and personal capability in self-management might affect student personal will to use or take e-learning courses.

The five groups of student assistant support staff indicated instructors and students were encouraged to use e-learning because of the university e-learning support policy. They reported instructors were happy to get help from student assistants to provide a well-designed webpage and course materials online. They indicated students would not like to use e-learning if the courses were not actively well-designed and complete. A student in Group C noted, “Students often consider well-designed and complete e-learning courses are worthwhile to review and learn. If not, they will not use e-learning” (SsCi2.3.1.4). Similarly, students could also get help from student assistants in online discussion and or in F2F inquiry at the student assistant office hour. Five student assistant support groups noted their instructors award extra grades to those active and diligent students who are more involved in online discussion or online course materials review. A student in Group B said, “My instructor provides additional grade awards to motivate those active and diligent students who are more involved in online discussion or online course materials review” (SsBi3.4.3.6). Three support groups

also noted some students did not have the required technical knowledge and skills to access e-learning online, especially for online assignments/tests or in online discussion. The five groups reported e-learning was an assisted instruction and student-centered design of teaching so they noted e-learning was suitable for advanced courses rather than a basic general course. They reported students in advanced courses might have more interest in the courses and would be more self-managed in controlling their own learning progress. A student in Group A remarked,

The advance courses often are elective and more specific than those basic general compulsory courses and often required a more active and self-managed learning attitude, especially for those courses requiring more involvement in online discussion and collaborative projects. Thus, if students are not interested in the courses and are not active, self-managed learners they will not take these advanced courses. (SsCi3.3.4.5)

This indicated course attributes and student interest, learning attitude and personal capability in self-management also influenced student personal will to use or take e-learning courses.

In sum, the additional perceived influences included university e-learning support policy encouraged instructors and students to use e-learning; a well-designed and complete e-learning course influenced students to learn and review lessons; incentives provided by instructors would motivate students to be engaged in e-learning activities; and course attributes and student personal learning attitude and capability would affect student personal will to use or take e-learning courses.

#### **4.4.5 Perceptions of possible enhancement strategies for e-learning practice**

Five student assistant support groups indicated the university should broadcast the benefits of e-learning to encourage instructors to use e-learning and change their perceptions of e-learning practice. One student assistant also suggested the university should hold more seminars or demonstrations so instructors could learn and inspect other e-learning courses. Another student assistant noted e-learning could improve instructor and student technical knowledge and skill to adapt to current information age. She noted increasing instructor personal will and capacity was an important factor in the enhancement of e-learning practice. She pointed out that if instructors liked to use e-learning they also would encourage

their students' use of e-learning. This indicated instructor personal factors were very important for the improvement of e-learning practice.

One group of student assistants reported their instructors cooperated with other universities or institutions to teach e-learning courses in video conference style. A student assistant in this group noted he needed to prepare all related facilities before class, video record class teaching and pack all facilities back into the storage room. He reported each time he spent at least forty minutes to prepare and pack e-learning facilities. Moreover, he noted he was troubled with technical problems such as disconnection of network and sometimes he needed to wait for the other institution to be ready for broadcasting. He noted each cooperating university or institution should have a dedicated video conference classroom for e-learning teaching in order to prevent wasting class time. He reported students were noisy and felt upset and uncomfortable while waiting for e-learning facilities to be ready for class. This implied that reducing technical problems might be a possible enhancement strategy for e-learning practice.

#### **4.5 Chapter summary**

This chapter has described four aspects of respondent administrator and support person experiences and perceptions of e-learning. These aspects were perceptions of national and university e-learning policy, the perceived benefits and challenges of e-learning, factors considered to influence instructor and student use of e-learning, and suggested e-learning enhancement strategies. This section summarizes the key points made by three administrators, two technical support staff and ten student assistants in relation to these aspects.

The administrators, technical support staff and student assistants interviewed considered e-learning a trend that could not be ignored, one that was supported by national government and university policy and investment. The perceived benefits of e-learning to the university were:

- An increase in the university reputation and competitiveness (administrators and staff);
- The potential to make or save the university money (administrators); and
- A good way to foster relationships with the community and other enterprises (administrators).

The benefits for instructors and students were considered to include:

- Improved instructor and student ICT knowledge and skills (administrators staffs, and student assistants);
- An improvement in teaching and learning quality and efficiency through, for example, ease of updating course materials and ease of student preview/ review of course materials (administrators, staff, and student assistants);
- Greater student flexibility in learning (administrators and staff); and
- Improved interaction between instructors and students (administrators, staff, and student assistants).

However, those interviewed also identified challenges for the university, instructors and students. The perceived challenges of e-learning to the university were:

- Lack of the cost of providing up-to-date technology facilities and sufficient manpower support (administrators and staff); and
- Lack of well-defined e-learning policy and goals (administrators and staff).

The perceived personal challenges of e-learning to the instructors and students were:

- Lack of the personal technical knowledge and skills e.g., typing Mandarin characters, science symbols or formulae online; and experiment simulation design especially for science courses (staff and student assistants);
- Lack of easy access and high quality access to the necessary equipment and e-learning system (staff and student assistants);
- Amount of time required to develop and use e-course or interact with each other (staff); and
- Good time management and organization ability required for the flexibility of e-learning especially needed by those lazy and or passive students (student assistants).

Two technical support staff also indicated four reasons why science instructors did not use the university e-learning system. These reasons were:

- Science instructors had their own personal characteristics;
- Science instructors had a high level of technical ability so could establish their own e-learning website on their own server for their e-learning courses;
- The science course or subject might be difficult to present in an e-learning format because of formulae, science symbols and science experiments; and
- Science student personality or learning attitude might be another influence in instructor use of e-learning.

At the same time, technical staff and student assistants noted they faced some challenges in their support services. These challenges were:

- The limitations of network resources or university e-learning policy;
- A need to improve their technical ability to follow up-to-date technology trends and adapt to this information age;
- Problems in management of e-learning system or websites;
- Lack of disk space to save all e-learning courses; and
- Low wages hindering their desire to support e-learning instructors to develop e-learning courses (student assistants only)

The administrators, technical support staff and student assistants all described a number of factors as influencing instructor and student use of e-learning. The personal factors were:

- Instructors had academic freedom (administrators);
- Instructor and student personal will (i.e., personal attitude to e-learning and perceptions of e-learning benefits and challenges) (administrators, staff and student assistants);
- Instructor and student personal capacity (staff and student assistants)
- Administrator and instructor views of e-learning and attitude to national or university e-learning policy (staff); and
- Provision of e-learning related project (staff).

The pedagogy factors were:

- Course/subject attributes (administrators, staff and student assistants); and
- Demand for well-designed and complete e-learning courses (administrators, staff and student assistants).

The policy factors were:

- Provision of incentives and support for instructors and students (e.g., various multimedia facilities, awards, extra pay, technical manpower support) (administrators, staff and student assistants); and
- Impacts of e-learning policy for instructors and students (administrators, staff and student assistants).

Suggested changes that might enhance e-learning practice for the university were:

- Clarification of university e-learning goals and policy and promoting college's own e-learning development plan (administrators and staff);
- A university wide organizational structure change towards university development and e-learning (administrators);
- Re-considering e-learning support policy and evaluation system (administrators, staff and student assistants);
- Providing more encouragement incentives and support (e.g., more seminars/training courses held to demonstrate the benefits of e-learning and the nature of effective e-learning courses) (administrators and staff);

- A good cooperation amongst all participant groups (administrators and staff);
- Requiring a certain percentage of college or department e-courses (administrators and staff);
- Changing the responsibilities of teaching assistants (administrators); and
- Reducing technical problems (student assistants).

Suggested changes that might enhance e-learning practice for all participants were:

- Changes in the perceptions and attitudes towards e-learning of administrators, technical staff, instructors and students (administrators, staff and student assistants);

The three administrators and twelve support people indicated all those involved with e-learning, and especially instructors, needed to change their perception of the value of e-learning and to improve their capacity to utilize e-learning. The three administrators and two technical support staff suggested a clear and well-defined e-learning goal and policy, and leadership and support services were required for the further development of e-learning practice. They noted a successful e-learning practice needed good communication and cooperation among administrators, technical support people, instructors and students. All those interviewed considered e-learning could improve teaching and learning quality and efficiency. All administrators and technical support staff noted e-learning could also increase the university reputation, competitiveness and profitability. However, they also saw some challenges to e-learning such as pedagogical issues around course attributes, technical issues, a limited budget, and limited manpower support. They also said instructor and student personal will and capacity were important factors in the e-learning practice. Taken together, it can be seen that the administrative and support people interviewed considered, as might be expected, that instructor and student experiences and perceptions of e-learning are pivotal to practice. Chapter 5 will describe instructor perceptions of e-learning; Chapter 6 details student views.

# **Chapter 5 Instructor perception of e-learning**

## **5.1 Introduction**

The previous chapter described e-learning administrator and support people's perceptions of their e-learning experiences. In this chapter, instructor opinions will be investigated in order to gain insight into their perceptions of their e-learning experiences. The data discussed in this chapter was obtained from sixty-nine questionnaires which included closed and open-ended questions and thirty-three instructors (including six science e-learning instructors, six science non-e-learning users, and twenty-one non-science e-learning instructors) in interviews. The data is presented in four sections. The first outlines the background and experience of the instructor participants, the second identifies instructor perceived benefits and challenges of e-learning, the third describes the factors influencing instructor use of e-learning, and the fourth outlines the suggested changes in e-learning practice. The final section is the chapter summary.

## **5.2 Academic background and e-learning experience**

This section synthesizes respondent instructor demographics and experience in, and of, e-learning. The respondent demographics include descriptions of the respondents' college, position, age, years teaching, year-level teaching, familiarity with e-learning policy, and the relationships among these factors. Respondent instructor background in e-learning includes years teaching e-learning and e-learning courses taught, e-learning ability, and the relationships among these factors. Instructor e-learning experiences describe the e-learning teaching methods and effective strategies they have employed in their e-learning courses. Not all the instructors responded to all the questions in the questionnaire, so the numbers of respondents in each table are different.

### **5.2.1 Respondent demographics**

This section synthesizes general information about instructors from the questionnaires and interviews. It includes the descriptions of respondent's college,

position, age, years teaching, year-level teaching, familiarity with e-learning policy and the relationships among these factors.

Respondent's e-learning colleges are shown in Table 5.1. A majority of respondents to the questionnaires and interviews were in non-science colleges.

Table 5.1  
*Respondent's e-learning instructor colleges represented*

College	Questionnaire respondents		Interviewees	
	N1(=69)	% of N1	N2(=33)	% of N2
Science	7	10%	12	36%
Engineering	20	29%	8	24%
Medicine	11	16%	4	12%
EE and Computer Science	10	14%	1	3%
Social Sciences	6	9%	3	9%
Others	4	6%	3	9%
Planning and Design	4	6%	2	6%
Management	4	6%	0	0%
Liberal Arts	3	4%	0	0%

A majority of respondents were professors (91%-63 of questionnaire respondents and 88%-29 of interviewees), this included twenty-three full professors, twenty-three associate professors and seventeen assistant professors in the questionnaire and seven full professors, sixteen associate professors and seven assistant professors from the interviews. Only 9% (6) of questionnaire respondents and 12% (4) of interviewees were lecturers. The questionnaire respondent instructors taught at different year-levels as shown in Table 5.2. A majority of instructors did more teaching at the higher year-level. The high percentage of higher year-level teaching is likely because most of questionnaire respondent instructors had high positions (33% were full professors and 33% were associate professors). It is university practice/culture that the lower position of instructors the lower year-level courses they teach.

Table 5.2  
*Teaching levels of questionnaire instructors*

Year level taught	Respondents	% of respondents (N=69)
Freshman	22	32%
Sophomore	31	45%
Junior	41	59%
Senior	48	70%
Master	55	80%
PhD	40	58%

Based on the cross tabulation of instructor familiarity with national and e-learning policy, seventeen questionnaire instructors (25%) said they were familiar with

both national and university e-learning policy. Twenty-four (35%) instructors were familiar with university e-learning policy but not national policy. Nineteen instructors (28%) were not familiar with either national or university e-learning policy. A Chi-square test and Phi value shows there was a significant difference and a strong relationship in the responses of instructors familiar with national e-learning policy and university e-learning policy (Chi-square = 58.588, df = 4, p= 0.000, Phi = 0.921).

To sum up, a majority of respondent instructors came from non-science colleges. A majority of instructors taught high year-levels. Overall, the respondent instructors were not familiar with national policy but were familiar with university e-learning policy.

### **5.2.2 Background in e-learning**

This section sets out the instructor background in e-learning. It includes descriptions of years teaching in e-learning, courses taught in e-learning, self-rated ability to use e-learning and the relationship of these factors with age, position, and years teaching in e-learning.

Overall, the questionnaire and interviews showed that instructors were relatively inexperienced with e-learning. Most had had less than three years experience in e-learning (83% and 86% respectively) and had taught fewer than three e-learning courses (74% and 78% respectively). As might be expected, a cross tabulation of instructors' years teaching in e-learning and e-learning courses taught showed the fewer years teaching in e-learning the instructors had, the fewer e-learning course(s) they taught (Chi-square = 62.13, df = 30, p= 0.001, Phi = 0.941).

A contingency table of instructors' years teaching and years teaching in e-learning and a Chi-Square test indicated there was no relationship between instructor's years teaching in general and years teaching in e-learning (Chi square=25.726, df=25 , p=0.422). That is, the more years teaching in general instructors had did not indicate they had more years teaching in e-learning. Most instructors (85%) who had less than 20 years teaching experience had less than three years teaching in e-learning. This implied most instructors were inexperienced with e-learning

teaching, perhaps because e-learning teaching had only been available in the university since 1999.

A majority of instructors rated themselves as having a low level of e-learning ability. A Chi-Square test indicated there was no relationship between instructor respondent's self-rated e-learning ability and their age (Chi square=10.508, df=12, p=0.571). This implies instructor age was not an issue to their self-rated ability to use e-learning. Table 5.3 shows how these self-rated levels of e-learning ability were split across age.

Table 5.3  
*Cross tabulation of instructor age and self-rated e-learning ability*

Instructor age	Instructor self-rated ability to use e-learning									
	beginner		between beginner and intermediate		intermediate		between intermediate and expert		Total (N=69)	
	N	Row%	N	Row%	N	Row%	N	Row%	N	Total%
under 30	0	0%	0	0%	1	100%	0	0%	1	1%
30~40	7	37%	2	11%	8	42%	2	11%	19	28%
41~50	12	36%	6	18%	9	27%	6	18%	33	48%
51~55	4	44%	1	11%	4	44%	0	0%	9	13%
>56+	1	14%	3	43%	3	43%	0	0%	7	10%
Total	24	35%	12	17%	25	36%	8	12%	69	100%

Table 5.4 also shows a majority of questionnaire respondents rated their e-learning ability as beginners and lower than intermediate level, split across their professional position: 56% of 23 full professors, 59% of 17 assistant professors, and 67% of 6 lecturers. A Chi-Square test indicated there was no relationship between instructor's ability and position (Chi square=6.254, df =9, p=0.714). That meant instructor position was not an issue to their self-rated ability to use e-learning.

Table 5.4  
*Cross tabulation of respondent's e-learning ability and position*

Instructor position	Instructor self-rated ability to use e-learning								
	beginner		between beginner and intermediate		intermediate		between intermediate and expert		Total (N=69)
	N	Row%	N	Row%	N	Row%	N	Row%	N
Full professor	7	30%	6	26%	8	35%	2	9%	23
Associate professor	8	35%	1	4%	10	44%	4	17%	23
Assistant professor	6	35%	4	24%	5	29%	2	12%	17
Lecturer	3	50%	1	17%	2	33%	0	0%	6
Total (N=69)	24	35%	12	17%	25	36%	8	12%	69

Table 5.5 shows the relationship between instructor self-rated ability to use e-learning and years teaching in e-learning. A Chi-square test and Phi value shows there was a significant and strong relationship between instructors' years teaching in e-learning and self-rated ability in e-learning (Chi-square =34.209, df =15, p= 0.003, Phi = 0.704). This implies the instructors who had more years e-learning teaching experience tended to rate themselves as having a higher level of e-learning ability.

Table 5.5  
*Self-rated e-learning ability and years teaching in e-learning*

Instructor's years teaching in e-learning	Instructor self-rated ability to use e-learning								Total N=69
	beginner		between beginner and intermediate		intermediate		between intermediate and expert		
	N	Row %	N	Row %	N	Row %	N	Row %	
1 year	19	66%	2	7%	8	28%	0	0%	29
2 years	2	15%	4	30%	6	46%	1	8%	13
3 years	1	7%	3	20%	7	47%	4	27%	15
4 years	1	33%	1	33%	0	0%	1	33%	3
5+ years	1	13%	1	13%	4	50%	2	25%	8
Not answered	0	0%	1	8%	0	0%	0	0%	1
Total (N=69)	24	35%	12	17%	25	36%	8	12%	69

Overall, the instructors were relatively inexperienced with e-learning. Most had had less than three years experience in e-learning and had taught fewer than three e-learning courses. Overall, a majority of instructors rated themselves as having a low level of e-learning ability. A Chi-Square test showed neither instructor age nor position was related to their ability to use e-learning. However, a Chi-Square test and Phi value showed the years teaching experience in e-learning had significant and strong relationship with their self-rated ability in e-learning. Instructors who had fewer years e-learning teaching experience often rated their level of e-learning ability as low.

### 5.2.3 Instructor e-learning experience

The instructors' reports of teaching approaches and the support services they had experienced are synthesized and described in this section. The teaching approaches included the e-learning teaching method, and most effective strategies used in e-learning courses. The support services included the technical support services they had received and found helpful, the number of e-learning courses for which they had student assistant support from the university, and the advantages and disadvantages of having and not having student assistant support.

### **Teaching methods used in e-learning courses**

In order to obtain information regarding the instructors' e-learning experiences with the University Network Teaching and Learning System, the instructors were asked to describe the teaching methods they had used. Sixty-nine questionnaire respondent instructors ticked more than one choice from the list provided. The researcher has grouped these teaching methods into four categories: course materials, audios/videos, synchronous, and asynchronous interactions. Some instructors also added their own specific teaching methods. These were categorized as other teaching methods. The responses from twenty-seven e-learning instructor interviewees were developed into thirteen sub-categories based on the choices in Question 14 of the instructor questionnaire (Appendix J) and then grouped into the same five categories as the questionnaire categories.

The instructors in the interviews indicated they used different e-learning methods in different e-learning courses. As a science instructor explained, "It all depends on instructor need and preference. Sometimes I just put my course materials online in a course but sometimes I also put videos of my lesson online or provide online discussion" (SeiBi.1.1.3). Some instructors put their course materials online or used online assignments or tests only. Some instructors had extra course materials in videos online.

Table 5.6 summarizes instructor responses from questionnaires and interviews. Responses were placed in 'course materials' category if words such as provision of online course notes, outlines, syllabi, all related supplementary references, and online assignments or quizzes or tests or test banks and their answers for each were mentioned in the response. Responses were placed in the 'audios and videos' category if words such as audios/videos of lessons or student presentations, or audios/videos of private commercial products, computer video conferencing, audios with PowerPoint content, and VOD (video on demand, being videos they were able to access from the library video database) were used in the response. Responses were placed in the 'synchronous interactions' category if mention was made of all kinds of interactions such as immediate response interactions in online (group) discussion mentioned in the response. Responses were placed in the 'asynchronous interactions' category if words such as (collaborative) student

projects or reports online and interaction or feedback from their instructors or peers, and immediate response interactions via email, a bulletin board, or online Q and A were mentioned in the response. Responses were placed in the ‘other methods’ category if mention was made of words such as synchronous teaching and learning, distance education, monitoring the computer screens, practical operation, case studies, and roll-calls were used in the response.

Table 5.6

*Teaching methods questionnaire and interviewed instructors used*

<b>Category</b>	<b>Teaching method</b>	<b>N1 (=69)</b>	<b>% of N1</b>	<b>N2 (=27)</b>	<b>% of N2</b>
Course materials	Lecture notes online	57	90%	26	96%
	Supplementary references online	52	83%	25	93%
	Online assignment, quiz/test	19	30%	10	37%
Audios/videos	Video of lessons	39	62%	16	59%
	Video of student presentations	14	22%	6	22%
	Computer video conference	11	17%	3	12%
	VOD (video on demand)	9	14%	2	7%
Synchronous interaction	Online discussion	29	46%	9	33%
	Online group discussion	12	19%	5	19%
Asynchronous interaction	Bulletin board, email, Q and A	56	89%	24	89%
	Collaborative projects	29	46%	11	41%
	Student projects/reports online	26	41%	10	37%
Other teaching methods	Use computer technology or other incentives	17	27%	24	89%

N1: Questionnaire respondent instructors

N2: Interview respondent instructors

***Course materials***

Nearly all instructors from questionnaires and interviews reported they had provided lecture notes (90% and 96% respectively) and supplementary references (83% and 93% respectively) online. As science e-learning instructor A noted, “Except for the video, all course materials are already online and I also scan supplementary materials immediately after class. Thus, the students will have no excuse to say they do not have all kinds of course materials to prepare for exams” (SeiAi.2.3.6). Most instructors indicated they found online syllabi and references were helpful for student understanding and learning progress. They noted a definite outline of the course structure could help students arrange time to preview or review course materials before class and or after class and hence students could manage their study program better and learn more. Moreover, when instructors provided reference websites, textbooks or hints online students could follow these up. As science e-learning instructor D noted, “I provided some reference books

and websites for the students especially when I did not have enough time to explain the course content in detail at class” (SeiDi.2.4.8).

Around one third of instructors (30% and 37%) had used e-assessment tools such as online quizzes, tests or assignments and found them helpful for student learning, especially before exams and or when students did not attend a class or did not study hard. Instructors saw this is a method to improve student learning outcomes. As a science e-learning instructor B described, “If the instructor gives a small quiz when the students come to class, it will motivate students to preview online materials before class or review after class and students would also come to class every time” (SeiBi.2.5.3). This instructor also noted he could easily transfer his class quizzes to become online quizzes. He noted, “I also can use simple yes-no questions or fill in blankets or simple questions to easily transfer my class quizzes online because the purpose of the quiz is just to check whether or not students have done the preview or review” (SeiBi.2.6.1). In addition, some instructors noted they could discover whether their students really understood the lectures or not from the results of online exercises or assignments in class. These instructors noted they would adjust their teaching approach if their students did not understand well.

All these instructors noted their students not only could preview/review online course materials at their convenience but also could improve their learning outcomes by doing more exercises in the form of online assignments or quizzes or tests provided by instructors. These instructors perceived the aim of all the online materials as to give students flexibility of learning and improve student learning outcomes. As a science e-learning instructor D explained:

I put all my lecture notes in PowerPoint files online, and also put references and previous tests online. In order to motivate students to preview or review online course materials and do more exercises, sometimes I give them online assignments or quizzes or tests before/in/after class. I think the purposes of these teaching methods are great to improve student learning outcomes. (SeiDi.3.5.6)

### ***Audios/videos***

Respondent instructors reported the provision of audios/videos of lessons could help student learning by allowing students to review lessons and learn about the interactions that happened in the face-to-face teaching. Nearly two thirds of

instructors (62% and 59%) had audio/video of their class lectures online. As science e-learning instructor A said, “I also video-record all my class lectures. I often teach with many slides, films, figures, and written texts in whiteboard in class so my students can review them after class” (SeiAi.2.1.5). Some instructors also noted they revised the videos before putting them onto the system. This implies instructors can reflect on their own practice and improve their teaching quality and student learning outcomes. Another non-science instructor described,

I video-record my real class lectures and my voice synchronously. However, I still need to check it after class and make it better before I upload it onto the system. I think revision with the video is necessary and good for the students because they would like to learn more from those videos or audio/video tapes. (NSeiMi.3.2.1)

Another non-science e-learning instructor G commented, “Our students had many practical operations and experiments required in the courses so I would like to video-record those activities and students’ performances to let students review and familiarize themselves with those operations and activities after class” (NSeiGi.3.6.1). These instructors noted videos of student presentations or performances could motivate and help students learn from peers and themselves by reflecting on student own practice and co-construct their ideas and knowledge.

Some instructors provided their students more chances in ‘role-play’ activities when they assigned a collaborative project or experiment. They also requested that their students video-recorded their presentations or performances in the activities online. As non-science e-learning instructor G described it, “I provide students more chances in ‘role-play’ activities and the students could use V8 (video camera) to record and edit their self-guided performances online. I thought it had good learning effect” (NSeiGi.3.6.2). These instructors saw this as another way to help students learn from themselves and peers. As non-science e-learning instructor M noted, “When students looked at their own or peers’ performances in videos, they could easily know whether they did well or not and know how to correct their performances” (NSeiMi.3.6.5). This showed that instructors perceived audios/videos could help students review or share the seminar findings with peers.

In addition, some instructors noted they also provided external professional or private commercial audios/videos to assist their teaching. As science e-learning instructor A noted, “I also provided three additional professional videos for explaining my course topics. Two videos were provided from the government and another one was made by my research team which worked for my ‘Global Position System’ project supported by the Ministry of Interior” (SeiAi.2.2.6). Other instructors also said they provided many private professional commercial audios/videos in their e-learning courses such as ‘Helicopters’, ‘Jazz Dance’, and so on. Few instructors (17% and 12%) reported they had provided professional computer video conferencing instruction to their students because they collaborated their teaching with some instructors from other university or research institute. They noted using video conferencing instruction is a good experience for students, especially for advanced courses. Instructors also highlighted this as a benefit for the university and themselves because it is a good chance to cooperate with another institution or university and they could have more advanced collaboration in research projects. A few instructors (14% and 7%) noted they required their students to access VOD (video on demand) from the university library video database to review the course related materials.

### ***Synchronous interaction***

Some instructors (46% and 33%) noted they had provided discussion forum, online discussion case study or debate, and some interesting topics online. As science e-learning instructor D said, “I put some interesting topics in the online discussion forum so students can discuss there and I also let them ask questions or discuss the subject contents with them in the forum” (SeiDi.3.6.5). A few instructors (both 19%) indicated they had provided online group discussion forum (chat room) so those students who lived in different places could attend this online group discussion on the same topic at the same time period. Respondent instructors reported students could get more feedback and clarification of course ideas or contents, and could ask follow-up questions after class, especially when they did not have time to answer or explain detail in class.

### ***Asynchronous interaction***

A majority of respondent instructors (both 89%) noted they often used email or bulletin board to interact with their students and to announce class notifications, and test or assignment schedule or grades or answers online, especially for those instructors who did not provide online discussion forum to interact with students.

A typical comment was:

It's useful in an emergency to make announcements or interact with students via bulletin board or email. The students also can give their suggestions, ask any theoretical or operational problems associated with the course subject, and exchange their ideas with peers or their instructor in Q and A area. (NSeiPi.3.2.6)

Over two fifths of instructors (46% and 41%) had provided collaborative projects or assignments online which instructors noted students had learned more by sharing experiences with their peers and by doing projects together. Around two fifths of instructors (41% and 37%) also considered students could learn more and better from viewing peer projects and or reports online and the interactions or feedback from their instructor or peers on the online projects or reports.

### ***Other teaching methods***

Just over a quarter of the questionnaire respondents (27%) and the majority of interviewees (89%) described how they have used their own specific teaching methods to improve their teaching quality and student learning outcomes. These specific teaching methods are supplemented by private commercial software and mechanism. Some comments were:

I use Flash and PowerPoint to design and present my course materials such as use step-by-step animation in my case or example presentation to help students learn more technical knowledge or skills. Online practice is an effective way to learn how to write a computer program. (NSeiNi.4.4.2)

I provide additional score-awards as incentives to attract students using e-learning and provide more interesting topics or design subjects in online discussion area. When I teach in the computer room, I also use computer broadcasting system to control my class situation and progress in order to improve students' learning outcomes. (SeiEi.4.2.3)

### **Effective strategies used in e-learning courses**

In line with the focus of the study, instructors were asked to describe one or two of the most effective strategies they had used in their e-learning courses. Nearly two thirds (65%-45) of instructors responded to this open-ended question in the questionnaire and all e-learning interviewees (100%-27) did so. The same five

categories as for teaching methods were developed (Section 5.2.3). Each response was coded against these categories. Some responses were counted in two or more categories. Table 5.7 shows the frequencies of effective strategies questionnaire and interviewed instructors had used in the online component of blended courses.

Table 5.7  
*Effective strategies instructors had used*

Effective strategies instructor had used		N1 (=45)	% of N1	N2 (=27)	% of N2
Course materials	Lecture notes online	23	51%	22	81%
	References online	8	18%	5	19%
	Online quiz/test/assignment	16	36%	15	56%
Audios/Videos	Audio/video class lessons	8	18%	8	30%
	video student's presentation	4	9%	3	11%
	Computer video conference	3	7%	2	7%
	VOD (video on demand)	2	4%	2	7%
Synchronous interaction	Online discussion	5	11%	4	15%
	Online group discussion (Chat room)	1	2%	0	0%
Asynchronous interaction	Email, bulletin board, Q and A	21	47%	21	78%
	Collaborative projects	6	13%	5	19%
	Student projects/reports online	5	11%	4	15%
Other strategies	Incentives, computer broadcasting system, etc.	16	36%	13	48%

N1: Questionnaire respondent instructors;

N2: Interviewed instructors

### *Course materials to assist with understanding the course content*

Over a half of the instructors (51% and 81%) indicated lecture notes provided online was the most helpful and effective strategy they had used in the online component of a course. They reported a main benefit of these materials was that they could be viewed and reviewed at a student's convenience until the students felt they understood what was required. Some responses mentioned that the use of online notes could help student concentration in class sessions because students did not need to take notes and students could also preview and or review these before and or after class. Moreover, the instructors said they did not need to spend extra time and effort to help students to get and understand the complete and up-to-date lecture notes. Non-science e-learning instructor G said,

I have taught many years in the university and I had many lecture notes so I would like to put them online to let my students view or review them at their convenience. Complete and up-to-date lecture notes will help students better understand the course content and I also do not need to spend extra time and effort to help students on this. (NSeiGi.1.2.2)

A few instructors noted they provided supplementary online references, databases, websites, syllabi, previous test questions and assignments, important course outlines and hints, graphs, pictures and figures online after class in order to

improve student learning outcomes. Science e-learning instructor D described his strategies:

I try to use different strategies to improve student learning outcomes. For example, I always put my syllabi, up-to-date course notes, supplementary online reference materials, previous test questions and assignments, grade percentages and so forth on the system so the students can preview and or review all these online materials. At the same time, students can also familiarize themselves with the entire teaching process of the course they have selected. (SeiDi.3.3.2)

Over one third of the instructors (36% and 56%) said e-assessment tools such as online quizzes, tests, and assignments were effective strategies in their e-learning teaching. Instructors noted posting online quizzes, tests, and assignments before and or after class could motivate students to preview and or review course materials and concentrate on class lectures. Two typical comments were:

Usually I request the students to preview the Web course materials before class so I do not need to explain the details in class. I give a small online quiz at the beginning of the class and then discuss it. If students have any questions, they can feel free to ask and discuss in class. Sometimes class discussion can remind me to give them more supplementary materials or knowledge which I have not prepared to teach them. This will allow students to learn more from me. I also give them different materials depending on their needs and abilities. I do not run far away because the class time is short and limited. After discussion, I also give another small quiz about the class content. I think this is good for their learning outcomes because quizzes in class can solve the problems which the students do not preview course materials and do not attend the class. (SeiBi.2.6.3)

A quiz before class session is useful to encourage students to preview online course materials. The quiz following the class session is useful to encourage the students to pay more attention on the class session. (NSeiFi.2.3.5)

Instructors indicated tests online could encourage students to do more drill and practice. They could easily put solutions or answers online immediately after a quiz or test so their students could learn more and better from this. A typical comment was:

I provide a test database (test-bank) and test content online to attract the students do more drills. I also gave online open book exams and usually I post the answers or solutions of the quiz, test or examination online immediately after the quiz or test. (SeiDi.3.8.3)

Online immediate social interactions are important for instructors and students and could assist them to reflect on their own practice and co-construct their ideas and knowledge. Some instructors said they could easily download or upload assignments and provide assignment solutions/answers online. Moreover, some of them said they also put all, or good, student assignments online along with their interactions and feedback online so their students could learn from these and share the information with peers.

### ***Audios/videos to help teaching and learning better***

Not many responses from questionnaires and interviewees noted audios/videos of class lessons (18% and 30% respectively) and student presentations (9% and 11% respectively) as being effective in helping them to teach better and students to learn better. Some instructors noted they provided external professional or private commercial audios or videos to assist their teaching. Non-science e-learning instructor K said, “I use some commercial videos to assist my teaching in my ‘Jazz Dance’ course. I also provide some referred music websites or some CD/VCR on the system so students could review them. It depends on the need of the course subjects” (NSeiKi.3.3.6). They also noted audios/videos could help students view or review at their convenience, especially when students could not remember or understand the explanations of formulae derivations or practical operations or computer programming design. Some instructors indicated they had many courses which were taught collaboratively by many instructors so they had to video-record class lessons for student review. A typical comment was:

I had a course named ‘Health check’ which was taught collaboratively by many instructors and many practical operations students need to learn. I think I had better video-record the class lessons so students could review them repeatedly and learn better. (NSeiGi.3.2.2)

The provision of private audios/videos and video conferencing teaching with colleagues/external professionals collaboratively can improve social interactions. Some respondents noted that pre-recorded videos of lessons online were effective and convenient not only for student preview or review but also effective for their time management especially when they must be out of campus on the lecture day. Non-science e-learning instructor K said, “It is convenient and flexible for me when I need to be out of campus on the lecture day. Students can view my pre-recorded videos of lessons online so the class progress still can go well” (NSeiKi.3.2.6). Moreover, a few instructors noted video conference teaching was another choice for instructors when they were off campus or when they invited other instructors in another universities or research institutes to cooperate in teaching the e-learning course. One remarked:

The instructors can pre-video-record their lessons to let student view at any place or even use computer video-conferencing to teach the course with other instructors. It is convenient for the instructors and the students, especially when the instructors need to be out of campus. (NSeiPi.2.6.2)

### ***Synchronous interactions to enhance student learning and interaction***

Around one tenth of instructors (11% and 15%) considered online discussion was an effective strategy to improve student learning and interactions. Science e-learning instructor D described this:

My students use the online discussion area a lot and it can increase their learning interest and outcomes. For instance, students need to select a plant name to represent them and they should be familiar with their own plant, the characteristics and life styles of that plant. Students use their plant name to discuss with each other. It can stimulate their interest to learn the general concepts about all the plants that are related to their lives and then they extend their knowledge in depth for the future. Moreover, the students feel it is better to discuss in a 'discussion area' because they can prepare in advance and then cut-paste on it. I found online discussion is useful and attractive for student learning. (SeiDi.3.2.5)

Online discussion was said to be an effective forum to improve the interactions between instructors and students, partly because it could provide students with a place to ask questions, discuss ideas and share experiences with instructors and peers, and allow students look back at previous postings. Science e-learning instructor D noted, "I put some topics in online discussion area and discuss with them. I also required their engagement and assessed their performance in online discussion" (SeiDi.3.5.5). Furthermore, some instructors also indicated providing guidance or strategic support or assistance could attract student engagement in online discussion and carrying out the activities. Non-science e-learning instructor L said, "I must pay much attention and effort in online discussion to interact with and guide students so students could be motivated to learn more efficiently in e-learning" (NSeiLi.3.5.6). Another non-science e-learning instructor J reiterated this by saying, "To motivate and guide students in online discussion is a time-consuming task if I expect to have more students involved in it. Perhaps this is a reason why many instructors do not provide online discussion and students also do not engage actively in online discussion" (NSeiJi.4.3.1).

However, only one of questionnaire respondents indicated online group discussion forum (chat room) was effective, especially for those students who lived in different places because they could attend this online group discussion at the same time period on the same topic. Some interview instructors suggested it needed to have good discussion rules for everyone to follow otherwise students themselves could not control and focus on the topic. Moreover, students could face problems in arranging their online group discussion schedule well.

In sum, synchronous online discussion was thought to be an effective strategy to enhance student learning and interaction only when instructors could be involved in person, require student engagement and also assess their performance.

### ***Asynchronous interactions to improve communication and student learning***

Questionnaire (47%) and interview (87%) respondents noted a bulletin board or email or Q and A area online was an effective strategy to improve their communication with students. These instructors said they often posted various messages on the bulletin board or send email to notify students about the class information such as up-to-date course materials or class schedules. They also noted students could ask questions via email or in the online Q and A area. Instructors found this could redeem fewer interactions in e-learning and improve student learning outcomes. Asynchronous interactions were said to be effective in supporting their interactions with students and addressing the lack of knowledge or course content for students.

### ***Other strategies to attract student engagement and improve learning***

Around two fifths of the instructors (36% and 48%) indicated they used some effective strategies to attract student engagement in e-learning and to improve their teaching quality. These were synchronous distance teaching, monitoring student computer screen, demonstration of practical operation, roll-calls in class, and assessing their performances or awarding additional marks in the online discussion or other e-learning components. As one instructor noted,

I had an e-learning course taught in the Computer Center classroom and I monitored all the computer screens when I showed my e-contents. When I required students to do some exercises, I switched the broadcasting screen to their individual screen. If I did not monitor their computers, students might wander in the Internet and not listen to the lectures. Therefore, students could concentrate on the lectures and learn better. (QI.21.68)

Some instructors reported they provided many quizzes or tests or exams to the students because they worried that their students would not attend the class and not study hard due to the provision of complete e-content. They said sometimes they used oral test or described the questions in spoken words in class to encourage students attend the class. Science e-learning instructor C remarked,

I put more stresses on the students because I am afraid of the provision of complete e-content would let students become lazy to attend the class so I give them many quizzes and mid-term and final exams. Sometimes I use roll-call or oral test in small class and/or I

have some quizzes which I describe the questions in spoken words. I use different teaching strategies for different courses and for different students. (SeiCi.3.2.8)

A majority of instructors indicated they demonstrated how to use the e-learning system at the beginning of semester so students would know how to access the online components. Some of these instructors also reported they demonstrated the practical operations in class and or put demonstrations online so students could review repeatedly and learn better. Science e-learning instructor E said:

I demonstrated how to use e-learning system in the computer room when the semester class started, so my students could learn how to access online course materials ... I also demonstrated the practical operations of the experiments in class and put them online so my students could learn better and really understood the course contents. I think this is an effective strategy to encourage their engagement in e-learning. (SeiEi.5.3.8)

Moreover, interviewees indicated they also assessed student performances in online discussion or awarded additional marks to attract student engagement in online discussion or other online components. As an instructor noted, “Most students were active in online discussion but I still had few students who were passive and not engaged in the online discussion or other activities in e-learning. Thus, I also assessed their performances in online discussion or gave additional incentives (e.g., score-awards) in order to improve their engagement” (SeiFi.3.2.1).

All these strategies, monitoring computer screen, roll-call, quiz, oral test, and awarding additional marks, were considered to be effective to keep students concentrating on the class lectures, participating in F2F instruction and or online components of e-learning and then improving their learning outcomes.

### **Support services experienced**

In order to obtain the feedback regarding the e-learning support services from the university, departments, and peers, the questionnaire instructors were asked about the support services they had received and found helpful and the number of e-learning courses for which they had student assistant support from the university. The advantages and disadvantages of having and not having student assistant support were also described by the respondent instructors.

### ***Responses of support services instructors have used and found helpful***

The respondents to the questionnaire were asked about the support services they had received and found helpful. The instructors could tick as many as applied for their current use and helpful ones. Of the sixty-nine respondents, fifty-two (75%) replied to this question. Forty-nine (71%) indicated which service they found to be helpful. Table 5.8 summarizes the questionnaire responses about support services the instructors have experienced and found helpful.

Table 5.8

#### ***Support services instructors have experienced and found helpful***

Support services	Have experienced		Found helpful	
	N (=52)	% of N	N1(=49)	% of N1
Student assistant	38	73%	37	76%
Technical support staff	32	62%	27	55%
Training course	26	50%	10	20%
Demonstration	20	39%	15	31%
Seminars	11	21%	6	12%
Provision of extra technology	10	19%	9	18%

Based on Table 5.8, the support of the student assistants and technical support staff for the questionnaire respondents was important and helpful. However, providing training courses, good course demonstrations, seminars, and provision of extra technology support seemed not to be very helpful for enhancing e-learning practice. A Chi-Square test and Phi value show all the support services such as student assistants and technical staff support the instructors have used did not have any significant relationships with the proportion of the instructors found those support services helpful (all Pearson Chi-Square Asymptote Significance greater than 0.005 and Phi values approximately between 0.128 and 0.326).

### ***Courses have received student assistant support***

When the instructors were asked how many e-learning courses they have received student assistant support for from the university, four instructors did not answer this question. Table 5.9 shows the frequencies of e-learning courses having received student assistant support from the university.

Table 5.9

#### ***E-learning courses which received student assistant support***

Courses	Respondents (N=65)	Percent of respondents
1 course	25	38%
No course	22	34%
2 courses	11	17%
3 courses	4	6%
5+ courses	3	5%
4 courses	0	0%

Over half of the instructors received student assistant support from the university in one e-learning course (38%) or two courses (17%) or three (6%) and five or more (5%) e-learning courses. However, just over one third (34%) of the instructors did not have any such support for their e-learning courses.

***Advantages of having student assistant support***

Instructors were asked to describe the advantages of receiving student assistant support from the university. Over two thirds (68%) of instructors described their e-learning experiences and perceptions of student assistant support. Nearly one third (32%) of respondents did not answer this question. Based on these forty-seven respondents’ descriptions in this open-ended question, eleven response sub-categories were developed. Each response was coded against these categories. Some responses were counted in two or more categories. Five main categories had been developed and grouped. The first dominant category is e-learning content creation and maintenance which indicated all e-learning content related issues such as inputting and updating course materials online, designing a webpage and setting up or maintaining a website, video-recording and putting video online. Second, the technology category included any technical problem-solving and knowledge of technology. Third, a general category included any time-saving issues for dealing with e-learning related chores and brainstorming on e-learning course design. Fourth, interaction with students category included all the help in managing student online discussions and answering questions or interaction with students. Fifth, managing student academic records category included all the assessments of student assignments or tests or exams. Table 5.10 names the analytical categories, and gives numbers of responses which were classified into each category.

Table 5.10  
*Frequencies of advantages of student assistant support*

<b>Main category</b>	<b>Sub-category</b>	<b>N (=47)</b>	<b>% of N</b>
Creation and maintenance of e-learning content	Course materials online	21	45%
	Video recording and video online	20	43%
	Webpage design or website setup	4	9%
Technology	Solve technical problem	18	38%
	Improve knowledge of technology	5	11%
General	Save time for chores	13	28%
	Improve teaching quality	5	11%
	No great help	3	6%
Interaction with students	Answer or interact with students	6	13%
	Manage online discussion	5	11%
Manage student academic records	Assess student assignments/tests	7	15%

The instructors pointed out that student assistant support mainly could help them create and maintain course materials online (45%), video-record class lessons and put videos online (43%), solve technically related problems in class (38%) and could save much of their time on all e-learning chores (28%). However, three instructors (6%) pointed out that the student assistant might not provide great help for their e-learning teaching because they might not be familiar with the course content although they might be experts in technological knowledge or skills.

***Disadvantages of no student assistant support***

Instructors were asked to describe the disadvantages of not receiving student assistant support from the university. Nearly three quarters (74%) of instructors responded with their e-learning perceptions of no student assistant support. Eighteen respondents did not answer this question. Based on these fifty-one respondents' descriptions in this open-ended question, eight response categories were developed. Each response was coded against these categories. Some responses were counted in two or more categories. Table 5.11 below shows the analytical categories and gives numbers of responses.

Table 5.11

***Frequency of disadvantages of no student assistant support***

<b>Category</b>	<b>N (=51)</b>	<b>% of N</b>
Need more time	20	39%
Quit e-learning	13	25%
Face more technical challenges	11	22%
Increase teaching load	7	14%
Decrease teaching quality	7	14%
Reduce motivation	6	12%
No influence	5	10%
Need more funding	3	6%

Not many instructors (39%) indicated the first disadvantage was they need more time to make or update the course materials online but they said they did not have enough time to do it unless they reduced their research time. A representative comment was:

I have to do all the work myself when I have other things to take care of. It is very hard to do the e-learning because there are too many things to do and too little time available; especially, as NRU is a research university. Usually the instructors do not have enough time to deal with all e-learning related work by themselves. (QI.26.300)

One quarter (25%) of respondents identified the second disadvantage as being that they could not video-record their class teaching and transfer video to e-learning

system by themselves and solve all related maintenance works of e-learning course so they would quit e-learning teaching. A representative comment was:

If there is no student assistant helping me on e-learning system, I could not provide class teaching video because I could not video-record my class teaching by myself and then transfer video file to e-learning system. Moreover, on-line debate or online discussion would become hard to control or access. Therefore, I will quit the e-learning teaching. (QI.26.236)

Over one fifth (22%) of respondents remarked the third disadvantage was they would face more technical problems and challenges. One instructor said:

I do not have much time to manage my academic work. When I have problems of operating technology, I cannot get the instant assistance from student assistant and it will waste my valuable time to try or figure out how to proceed or operate those facilities. Thus, the e-learning course materials and audio-video files could not put online in time. (QI.26.53)

Seven instructors (14%) reported that if they did not have student assistant support of their e-learning teaching, it would increase their teaching load or their own students' workload because they still needed to deal with all e-learning related work. Similarly, seven respondents (14%) also indicated that a disadvantage of no student assistant support was the teaching quality would be decreased because they could not fully provide all functions of e-learning such as online class video, course materials, and discussion. A representative comment was, "If there is no student assistant helping me on e-learning system, some interactive teaching methods such as on-line debate, online discussion, video recording, and VOD would become impossible" (QI.26.159).

A small number (12%) of respondents indicated no student assistant support would decrease their motivation to use e-learning because the student assistant support could save much of their time on all e-learning related chores. Three respondents (6%) reported that if they did not have student assistant support from the university they needed more funding to find another assistant to deal with those e-learning chores for them. A representative comment was:

I have to pay for the student assistant to support my work so I need to find more funding. Otherwise, I don't think I can manage both e-learning teaching and researches in balance situations. It means, we will usually choose the research quality rather than the extra loading from e-learning. (QI.26.46)

Only five respondents (10%) indicated there was no influence on them because they could do it by themselves although it spent much of their time and effort.

Some representative comments were, “I have to do all the related work. But that's OK for me” (QI.26.48);, “It is no influence to me because I just put my lecture notes online” (QI.26.247);, and “It will not influence me a lot because I need to do the e-learning course design and assess the students’ assignments by myself in order to really understand what the students need and adjust my teaching approaches to improve their learning outcomes” (QI.26.89).

#### **5.2.4 Section summary**

A majority of instructors who completed the questionnaire and interview were professors and came from non-science colleges. A majority of instructors were familiar with university e-learning policy but not national. A majority of instructors were relatively inexperienced with e-learning, had less than three years experience in e-learning and had taught fewer than three e-learning courses. They rated themselves as having a low level of e-learning ability. Data shows instructor age or professional position was not an issue in their ability to use e-learning. However, the fewer years teaching in e-learning the lower level of self-rated e-learning ability they had.

Respondent instructors noted they used different teaching methods and strategies to motivate student engagement in e-learning and to improve their learning outcomes by providing them with the same face-to-face instruction or more opportunities and different sorts of course materials and interactions in e-learning. Most respondent instructors indicated the provision of online complete up-to-date course materials was helpful and effective in improving student learning outcomes because they could be viewed or reviewed at the student’s convenience and assist student understanding, especially for passive and lazy students. The use of e-assessment tools such as online assignments or quizzes was thought to be an especially effective strategy to address a lack of student motivation and effort in learning. Some instructors considered the provision of audios/videos could help student learning by allowing them to review lessons and learn about the interactions that happened in the face-to-face teaching.

Synchronous or asynchronous interactions or other techniques were thought to be effective strategies for different students in supporting different aspects of

learning such as addressing a lack of knowledge and learning strategies, fewer interactions, and an inappropriate learning attitude in their e-learning practice. The instructors reported they also needed to spend much time and effort in supporting and interacting with students. They noted discussion forums would become more interesting and engaging if instructors provided guidance or strategic support and assistance to help students control their own learning and reflect upon or readapt activities accordingly, particularly when they required student engagement and also assessed student performance in online discussion. They also used bulletin board, email and online Q and A to compensate for fewer interactions with their students. Half of the instructors said other techniques could help them to manage student progress and attract student engagement in e-learning. The aim of these teaching strategies was to draw student attention, to concentrate on the class lectures and review online course materials so the students could improve their learning outcomes and to enhance their interactions with instructors and peers.

Instructors reported they have used different dynamics of technology in terms of specific delivery systems such as interactive audio-video, videotapes, digital and video cameras, scanners, CD-ROMs, DVDs, VOD, audiocassettes and even computer videoconferencing, e-mail, live chat, sophisticated use of the Web, television and satellite broadcast in their e-learning teaching. The use of different technologies could result in the removal of time and place constraints so student learning could happen synchronously and or asynchronously. Instructors said these types of equipment helped them in providing the same face-to-face class teaching environment online and in providing more supplementary course materials to improve student learning outcomes and more opportunities to improve the quality of interactions.

However, to utilize these various technologies, the instructors needed technical support from the university. A majority of the questionnaire respondents had had the support of a student assistant and technical support staff from the university and found them helpful for their use of e-learning. They also had had training courses, good course demonstrations, seminars, and extra technology support but it seemed not to be very helpful for enhancing their e-learning practice. Most instructors indicated that a student assistant could help them in the creation and

maintenance of e-learning content; solve technological problems and improve their knowledge of technology; save much of their time on all e-learning chores and provide new ideas or brainstorming on e-learning course design; answer or interact with student and manage online discussion; and manage student academic records for them. Some disadvantages of no student assistant support were also identified. These included instructors needing more time to make or update the course materials online; they could not video-record their class teaching and transfer video to e-learning system by themselves and solve all related maintenance work of e-learning course so they would quit e-learning teaching; and would face more technical problems and challenges. In a word, the instructors needed student assistant support in their development of e-learning courses.

E-learning in this study is an online component of blended learning so it differs from face-to-face instruction. E-learning has its own benefits and challenges. The following section will describe instructor perception of benefits and challenges of e-learning.

### **5.3 Perceived benefits and challenges of e-learning practice**

This section sets out instructor perceived benefits and challenges of e-learning practice from questionnaires and interviews.

#### **5.3.1 Perceived benefits**

Data on the benefits of using e-learning reported by instructors came from closed questions in the questionnaire and interviews. These perceived benefits included benefits for the university, for the instructors themselves and what they found important, for the students and what they found important. Each perceived benefits will be described next.

##### **Benefits for the university**

On the questionnaire, the instructors were asked to tick as many as applied from a list of benefits for the university. Table 5.12 shows the frequencies of instructor perceptions of the benefits for the university.

Table 5.12  
Instructor perceptions of benefits for the university

Benefits for the university	Questionnaire		Interviewees	
	N1 (=65)	% of N1	N2 (=27)	% of N2
Increase the quality of teaching and learning	40	62%	22	81%
Increase university reputation and competitiveness	40	62%	20	74%
Improve the interactions among students and instructors	36	55%	18	67%
Lower average costs per course per student	21	32%	9	33%
Increase institutional cooperation or partnerships	14	22%	6	22%
An income source of the university or the department	7	11%	3	11%

A majority of questionnaire and interview respondents indicated e-learning practice could increase the quality of teaching and learning (62% and 81%) and increase university competitiveness and reputation (62% and 74%). The respondent interviewees intimated they used e-learning because they had seen the benefits of e-learning for the community, for the university, for their students, and for themselves. In particular, science e-learning instructor A, who taught a general education science course via distance/e-learning, commented that this allowed more community people to access to his course. He saw wider access as important within a Confucian philosophy. He considered that offering his course more widely also enhanced the university's reputation. He highlighted this, saying:

Confucius said that education is for everyone not for special groups. Since this course is a general education course, why not broadcast to the community? The more people listen, the better it is. I do not spend extra of my time to do it again, so why not? Let TV Company broadcast the course video freely via TV Channel to the general community people. It is a good corporation and it also increases the university reputation. (SeiAi.1.4.8)

Over a half of the instructors (55% and 67%) noted e-learning practice would improve the interactions among students and instructors (see Section 5.2.3). Around one third of the instructors (32% and 33%) indicated e-learning practice could lower average costs per course per student. Respondent instructors noted it was appropriate for NRU to develop distance-education or e-learning because NRU had many good instructors and large conference rooms for e-learning teaching. A non-science e-learning instructor said, "I teach a course with my colleagues in a large conference room. We share teaching this course and everyone just needs to prepare their own chapters ... It is a good incentive for us and a benefit for the university" (NSeiBi.3.2.6). They all suggested the university could get 200~300 students together in a class and arrange for three or four instructors to share teaching for this big class. They said this would save much money for the university because the university did not need to pay many extra

hours pay for many instructors who taught in many small classes in e-learning and this also could reduce their teaching load. As a science e-learning instructor said,

Based on current university policy, the instructors can get extra half of credit hour-pay for their e-learning teaching or when they have over 70 students in a class. If the university could put all the students in three or four small classes together into a class and then arrange three or four instructors to share this big class teaching, it not only can save much money for the university in extra hour-payment and also could reduce the instructor teaching load. This is a good cooperation among instructors. (SeiBi.4.2.5)

Another science e-learning instructor reiterated, “E-learning could increase student enrolment and benefit for other universities” (SeiAi.2.2.8). He noted that e-learning could increase student enrolments so it would lower average costs per course per student. He also said other universities could save much money in employing many instructors to provide every kind of course in their universities if they cooperated with NRU. He gave an example of this:

Every semester I have a class with 300 students come from five universities. I reserve 150 students for NRU and the rest for others ... This can save much staffing budget for other universities in providing every kind of course to their students. (SeiAi.2.3.6)

Some respondents (22%) said e-learning practice would increase institutional co-operations or partnerships. These instructors reiterated the responsibility of NRU and the benefit for NRU. They noted NRU was responsible to broadcast distance-education or e-learning courses to other universities so it was a good chance to co-operate with other universities in teaching and even more in research and also increase the university reputation and competitiveness. A science e-learning instructor described this happening:

NRU is an excellent university so it can share its university and instructor’s resources with other universities because some universities do not have good infrastructures or have many instructors to teach some specific courses ... We can put many monitors in front of the students in a good conference room and then teach in video-conferencing style for a large amount of students within one university or even cross among different universities. This is a good chance to co-operate with other universities in teaching and even more in research and also increases the university reputation and competition. (SeiBi.4.2.6)

Moreover, a few (11%) respondents thought e-learning practice could be an income source for the university or the department. They noted their e-learning courses were used in some enterprises or companies for their staff training. They said it was good cooperation or partnership, and could also earn money for the university or their department.

## Benefits for the instructors

In the questionnaires, instructors were asked to select from a list of benefits for themselves, then add a second tick beside the benefits they considered important in their use of e-learning. They could tick as many categories as applied. Of the sixty-nine respondents, fifty-five replied to this question and fifty-two also indicated which benefits they found important. All interviewees (27) also described the benefits for themselves based on the categories of benefits in the questionnaire. Based on the data analysis of instructor selections of e-learning benefits on the questionnaires and descriptions from interviewees, five categories of e-learning benefits for instructors were identified: better instructor teaching and teaching quality, flexibility of teaching, improvement of interaction, increase of personal reputation, and saving in course cost and time. Table 5.13 shows the benefits for the instructors and those they found important from questionnaires and interviews.

Table 5.13

*Instructor perceptions of benefits for themselves and found important*

Category	Benefits for the instructors	Questionnaires		Found Important		Interviewees	
		N (=55)	% of N	N1 (=52)	% of N1	N2 (=27)	% of N2
Better instructor teaching and teaching quality	Increased teaching efficiency	38	69%	25	48%	23	85%
	Ease of managing academic work	37	67%	30	58%	22	81%
	Improved teaching quality	35	64%	28	54%	23	85%
	Ease of managing course material	21	38%	16	31%	15	56%
Flexibility of teaching	Flexibility of time and place of teaching	30	55%	22	42%	16	59%
Improvement of interaction	Improved interaction with students	27	49%	22	42%	20	74%
	Ease of sharing experience with others	20	36%	19	37%	13	48%
Increased personal reputation	Increased personal reputation	10	18%	6	12%	4	15%

N: Questionnaire respondent instructors

N1: Questionnaire instructors found this important

N2: Interview respondent instructors

### *Better instructor teaching and teaching quality*

This category of benefits included increased teaching efficiency, ease of managing academic work, improvement of teaching quality, and ease of managing course material. A majority of instructors (69% and 85%) perceived increased teaching efficiency and said it was an important benefit. A science e-learning instructor

noted, “I can reuse my e-content for same courses next time once I have done them. And I am not afraid that the contents are taught more or less in many different small classes. It improves my teaching efficiency” (SeiCi.1.1.12). Over two thirds of instructors (67% and 81%) perceived ease of managing academic work and also said it was an important benefit. They indicated the functions of the e-learning system could assist them to better manage student progress and academic records such as online submitting assignments/exams, automatic grade calculation and so on. They also noted the functions of the e-learning system could save them much time and effort in doing many tedious tasks; for example, synchronous (e.g., online discussion) or asynchronous (e.g., bulletin board, email) interactions helped them to interact easily with students and manage their academic work well. This implied they could save much time and effort in teaching and had more time to do research. Science e-learning instructor E said:

I can set up the due date or due time for submitting assignment or exam online so I do not need to check which student does not hand-in on time. The e-learning system also can calculate student grades for me. If I have some information to notify my students, I can use bulletin board or email to tell them. Students also can use email or Q and A or online discussion to ask me questions and all of them also can see all these records ... In a word, e-learning can save me much time and effort in doing these repeated and tedious tasks and then I can have more time to do my research. (SeiEi.3.6.4)

A majority of the instructors (64% and 85%) said e-learning could help instructors to improve their teaching and its quality and said this was an important benefit.

Some typical comments were:

Instructors can not memorize all the actions when they are video-recorded; sometimes they forgot one special action or another. However, e-learning provides them a chance to review their video and revise it before they put their video online. They can delete the bad parts and add in the good ones. This is also good for their teaching quality. (NSeiKi.5.2.1)

I feel it is better to show up all the procedures of formulae derivations online because instructors can prepare in advance and correct errors before class. It is very important to show your best in front of the students because if you write wrong in the blackboard and correct it in class too often, your students will feel bad and wasting their time. (SeiBi.4.3.6)

Some instructors (38% and 56%) perceived ease of managing their course material was an important benefit. They said they could maintain their course materials easily and keep course materials on the system for a long time, although they needed to expend much time and effort on creating e-content in the beginning. A science e-learning instructor described this:

In the beginning, instructors may spend much time and effort to develop their courses in e-learning. However, for the long term it is good for them because the need for maintenance of e-content becomes lower. Once they have been created, they are easy to change or update a little depending on their students’ feedback or suggestions. They can save much time and

effort to prepare for next same courses and then they can have more time to do their research. (SeiEi.2.8.6)

### ***Flexibility of teaching***

Over a half of the instructors (55% and 59%) perceived flexibility of time and place of teaching as a benefit, and said it was an important one. They noted e-learning provided them with flexibility of time and place for teaching, for example, they could video-record their lessons in advance and put them online or use video-conferencing teaching to manage their class progress when they were off campus on the lecture day. Some instructors noted online tests also gave them flexibility in their teaching because they could set up the test day and time even when they were off campus. Science e-learning instructor E said, “When I must be out of campus to attend a meeting on the lecture day, I also can give students a test online because I can pre-set up the day and time. It is convenient and flexible for me and students” (SeiEi.2.5.6).

### ***Improvement of interactions***

This category included improved interactions with students and ease of sharing experience with others. A majority of instructors (49% and 74%) perceived improved interaction with students and said it was an important benefit. They noted the provision of different sorts of synchronous and asynchronous interactions helped them interact with their students better. Non-science e-learning instructor O noted, “I put all the course-related messages on the bulletin board and request students to check it every day so they can get up-to-date course materials and so forth. I also provide my email or online discussion forum to compensate for fewer interactions in e-learning” (NSeiOi.3.4.5).

Some instructors (36% and 48%) perceived ease of sharing experience with others and said it was an important benefit. The instructors noted they collaborate with their colleagues or other instructors from other institutions or universities in e-learning teaching so they could share their experience with others in teaching and even in research. They said this helped them to improve their cooperation with other instructors or specialists and also benefited their teaching and research.

### ***Increased personal reputation***

A small portion of instructors (18% and 15%) perceived increased personal reputation and some said it was an important benefit. These instructors said their well-designed e-courses were used in the staff training within the university or in the enterprises so they had become well-known. Science e-learning instructor A said:

Many staff or students within the university or in the company had viewed my e-course so they knew me well especially the people in the community. I think e-learning can increase my personal reputation and this benefit me to get more resources or funding easily to do my research. (SeiAi.1.5.3)

### ***Saving in course cost and time***

Over a half (52%) of the interviewed instructors said another benefit of e-learning was that they could save course costs and time in e-learning. They noted e-learning could save the instructor time and effort in printing out the lecture notes, the questions and answers sheets of the quizzes, tests and assignments because they could put all these course materials online and students also could view and review them at their convenience. They also said this could save much money for the university in the paper cost. Thus, this benefit is significant for the university and for instructors themselves in saving course costs and time.

### **Benefits for the students**

Similarly, on the questionnaire the instructors were asked to tick as many as applied from a list of benefits for the students and then to put a second tick beside the benefits they considered important for their students. All interviewees also described the benefits for students based on the categories of benefits in the questionnaire. Table 5.14 shows the instructor perception of benefits for the students and those found important by questionnaire instructors and interviewees.

Table 5.14

*Instructor perceptions of benefits for students and found important*

Category	Benefit for the students	Questionnaires		Found Important		Interviewees	
		N (=57)	% of N	N1 (=49)	% of N1	N2 (=27)	% of N2
Flexibility of learning	Flexibility of time and place	40	70%	35	71%	27	100%
Increased ICT knowledge and skills	Improved technological ability	30	53%	30	61%	20	74%
Improve student learning and	Ease of managing homework or report	34	60%	23	47%	20	74%

learning outcomes	Improved learning quality	28	49%	26	53%	19	70%
	Improved student motivation	18	32%	13	27%	8	30%
Improvement of interaction	Improved interaction with instructors	32	56%	19	39%	18	67%
	Improved student participation	25	44%	15	31%	11	41%
	Improved interaction with peers	21	37%	11	23%	9	33%

N: Questionnaire respondent instructors

N1: Questionnaire instructors found important

N2: Interview respondent instructors

### ***Flexibility of learning***

Flexibility of learning was the most commonly perceived benefit of e-learning for students by a majority of instructors (70% and 100%). A science e-learning instructor noted, “I put all my course materials, videos and supplementary references online so my students can preview and review them at their convenience” (SeiAi.2.4.6). Another science instructor commented, “I feel e-learning provides students an opportunity to learn independently because they can learn any time, any place and at their own pace. It is really good for the students and that is why e-learning is so attractive to them” (SeiBi.2.2.2).

### ***Increased ICT knowledge and skills***

Over half of the instructors (53% and 74%) perceived improved student ability to use technology adaptable to this ‘information age’ and many said it was an important benefit for the students. A non-science e-learning instructor noted, “Although many students know how to use computer, they still do not know how to use computer technology and access online well. E-learning can improve their ability to use new technology and multimedia facilities to adapt to this ‘information age’” (NSeiPi.5.1.2).

### ***Improve student learning and learning outcomes***

This category of benefits included student ease of managing their homework or reports, improvement in student learning quality, and improvement in student motivation. Around three fifths of instructors (60% and 74%) perceived e-learning could help students to manage their homework or reports easily and many said it was an important benefit for the students. A science e-learning instructor pointed out: “One advantage of the e-learning system is the convenience for the students

to hand in the assignments via the system before the due day. This will help them manage their homework and study progress well” (SeiCi.6.3.1).

Many instructors (49% and 70%) identified improved student learning quality and many instructors said it was an important benefit. Science e-learning instructor C said, “The main purpose of my teaching in e-learning is to help the students who are absent from class and or have lower capability in learning” (SeiCi.3.2.1). All these instructors reported that e-learning could improve student learning outcomes by providing more resources and support for student learning. A non-science e-learning instructor highlighted this:

The goal of teaching and learning is to let the students learn more and more effectively. How can we reach that goal? The solution is to provide them with more resources or support such as using e-learning to let the students find and view course related materials on the web, enjoy the class discussion, and learn more deeply. (NSeiFi.2.9.1)

The instructors thought students did not need to take full notes in class due to the provision of complete course materials so students could concentrate on the lectures. They considered this led to improved student learning outcomes.

Non-science e-learning instructor K remarked:

The students can download and print out my course materials to review anytime or before exams. ... Moreover, they do not need to take full notes in class because they can download the course materials after class. E-learning also can train their organization skill and inductive ability. This training is very important for the university students. (NSeiKi.6.4.3)

The instructors also thought that if students read course materials before coming to class they could ask and or discuss questions they had while they were in class and therefore they would learn more and better. A science e-learning instructor noted, “The materials of basic knowledge have been put on the Web and the students can read it by themselves before class. If they have questions, they can ask or discuss in class. The students will learn more and better” (SeiBi.5.6.2). Moreover, nearly one third of instructors (32% and 30%) also noted the provision of course materials could improve student motivation to study the lessons and better their learning outcomes.

### ***Improvement of interaction***

This category of benefits included that students could improve their interaction with instructors, improve student participation and improve student interaction with peers.

Over half the instructors (56% and 67%) perceived e-learning could improve student interaction with the instructors and some said it was an important benefit. Instructors said they had provided synchronous and asynchronous interactions so their students could have more opportunities to interact with them. As a non-science e-learning instructor said, “My students like to use email or in Q and A area to contact with me or ask me questions. It is very convenient for them to interact with me” (NSeiIi.4.6.3).

Over two-fifths of instructors (44% and 41%) perceived improved student participation was an important benefit. The instructors reported they provided collaborative projects or online group discussion to motivate student participation and cooperation in e-learning. As a non-science e-learning instructor said, “To encourage student engagement in online discussion, I assess their performance and provide additional marks as incentives. I also assign collaborative projects to motivate students into participating and cooperating with their peers in their learning” (NSeiKi.4.3.1). Just over one third of instructors (37% and 33%) identified improved interaction with peers and some instructors said it was an important benefit. In a word, respondent instructors reported that e-learning provided students more opportunities and different sorts of interactions to interact with their instructors and peers than face-to-face instruction, especially when needed after class.

### ***Savings in course costs and time***

Over a half (52%) of instructor interviewees said another benefit of e-learning was that students could save time and money on course paper costs in e-learning. Instructors noted they already put e-content online and provide online questions and answers of the assignments, quizzes, and tests in e-learning so their students did not need to spend time and effort to find and print out all the course materials, including questions and answers. They noted their students not only could view and review all the course materials online but could also receive online answers or results immediately after they submitted the quizzes, tests and assignments. This benefit suggested students could be motivated to learn better as a non-science e-learning instructor noted, “My students could receive online answers or results

immediately after they submitted the quizzes, tests and assignments so they could be motivated to learn better due to the provision of immediate response of answers to the assignments, quizzes, and tests” (NSeiQi.5.3.4). This benefit is significant for the student not only in saving course costs and time but also in motivating students to learn better because of the provision of an immediate online response with answers to the assignments, quizzes, and tests.

All these benefits were synthesized from three questions asking instructors to select e-learning benefits for the university, instructors, and students from a list in the questionnaire and descriptions of benefits from interviewees. Further evidence of the instructor perceived benefits of e-learning came from responses to a question on personal factors that encouraged their use of the university e-learning system. The details will be described in the Section 5.4.1.

### **5.3.2 Perceived challenges**

This section sets out the descriptions of the challenges instructors faced in their e-learning teaching from twenty-seven instructors in interviews and fifty-five of sixty-nine instructors who responded to this open-ended question in the questionnaire. Based on respondents’ descriptions and the literature, nine sub-categories were synthesized from questionnaires and interviews. Each response was coded against these categories. Some responses were counted in two or more categories. Three dominant categories that had been developed from the literature were grouped from those nine sub-categories. The first dominant category is pedagogy which included new curriculum design, new teaching methods, new assessment of student learning outcomes, and new ways of interaction. The second is personal challenges which indicated all personal related issues such as personal time management and role change. The third category is technology category which included familiarity with new technology and any technical problems faced such as network bandwidth, computer storage and computer facilities and technology operation. These responses are summarized in Table 5.15 below.

Table 5.15  
*Frequencies of perceived challenges faced by instructors*

Category	Challenges for the instructors	Questionnaire		Interview	
		N1 (=55)	% of N1	N2 (=27)	% of N2
Pedagogy	New curriculum design	35	64%	22	81%
	New teaching methods	28	51%	20	74%
	New assessments	19	35%	14	52%
	New interactions	13	24%	13	48%
Personal	Time management	7	13%	23	85%
	Role change	7	13%	7	26%
Technology	Required technology	7	13%	6	22%
	Technical skills	6	11%	13	48%
Other	Other comments	5	9%	8	30%

Three dominant categories pedagogy, personal, and technology and other challenges will be described below.

### **Pedagogical challenges**

This category included new curriculum design, new teaching methods, new ways of assessment, and new interaction approaches. When respondent instructors were asked to identify the challenges they faced in their e-learning teaching, a majority of instructors from questionnaire and interviews reported pedagogical challenges they faced most as being new curriculum design (64% and 81%), and new teaching methods (51% and 74%). The respondents noted they needed to provide various types of e-content online so they had to learn new curriculum design and new teaching methods for their e-learning courses. They noted different course attributes would also challenge their use of e-learning because they felt not all the courses were suitable to teach in e-learning. A science e-learning instructor said, “Some science laboratory courses are hard to design in e-learning and it is better to let students learn by ‘doing’” (SeiCi.4.2.4). Another science e-learning instructor said, “It takes me much time and effort to type all formulae or symbols online especially for science courses. Some instructors feel it is hard for them” (SeiEi.5.2.1). Non-science e-learning instructor P reiterated that the course attributes influence their use of e-learning, “The computer programming courses are not appropriate to be developed in e-learning because IT changes very fast. Often I just complete developing a course this semester, but I cannot re-use it for next semester or next year because a new version of computer programming language is announced” (NSeiPi.3.5.2). Moreover, the instructors also indicated

they faced many challenges while they were required to video-record their lessons and they needed to prepare well in advance to design their course curriculum.

Some instructors (35% and 52%) noted new ways of assessment was a pedagogical challenge they faced in e-learning teaching. Instructors noted the ways of assessment of student learning outcomes were different from those in F2F instruction and they had difficulties in typing all formulae or symbols in online assignments or tests. Non-science e-learning instructor S noted this difficulty, “I have many formulae derivations needed in my ‘Economics’ courses and it is hard for me to design and type them online. I am afraid my students also have this problem, especially in online tests or assignments” (NSeiSi.5.1.4). They noted they also worried about the unfairness of assessments in their online assignments or tests because many online cheatings have easily been made by some students who used ‘cut and paste’ method to copy peer’s answers online.

Not many instructors (24% and 48%) noted the new interaction approach was a pedagogical challenge they faced in e-learning teaching. Science e-learning instructor F said, “Instructors need to adopt different pedagogical approaches developed to work with new media in the e-learning courses. It was hard for me because I do not know how to design and support students in synchronous and or asynchronous interactions” (SeiFi.6.3.9). This implied the instructors also faced the anxiety of computer technology use in e-learning. Instructors needed to learn how to design, support, guide and interact with the students and usually they needed to spend much time and effort to respond in time. The instructors said they faced the problem of timely responses in their interaction. A non-science e-learning instructor said, “I often spend one or two hours per day to reply student email and respond in Q and A and online discussion. If I do not have time to respond to them immediately, I let my student assistant help me to respond online” (NSeiGi.5.3.7). The respondent instructors noted that they and their students faced different demands in communication methods and quality. Some missed being able to monitor facial expressions and voice tone. Others had difficulty including figures, formulae and symbols in their contributions to online discussions. Some comments were:

In e-learning interaction or discussion, we can only communicate by using words but no facial expressions or body or tone language. I feel it is hard to present the abstract concept especially in my science courses. I often use my fingers to show the rotations of some 'Chemistry' elements. (SeiCi.4.6.1)

When I ask questions or discuss with students online, it is difficult to express my questions or ideas clearly, especially for mathematical formulae derivations or science symbols or figures. (SeiEi.5.2.6)

Thus, the instructors needed to be supported by the university to overcome their pedagogical challenges in their e-learning teaching. Science e-learning instructor B remarked, "The University needs to provide more support services to help instructors in their development of e-learning courses such as providing seminars for new instructional design or new teaching approaches and so on" (SeiBi.6.2.1).

### **Personal challenges**

Personal challenges are about the problems instructors faced in using the e-learning system and/or developing e-learning course materials. These included their time management and role change. Over four fifths (85%) of interviewees reported they faced the challenge of time management. They said when the instructor had an e-learning course, how to manage his/her time schedule becomes a big problem if he/she needs to respond to the students' questions online and immediately. They noted that usually in a face-to-face class they can answer the questions in class or after class or by help from the teaching assistant. A science e-learning instructor highlighted this:

We often need to spend double or triple time in developing an e-course than F2F instruction and we need to guide or support students in their e-learning activities such as providing guidance in online discussion or helping them solve the technology problems. This is a big challenge for the instructors in their time management because they also need to do their research. (SeiAi.5.3.2)

The instructors indicated they had a time management problem in providing course materials online. A science e-learning instructor commented on this:

E-learning courses have their time efficiency problems. Usually I need to put my video on the system soon after class because the students wait to review it. In addition, the course materials must be prepared well and put on the system before class. To complete all this work in a certain time period I must spend much time. Sometimes I have troubles in my time management. (SeiBi.3.2.6)

The general perception was that e-learning courses required a greater investment of time and effort in both setting up and monitoring ongoing involvement. A typical comment, from science e-learning instructor B is:

The reality is that the instructors do not think they need to spend more time and effort to develop their courses in e-learning although they know they will be overloaded in the beginning but will reduce their teaching load later on. They do not have much time and capability to do that. (SeiBi.2.11.1)

This greater investment of time and effort required was also said to be largely unnoticed by the university administration, as this instructor noted:

Usually we spend much time and effort in correcting content characters, online discussion, e-mail, answering questions, etc. However, the results of the university dealing with this matter let us feel unhappy and uncomfortable. (SeiBi.2.13.1)

A small portion of instructors (13% and 26%) noted instructor role change was a challenge. The instructors declared they needed to spend more time and effort on their e-learning teaching because it was significantly different from face-to-face classroom teaching. They pointed out that in e-learning, the role or main responsibility of instructors had changed from an instructional designer to discussion guide and problem-solver. A science e-learning instructor remarked, “The role of the instructor is changed to be a discussion guide and problem-solver rather than only be an instructional designer and the practitioner for his/her teaching strategy” (SeiBi.2.14.2). Another science e-learning instructor A reiterated this point. In addition, he emphasized the added technology requirements associated with e-learning. He pointed out, “Instructors are not just responsible to prepare their course materials to teach in e-learning but also need to be concerned with the e-learning environment and to solve all related technical problems” (SeiAi.13.1.6).

Instructor psychological barriers were considered an important challenge, influencing their use of e-learning resources, particularly while they were in a video of lessons. A non-science e-learning instructor said, “I am afraid my face will become uglier due to bad quality of video facility ... It will decrease my students’ good impression of me” (NSeiCi.3.1.5). Another science e-learning instructor reiterated this challenge, “I do not like to be video-recorded because I feel embarrassed on it. Once I feel uncomfortable and unnatural, I do not know how to teach my class” (SeiDi.3.4.2). They said these barriers included fears of facing the video camera, discomfort with e-learning tools or methods and fears of bad impressions in video from students were their psychological barriers to be overcome.

## **Technological challenges**

Technological challenges are broadly defined as challenges surrounding issues of familiarity with new technology and technical problems encountered by instructors, for example, network bandwidth, computer facilities and storage and technology operation. A personal lack of easy access to these technologies as well as a lack of skills necessary to use available computer and communication technology has hindered instructor use of e-learning. Even when instructors did have access to computers themselves, there could be issues to do with the quality of this access, for example other technologies (e.g., high quality of audio-video facilities or network) related to e-learning practice were sometimes also required. Four categories of technological challenges will be discussed: easy access to necessary computer equipment, technical skills to access computer technology and the e-learning system, technical skills for communication, and the quality of e-learning computer facilities and technology.

### ***Easy access to necessary computer equipment***

Only a small portion of instructors (13% and 22%) instructors identified a lack of easy access to necessary computer equipment. They repeatedly emphasized that the time and capability needed to prepare course materials which often meant that the inconvenience involved in using the university e-learning facilities would become a challenge for them. In support of this, a science e-learning instructor described the inconvenience involved in using the university e-learning facilities because he spent a lot of time collecting and/or waiting for equipment to transfer videos onto the e-learning system. He explained:

The students and instructors won't use the university facilities very often because it is not convenient for them to use. Currently, the university has put all the e-learning equipment together in the Computer Center so everyone needs to go over there to use it. However, they think it wastes their time to go back and forth, and sometimes they can not use it immediately when they go over there. They maybe spend much time in waiting ... Time consuming and inconveniences are the two important issues for the instructors and the students to use the related equipment. (SeiBi.4.3.8)

### ***Technical skills to access computer technology and the e-learning system***

Few (11%) questionnaire respondents, but nearly a half (48%) of the interviewed instructors indicated they lacked the necessary technical skills to engage properly in e-learning. They noted that the complex nature of the e-content demanded high

technical literacy of participants engaged in them. They found this technological requirement challenging due to a lack of familiarity with the university e-learning system and recently up-dated ICT facilities, as well as with multimedia operations themselves. Instructors felt they needed not only to be familiar with new technologies but also able to deal with technical problems encountered, for example, network bandwidths, computer facilities and storage and technology operations. Similarly, some instructors reported their colleagues had difficulties using e-learning systems due to a lack of technical skills. Typically, they reported overcoming these problems by asking their colleagues, technical support staff or student assistant support for help.

Some respondents noted older instructors would resist e-learning because of being unfamiliar with computer technology. Non-science e-learning instructor T said:

Older instructors may be afraid of using computers because they had never used computers before, so they will reject to use e-learning. Therefore, they need to learn new technology knowledge and skills. On the contrast, younger instructors have used computer before while they are educated so perhaps they do not resist in using e-learning. (NSeiT1.2.3.2)

### ***Technical skills for communication***

The instructors noted they struggled to communicate their ideas with students in online discussion when this involved the use of figures or pictures. They indicated they were only able to post text and not figures or pictures in the online discussion forum of the university's e-learning system, so sometimes they could not express their ideas clearly. Instructors indicated they had difficulty with their online typing ability, particularly identifying Chinese characters, formulae and symbols as slow to type. Thus, they proposed the university should improve their computer facilities or the e-learning system interface by providing, for example, digitizing tablets, drawing tablets or network online talk programs like Skype. Respondents indicated they also worried about the difficulty of typing formulae or symbols in online tests or assignments or online discussion due to their own lack of personal technical skills and ability. A science e-learning instructor noted:

The instructors in the College of Science and College of Engineering may easily accept the ideas of e-learning but they may feel it is inconvenient or difficult to input lots of symbols or formulae in online tests or assignments or online discussion. (SeiFi.3.6.5)

### ***The quality of e-learning computer facilities and technology***

Over a half (52%) of the interview instructors indicated the quality of the audio/video facilities affected their use of video of lessons. They reported that currently the quality of audio/video facilities for e-learning was poor so sometimes they were unable to see the images or contents clearly or hear the audio. They noted usually the complex nature of the e-content required their computers have necessary hardware and software such as a graphics card and high processing speed and often specific software. Moreover, some instructors indicated they lacked the high quality network and facilities required to download student assignments online. These instructors noted they needed more adequate and higher quality e-learning related computer technology, peripherals and other multimedia accessories. A stable, reliable, easy-use, fully functionalized and high performance e-learning system was considered necessary. Science e-learning instructor E indicated, “Classroom network and e-learning system is unstable. Sometimes I can not download my course materials to let students do the practice in class” (SeiEi.4.11.1). A high quality network for e-learning practice involving a high enough network bandwidth, fast speed for image presentation, good network management, and enough computer storage space was also considered important.

### **Other challenges**

This category included instructor perceptions of the challenges for the university and the students and other comments on themselves. Few instructors (9% and 30%) perceived the university faced the challenges which included shortage of budget and manpower; ambiguous e-learning policy and goal; distrust between the university and instructors; leadership; and language problem in e-learning. They noted these challenges also influence their use of e-learning (see Section 5.4.1).

The instructors responding to the questionnaire did not describe their perceptions of the challenges for the student but the interviewees did. However, interviewees’ perceptions of the challenges for the students had little difference. Some said students had personal and technological challenges but some said students did not have any challenges. Perceived challenges for the university and for the students and additional comments on themselves will be discussed below.

### *Perceived challenges for the university*

The budget for manpower support also becomes an important challenge for the university and the instructors. The instructors noted they felt sad because the university stopped the student assistant support. As a non-science e-learning instructor said, “We did not know why the university stopped providing awards and student assistant support for our e-learning development. This was not a positive encouragement for the instructor use of e-learning” (NSeiKi.3.5.7). Furthermore, they also noted it was difficult to get reliable student assistants due to small monetary rewards for this job. As a science e-learning instructor noted, “I do not apply for student assistant support because I feel it is difficult to get a reliable student assistant. Student assistants have their own research pressure on their thesis and they feel the monetary rewards for this job is too little so they would not like to be student assistant supporters” (SeiEi.3.7.2). Another science e-learning instructor reiterated this difficulty,

The PhD and Master student assistant in College of Science can get money subsidy from MOE every month. Usually they can get NT\$24,000 and NT\$12000 per month. The university only gives NT\$5000 per month for student assistant support to help the instructor develop e-learning. The students feel it is too little, so they don't want to be a student assistant supporter. (SeiCi.4.1.12)

Ten interviewees indicated the importance of the university policy and the trust between the university and instructors. They noted sometimes the distrust between them could cause big challenges. As a science e-learning instructor said, “In fact, I don't trust the university now because university policy changes all the time and I don't know how to follow-up. Therefore, I do it my own way and use my project research fund to develop it” (SeiBi.29.1.1). He also noted, “This is two-lose, not two-win strategy if no trust exists between the university and the instructors” (SeiBi.29.1.3).

In addition, the instructors said two changes in the national policy impacted all the universities which was the “University Law” and “Professors manage the university”. The key issue of these two changes was the professors would manage their own university development and the Administration Board of the University would control the university budget and manpower. A science e-learning instructor said, “Each university must earn their own incomes to balance their expenses by obtaining much funding or research projects from the government or

government associations, and enterprises. Thus, their instructors must do more research to earn money for the university” (SeiAi.14.4.7). Another non-science e-learning instructor confirmed this, “The goal of NRU has changed to become an international well-known research university, so the instructors need to focus on publishing more research papers” (NSeiHi.14.1.8). They noted this change has resulted in a leadership problem in the university e-learning practice. A science e-learning instructor explained:

Currently the Academic Office at NRU can not demand all the departments should develop e-learning courses and the departments also may not follow up the policy because their instructors do not focus on this. Usually the departments do not care about the survival of e-learning practice. Moreover, each college also faces the challenge in integrating different specific departments to cooperate together. Thus, how to enhance e-learning practice becomes a big challenge for the university. (SeiAi.11.1.5)

Instructors suggested the university could encourage instructors to develop many well-designed e-learning courses to broadcast to the world and then NRU would become a famous international university. However, they also noted it would be a little hard because of the language problem. A science e-learning instructor said:

Most of our e-learning courses were developed in Mandarin not in English so it would be hard to broadcast to the world. However, we could broadcast to Mainland China or other Asian countries. Thus, the university must encourage the instructors keep doing and doing. (SeiBi.8.4.8)

### ***Perceived challenges for the students***

This category included student personal and technological challenges as perceived by the interview instructors. Respondents to the questionnaire did not describe any challenges for the students because the researcher did not specifically ask their perception of the challenges for the students. A majority (85%) of interview instructors perceived their students faced personal challenges. They noted most students were passive and not good self-managed learners so students might face many challenges in their learning. A non-science e-learning instructor said, “A different and more active personal learning attitude and a new learning approach are required for the students in their e-learning. Students also need to learn how to manage their time and study progress well” (NSeiJi.9.10.3). Instructors also noted students’ passive learning attitude would hinder their desire to develop e-learning courses for their students.

Over a half (56%) of the interviewees noted their students might not face any technological challenges in their e-learning. A non-science e-learning instructor said, “It seems no challenges for the students while using e-learning. Perhaps they do not use it very often” (NSeiEi.4.10.2). Another science e-learning instructor said “Students like e-learning very much, so I do not think they have any challenges” (SeiFi.3.6.10). A non-science e-learning instructor explained, “I am not sure whether my students had any challenges or not because they did not come to talk or ask me questions about their problems. Perhaps they solved their problems by asking my teaching assistant, or their peers” (NSeiKi.10.4.6). This indicated those instructors did not perceive any challenges for the students but it did not mean their students did not face any challenges. This also implied the instructors should pay close attention to the student learning and help students overcome their learning barriers or challenges in order to improve student learning outcomes.

Nearly a half (44%) of the interviewees perceived their students faced the same technological challenges as they did: easy access to necessary computer equipment, technical skills to access computer technology and the e-learning system, technical skills for communication, and the quality of e-learning computer facilities. A non-science e-learning instructor said, “Some students could not afford to buy their own required computer hardware and software so they could not access e-content well while they are not on campus” (NSeiNi.8.6.7). Another non-science instructor noted, “The computer facilities and technologies provided by the university sometimes were not enough and up-to-date so students could not access the e-content well. For instance, the network bandwidth is not large enough for fast download of the images or audio/video files” (NSeiRi.6.9.4).

Instructors noted the quality of computer technologies and multimedia facilities was an important challenge for student use of e-learning. A science e-learning instructor noted, “If the quality of video-recorder and network were not good and up-to-date, students would not like to view the video of lessons because the images or sounds of video would be not clear and the speed for downloading was not fast enough” (SeiBi.7.8.5). Thus, the instructors suggested the university

should provide more and high quality of required computer technologies and multimedia facilities to support their e-learning practice.

Instructors also noted some students lacked personal technical knowledge and skills to access or interact in their e-learning, especially for science courses in online tests or online discussion. A science e-learning instructor said, “Some students did not have good technical knowledge and skills to access online and type science formulae or symbols in online tests or online discussion so they might not participate in these learning activities. This challenge would lower their learning outcomes” (SeiEi.6.9.8). This indicated the technological challenges students faced would hinder student engagement in e-learning and influence the instructor motivation in their development of e-learning courses.

### ***Other comments***

Five instructors answering the questionnaire did not directly respond to the question about the perceived challenges for themselves (see Question 30 in the Appendix J) but gave other comments such as “E-learning system should be considered as a supplement to the traditional F2F ‘lecture on class’ courses. E-learning could not replace all the functions and effects of the F2F class” (QI.30.27);, and “I think F2F is the best way of teaching ... It depends on university policy and definition of e-learning” (QI.30.65). Similarly, some interviewees also gave their additional comments. Some typical comments were:

I don't have any challenges in e-learning development. I developed it by myself and had no student assistant support. I like to learn new knowledge and skills and I found many interests and advantages in it. (SeiFi.12.4.1)

Instructor preference for face-to-face instruction also challenged their use of e-learning because working from a textbook was faster than creating videos or other materials online. (NSeiGi.14.5.9)

### **5.3.3 Section summary**

This section has described instructor perceptions of the benefits and challenges of e-learning. Respondent instructors perceived that benefits and challenges in e-learning were related to policy, personal, pedagogical, and technological issues.

A majority of instructors perceived the benefits for the university were that e-learning practice could increase the quality of teaching and learning, increase university reputation and competitiveness, and improve the interactions among students and instructors. Around one third of respondent instructors indicated e-learning practice could lower average costs per course per student due to instructors sharing the class teaching in e-learning and the increase in student enrolment. This implied the university could get return on investment (ROI) although the university had spent much money on staffing and infrastructures. Some respondent instructors noted e-learning practice could increase institutional cooperation or partnerships among instructors within or across universities or institutions. This also could lead the university to become well-known and the instructors to become good agents in the cooperation between the university and the community. This cooperation or partnerships would save money and would benefit the universities or institutions. A few instructors noted e-learning practice could be an income source of the university or the department due to the cooperation with the community or the enterprises.

A majority of instructors noted e-learning practice could better their teaching and teaching quality. These included increased teaching efficiency, ease of managing academic work, improved teaching quality, and ease of managing their course materials online. Over a half of the instructors have perceived e-learning could provide them flexibility of time and place of teaching so they could care for their research or administrative works well. Nearly a half of the instructors noted e-learning provided them more opportunities and different sorts of interactions to improve their communication with students and an ease of sharing experience with other instructors or specialists within a university or with other institutions due to their collaboration in e-learning teaching and or in research. Furthermore, over a half of interviewed instructors said another benefit of e-learning was that they could save course costs and time in e-learning and this benefit is also significant for the university.

A majority of instructors perceived e-learning benefits for the students were that the students could learn flexibly in time and place and at their own pace and increase their ICT knowledge and skills to adapt to the current 'information age'

and learn how to manage long-life learning. They also noted e-learning could assist student to manage their homework or reports easily, improve student learning quality and improve student motivation. This suggested e-learning could help students have different but more active and independent learning approach and attitude to improve their learning outcomes. The instructors reported e-learning could provide more opportunities and different sorts of interactions (e.g., synchronous and asynchronous) to enhance student interactions with their instructors and peers and to motivate their participation and cooperation in their learning; and save course costs and time for the students.

Instructors noted they faced pedagogical, personal, and technological challenges. They needed to adopt different pedagogical approaches to work with new media in developing their e-learning courses so new curriculum design, new teaching methods, new ways of assessment, and new interaction approaches were needed. A majority of respondents noted they needed to provide various types of e-content online so they had to learn how to use computer technology and multimedia to design or present their course content online and teach differently in e-learning. Instructors noted e-learning was significantly different from F2F instruction, for example, the ways of assessment on student learning outcomes and the approaches of synchronous and asynchronous interactions, so the role of instructors had been changed from an instructional designer or facilitators to discussion guide and problem solver.

The instructors faced personal challenges in time management and role change if they needed to provide course materials online and respond in time. They noted the greater investment of time and effort required in the e-learning courses seemed to be largely unnoticed by the university administration. Instructor psychological barriers were also considered an important challenge. Instructors noted they also encountered four categories of technological challenges: easy access to necessary computer equipment, technical skills to access computer technology and the e-learning system, technical skills for communication, and the quality of e-learning computer facilities and technology. All these challenges were surrounding issues of familiarity with new technology and technical problems encountered by instructors such as network bandwidth, computer facilities and

storage and technology operation. Although the Taiwan government has endeavoured to provide widespread public access to computers over the last decade, instructors still expected the university could provide more and better computers and e-learning related facilities to support their e-learning.

Instructors reported the university faced challenges: shortage of budget and manpower; ambiguous e-learning policy and goal; distrust between the university and instructors; leadership; and language problem in e-learning. They suggested the university should have a clear goal and well-defined e-learning policy and also could overcome those challenges and continuously support them and their students in their use of e-learning. They also suggested the university could provide more and higher quality of computer technologies to support their e-learning and the students also needed to improve their personal technical knowledge and skills to access or interact well in their e-learning practice.

Some instructors perceived their students also faced personal and technological challenges. Instructors noted a different and more active personal learning attitude and a new learning approach are required for the student. Their students also faced the same technological challenges as they did, although some instructors perceived their students did not face any challenges in their e-learning. Instructors reported these challenges also influenced their development of e-learning so they suggested the university should continuously encourage and support them and students in the e-learning practice and the students also needed to change their learning attitude and become more active and self-managed learners.

#### **5.4 Factors influencing e-learning use**

This section sets out the descriptions of factors influencing instructor use of e-learning. Several themes emerged from the quantitative and qualitative data. The four most dominant were most evident when instructors described their uses and expectations of e-learning and have been grouped as personal, policy, pedagogical, and technological factors. Other minor factors such as external professional and private factors are also described in this section.

### 5.4.1 Personal factors

Instructors discussed a number of factors pertaining to their own will and capacity. Personal will included instructor personal motivation and attitude as influences on their use of e-learning. This included: instructor personal desire and preference in teaching e-learning classes and using e-learning; personal attitude to education, learning, and e-learning, teaching load, and perceptions of benefits and challenges in e-learning. Personal capacity indicated instructor ability in time management and technical skills for e-learning course development and interaction online (see Section 5.3.2). The instructors completing the questionnaire were asked to select as many choices as applied from a list of personal factors that influenced their use of the university e-learning system, then put a second tick beside the factor they considered the important influence on their use of e-learning. Of the sixty-nine respondents, fifty replied to this question. Forty-six indicated which factor they found to be an important influence. Table 5.16 summarizes the questionnaire responses of instructor personal factors and those they found important.

Table 5.16

*Questionnaire instructor personal factors and factors found important*

Personal factors	Influence		Found important	
	N (=50)	% of N	N1 (=46)	% of N1
Improve teaching quality	39	78%	33	72%
Improve teaching efficiency	34	68%	28	61%
Comfortableness with the system	30	60%	21	44%
Requirement from department or university	10	20%	14	30%
Incentive pay (e.g. extra hour-pay)	6	12%	7	15%
Other	5	10%	5	11%
Pressure from students	2	4%	4	9%
Tenure promotion issues	1	2%	3	7%
Source of income (make money from content)	0	0%	1	2%

A majority of instructors answering the questionnaire reported they were affected by the benefits of e-learning such as being able to improve their teaching efficiency (78%) and quality (68%), and comfortableness with university e-learning system (60%). All these benefits were considered as important factors to their use of e-learning, 72%, 61% and 44% respectively. Further evidence of personal factors that encouraged instructor use of the university e-learning system came from the responses to a question on perceived benefits of e-learning (see Section 5.3.1). A Chi-square test and Phi (effect size) value showed there was a significant difference and a medium relationship in the responses of instructors'

personal factors influencing their use of university e-learning system and those factors which found important (all Pearson Chi-Square Asymptote Significance less than 0.005 and Phi values approximately between 0.4 and 0.7).

The interviews indicated personal motivation and attitudes to e-learning might most influence instructor's usage of e-learning. All the interviewed instructors indicated although the university had provided technical and funding support to entice instructors to use e-learning, they thought university policy and support did not necessarily impact on instructor desire to use e-learning. They noted e-learning was not linked to promotion, and saw the 'best teaching' award as no incentive to use it. They argued that because university instructors had academic freedom they were able to choose their preferred teaching style and methods of teaching and so their personal motivation and attitudes were important. A representative comment was:

Is the encouragement from the university useful? I don't think so because they have academic freedom and their attitudes to e-learning will affect their wills to use e-learning. I don't think the university policy will influence the instructors to teach in e-learning because there is no incentive for promotion and it is useless for the "best teaching" award. (SeiCi.2.3.7)

The instructors described education as a moral or conscientious enterprise. They asserted that instructors responded better to encouragement than enforcement. One science instructor intimated that he was motivated to use e-learning because he wanted to be a good teacher. He stated, "All the instructors think education is a good conscientious and self-motivated enterprise, so they need to be encouraged but not be enforced. For me, I also know education is a moral enterprise and so I do my best to be a good teacher" (SeiBi.1.3.8).

All the interviewed instructors indicated that they saw e-learning as the way of the future. Science e-learning instructor E noted, "I think this will be the learning trend in the future. If you always teach in your traditional way, it is not good for you and your students" (SeiEi.2.2.8).

Over four fifths (85%) of interviewed instructors noted their personal interests and feelings in e-learning also influenced their use of e-learning. A science e-learning instructor commented he had been interested in computer-assisted instruction

(CAI) and now found e-learning rewarding. He noted, “Using e-learning lets me feel very good” (SeiAi.1.8.3). Another science e-learning instructor reported his good feelings towards the e-learning system when he said, “I felt the function of the e-learning system was very good, so I began to start to use it” (SeiBi.1.6.4). However, this instructor implied recognition of instructor contribution in e-learning and respect for this from the university were very important to the adoption of e-learning practice. He described his experience of having his e-learning practice evaluated:

I feel unhappy because the attitudes of some administrators are not friendly. We felt we were not respected because some assessment committee members (administrators) gave us many unreasonable and strict comments while support is not provided ... I think the university should return respect to the instructors because each instructor attends this assessment meeting in person and presents their e-learning courses which represent the instructor’s respect of the university. (SeiBi.2.2.5)

The instructors repeatedly emphasized that personal will or desire to use e-learning were very important because of the time and capability needed to prepare course materials and monitor ongoing student involvement (see Section 5.3.2). Despite this, while they expended time and effort to prepare course materials, all the instructors thought the effort was worthwhile because course materials were easy to update and it was easier to maintain content consistency across one large class rather than a number of smaller classes. As a science e-learning instructor explained:

I am lucky that my class always has more than 250 students each semester. Therefore, I found it is worthwhile to spend time and effort to develop my e-learning course in my first year. When I developed my first e-learning course, I felt very tired at that time but I feel very good and easy now. It is easy to update my course materials. It is also good for the instructor because he/she will not worry that the content is taught more or less to different smaller classes. (SeiAi.3.1.5)

A majority of instructors, especially science e-learning instructors, reiterated they used e-learning because they had seen the benefits of e-learning for the community, for the university, for their students, and for themselves (see Section 5.3.1). They reported they had heard that their students encouraged peers to take their courses partly because the e-learning component was helpful. A representative comment was:

[Students] do not reject this teaching style; on the contrary, they always ask their peers who have taken this course before they select this course. They like this course and share with others. (SeiFi.2.6.4)

Some instructors including six science e-learning instructors reiterated that the course materials were easily maintained and they were able to keep their course materials on the system for a long time and to update them easily by incorporating student feedback and suggestions. They pointed out that because they were able to save time in preparation they had more time to do research. Moreover, some of them remarked e-learning could help instructors present and promote their research when seeking funding. A science e-learning instructor said, “It is easy to re-package our e-learning materials and show off our research study to apply for projects and get funds from the government or related associations” (SeiAi.6.2.6).

The science e-learning instructors who were the focus of this study thought that while science instructors in general may be interested in teaching, many did not want to spend much time on it because they were more interested in research. Science e-learning instructor A speculated that instructors in the College of Science were more interested in producing research scientists than teaching and/or teaching students in general science education. He explained:

From an education point of view, the aims (goals) of teaching should be to produce more educated people by using good teaching methods, case studies, and multi-media. However, for College of Science instructors, they may think they want to educate more research scientist. So, they do not like to pay much attention or effort in teaching. (SeiAi.6.3.2)

The instructors also speculated that the personal attitude to education of the College of Science instructors would influence their perception of the value of e-learning and their teaching. Science e-learning instructor A concluded, “It depends totally on their personal attitude to e-learning. Maybe College of Science instructors don’t think e-learning is a valuable tool to enlarge or benefit their teaching in general” (SeiAi.6.3.8). Science e-learning instructor B suggested that the instructors needed to treat e-learning as a long term project and to undertake research to improve in this aspect. He stated:

It relates to the College of Science instructors’ personal attitude. If you treat e-learning as a long-term project, you will do lots of research on it and try hard to solve all related problems. If you just want to earn some money and run away, you just do the labors for other people and you cannot go further. In general, you need to look it as a “long-term” project if e-learning is good for the instructor or university. Maybe you need to take 5~10 years to check its efficiency. (SeiBi.6.7.1)

Science e-learning instructor B also indicated that the instructors from College of Science might be more likely to pursue the high status rewards such as a Nobel Prize and to rely on students being impressed by their credentials. He indicated:

In general, the instructors in College of Science are too “person-cult” (worshiped to the famous instructors). So, they put much more pressures on the research that they pursue to compete with international researchers to get celebrated prizes such as Nobel Prize. This is the reason why they don’t want to pay much time and effort in e-learning teaching. I remember one instructor told me that most students like to be taught by a celebrated instructor. I feel it is too “person-cult”. (SeiBi.7.1.2)

Another inhibiting factor was the extent to which science instructors were prepared to share their materials and open their courses to more students and the general public. Some comments were:

Especially for those science instructors who would not like to share their course materials and/or teaching methods with others, they need to change their attitude and perspective to e-learning and try to present their best teaching methods and styles in e-learning to improve the students’ learning outcomes. (SeiDi.7.4.3)

If the science instructors like to open their e-learning courses to all the students and the public, then the e-learning practice will be improved. (SeiCi.6.5.1)

#### 5.4.2 Policy factors

This section describes two aspects of the policy factors influencing instructor use of e-learning. They are policy and leadership factors and support factors.

##### Policy and leadership factors

Policy and leadership factors included the impacts of national and university e-learning policy, and leadership factors: university or department requirements, income source and culture. When the respondents to the questionnaire were asked what kinds of policy and leadership factors would influence their use of the university e-learning system, fifty-seven (83% of 69) instructors responded. Table 5.17 shows the frequencies of policy and leadership factors from the questionnaire respondents.

Table 5.17  
*Frequencies of policy and leadership factors*

Policy and leadership factors	Questionnaire responses	
	N(=57)	% of N
University e-learning policy	41	72%
University/Department requirements	27	47%
University/Department income source	23	40%
National e-learning policy	16	28%
University Department culture	10	18%

Nearly four fifths (72%) of respondents identified issues to do with university e-learning policy as an influence on their use of e-learning but only about one third (28%) of all respondents indicated the national e-learning policy influenced their use of e-learning. Nearly half (47% and 40%) valued university or department requirements and a source of external income for university or department as being important influences. A small number of instructors (18%) mentioned they were influenced by university or department culture to use e-learning.

A number of projects have been proposed by the Ministry: promoting e-learning use, developing digital content for life-long learning, and so on. A non-science e-learning instructor noted:

In 1999, the Ministry changed its policy to allow universities more flexibility in staffing and budget expenditure meaning universities did not need to follow the official personnel and accounting systems and they were able to raise additional money through research and other projects. (NSeiSi.8.5.8)

Nine interviewed instructors noted the national policy included the National Executive Yuan and noted that this promoted e-learning research development funded projects. Science e-learning instructor A, a previous head of department and director of a research center, talked about the wider policy context as a support for the development of e-learning. He saw these projects as another source of funding for the Center where he worked:

I know National Executive Yuan's 'Digital Content' Project has funding or grants in e-learning training and courseware design. It is a good chance to cooperate in e-learning. I try to apply for some funded research projects from it. ... For example, my Research Center wants to make large progress in e-learning. We are going to sign the contract in May, 2005 to cooperate with the governmental fund association, named the "Chinese Computer Company", to develop e-learning courses for training. It will be good for staff training, second-major students, and/or more educated people. (SeiAi.4.4.3)

The need to raise additional funds through research projects had led to instructors coming under pressure to conduct research, all the more so at NRU where the goal is that the university becomes an internationally famous research-based university. All interview instructors described the pressure on instructors to conduct research, indicating that this diverted their attention from teaching. A science e-learning instructor noted that under the old promotion policy, instructors who wanted to could spend more time and effort in teaching because the university did not evaluate them for promotion by counting their research papers. Some instructors

then chose to teach many smaller classes repeatedly as a way of earning more money. Science e-learning instructor A explained:

In the old university staffing policy, the instructors felt few pressures in promotion before because each department had its faculty member position-limitation. If they want to be promoted to a certain position but their department does not have it, they still cannot be promoted until that position is available. Therefore, the instructors may not choose to be promoted and would like to spend more time in teaching many smaller classes repeatedly such as lab or computer practice sessions to earn extra pay. (SeiAi.1.14.1)

This instructor reiterated that now NRU had a goal to become a research-oriented university and research was linked to promotion, this had affected instructor attitudes towards teaching, including e-learning teaching. Within this changed context, teaching was not a priority, research was.

However, nowadays it is different. The instructors pay more attention to their research to be promoted and some of them don't like to spend much time in teaching, either traditional style or e-learning. ... The main duty of university instructors is not only teaching but doing research well. In a word, they have much research and promotion pressure. (SeiAi.2.9.3)

Science e-learning instructor B stated it was an unsolvable and cruel reality because he thought every instructor in the world was subject to the same research and promotion pressures. He noted if instructors did not present their best in their research then they could not be promoted. Science e-learning instructor C also agreed that the pressure for research and promotion influenced instructor teaching style and quality. She stated, "The instructors in a research-oriented university also need to teach well, but the stress is on research for promotion and this will affect their teaching style and efficiency" (SeiCi.3.4.5).

Ten instructors reported that the university had initially encouraged them to use "Distance Education" but then changed to providing them with student assistant support to transfer their courses to e-learning. Science e-learning instructor A explained:

Originally, NRU encouraged me to teach this course in the style of "Distance Education". However, later on the university suggested I also could transfer my Distance Education course into the e-learning system by giving me the support of two student assistants. (SeiAi.1.1.3)

This instructor was encouraged to use e-learning by the provision of support from the university, especially the technical support from the student assistants. The following section will discuss the support factors in detail.

## Support factors

This part sets out the questionnaire and interview descriptions of support factors influencing the use of e-learning. It includes the instructors' questionnaire choices from a list of support factors, the relationship between the university e-learning policy and teaching methods, the relationship between the support factors and the university e-learning policy, and descriptions of interview instructor's experiences and perceptions of support services and factors.

### *Choices of support factors*

Support factors were the provision of technical support from the support staff in the Computer Center or the Administration Office or from student assistants. Help from their colleagues or external professionals or others was also included. The respondents to the questionnaire were asked to select from a list of support factors that influenced their use of the university e-learning system and then to go back and put a second tick beside the factor they considered the important influence on their use of e-learning. Of the sixty-nine respondents, fifty-one replied to this question. Forty-seven indicated which factor they found to be an important influence. These responses are summarized in Table 5.18 below.

Table 5.18

### *Frequencies of influential support factors and those found important*

Support factors	Influence		Found important	
	N(=51)	% of N	N1(=47)	% of N1
Technical support from Computer Center	41	80%	33	70%
Student assistant support	33	65%	30	64%
Administrative support from department or university	25	49%	20	43%
Training from university	20	39%	13	28%
Help from colleagues	16	31%	6	13%
Help from external professionals	10	20%	6	13%
Other	2	4%	5	11%

A majority of instructors identified technical support from the Computer Center (80%) and student assistant support from university (65%) as influences on their use of university e-learning system and 70% and 64%, respectively, of instructors identified them as important influences. Further evidence of student assistant support was described in the previous support services instructors had experienced (see Section 5.2.3). Around two fifths (49% and 39%) of instructors were affected by administrative support from department or university and training from university and, they were important to 43% and 28% respectively of those who

(N1=47) responded. Over one fifth of respondents had been influenced by help from their colleagues (31%) and by help from external professionals (20%). However, only 13% in each case thought this had been important. Some other important factors such as awareness of university e-learning support, mature e-learning environment, and more enough advanced technical support in time were reported by some instructors. Five of these instructors pointed out that the computer technology changes very fast and e-learning teachers spend much of their time on designing the course online. Two instructors indicated they had already set up their own website, so they were not affected by those support factors. A Chi-square test and Phi value indicated there were medium significant relationships between support factors influence and found important for their e-learning teaching respectively in administrative support (Chi-Square=4.645, df=1, p=0.000, Phi=0.515), training from university (Chi-Square=3.152, df=1, p=0.000, Phi=0.427), and help from external professional (Chi-Square=18.321, df=1, p=0.000, Phi=0.457).

***Relationship between the university e-learning policy and teaching methods***

Further evidence of policy factors influencing instructor use of e-learning were analyzed by using cross tabulations of the questionnaire respondents who knew or did not know the e-learning policy and their teaching methods. Table 5.19 shows the frequencies of teaching methods for those questionnaire instructors who knew and did not know university e-learning policy.

Table 5.19

*Frequencies of teaching methods for those questionnaire instructors who knew and did not know university e-learning policy*

<b>Teaching methods</b>	<b>Respondents knew the university e-learning policy</b>		<b>Respondents did not know the university e-learning policy</b>	
	<b>N (=39)</b>	<b>% of N</b>	<b>N1 (=18)</b>	<b>% of N1</b>
Course notes online	36	92%	15	83%
References online	32	82%	15	83%
Video class teaching	28	72%	9	50%
Online discussion	22	56%	5	28%
Collaborative assignment project	20	51%	8	44%
Student project/report online	18	46%	6	33%
Online quiz tests	13	33%	5	28%
Online group discussion	10	26%	1	6%
Video student presentation	8	22%	4	22%

The respondent instructors mainly used course notes and references online in their e-learning teaching no matter whether they knew the university e-learning policy

or not. However, the respondents who knew university e-learning policy seemed to provide more videos of their class teaching, online discussion and online group discussion than those who did not know university e-learning policy. This prompts the question: Does it relate to the university e-learning support policy? The following will describe another evidence of policy factor influencing instructor use of e-learning.

***The relationship between support factors and the university e-learning policy***

Other evidence of policy factors influencing instructor use of e-learning was analyzed by using cross tabulations of the respondents who knew or did not know the e-learning policy and support factors. Table 5.20 shows the frequencies of use of support factors for those questionnaire instructors who knew and did not know university e-learning policy.

Table 5.20

*Frequencies of support factors for those questionnaire instructors who knew and did not know university e-learning policy*

<b>Support factors</b>	<b>Respondents knew the university e-learning policy</b>		<b>Respondents did not know the university e-learning policy</b>	
	<b>N (=31)</b>	<b>% of N</b>	<b>N1 (=14)</b>	<b>% of N1</b>
Technical support from Computer Center	24	77%	12	86%
Student support from university	22	71%	7	50%
Administrative support from university	14	45%	7	50%
Training from university	13	42%	7	50%
Help from colleagues	8	26%	6	43%
Help from external professional	7	23%	1	7%

A majority of respondent instructors (77% and 86% respectively) reported they mainly had had the technical staff support from the Computer Center, whether they knew or did not know university e-learning policy. More instructors (71%) who knew university e-learning policy had student assistant support than those (50%) who did not know university e-learning policy. The respondents also had had administrative support (45% and 50% respectively) and training (42% and 50% respectively) from the university whether or not they knew university e-learning policy. While over one fifth of those knew university e-learning policy had help from colleagues (26%) and from external professionals (23%), nearly a half (43%) of those who did not know university e-learning policy had help from their colleagues. In a word, the majority of respondent instructors who knew or did not know university e-learning policy reported the technical support staff was an influential factor in their use of e-learning. The provision of student assistants,

administrative support staff and training from university also influenced their use of the university e-learning system.

***Interview instructor's experience and perception of support factors***

A majority (81%) of interview instructors also responded they had had technical support from the university either from the Computer Center or the Administration Office. They saw the provision of support as an indication that e-learning was valued within the university and therefore worth pursuing. The instructors noted the university provided them with student assistant support to upload their video and course materials onto the e-learning system. A science e-learning instructor described this policy, "There was a policy to encourage the instructors to use e-learning by giving student assistant support" (SeiBi.2.1.1). Another non-science e-learning instructor thought it was important the university provided the support instructors needed as part of the policy to encourage the development of e-learning. She said:

The university should provide the chances, the facilities, the resources and the support to the instructors and must compromise with the instructors in the policy to encourage their use of e-learning. Then, the instructors will feel the university also emphasizes and values the e-learning practice so they will enhance their teaching in e-learning. It is important that the university provides all that the instructors really need and the instructors will try their best to teach in e-learning. (NSeiGi.2.21.1)

Three interviewed instructors reported they still taught their 'general education' course in both 'distance' and e-learning ways. The university provided technical staff support, from the Office of Academic Affairs, to help them to video-record and broadcast their class teaching to other universities and every semester four or five different universities cooperated to receive their course broadcast. Science e-learning instructor C commented that she had had support, "When I teach in that big seminar room, the staff of the Office of Academic Affairs help me video-record the whole classroom teaching" (SeiCi.3.1.1). Science e-learning instructor A reiterated he had student assistant help to load the syllabi and course materials onto the e-learning system before class and also to load supplementary course materials after class. All of his students, whichever university they were at, could use the NRU e-learning system to preview and/or review his course materials. He explained:

All my students can preview and/or review anytime and any place. Except the video, the course materials are already put on the Web. If I have supplementary materials in class, I also scan immediately after class and upload to the web. Therefore, the students have no excuse to say they do not hear and have the course materials. (SeiAi.1.3.2)

In fact, the instructors considered support staff and or student assistants should deal with all technical and administrative issues. Science e-learning instructor B said, “The university support staff or student assistant should solve all the technical problems” (SeiBi.2.24.1). A non-science e-learning instructor also commented, “Any teaching activity needs administrative support. The instructors need some staff to prepare the teaching environment for them so they are just responsible to prepare their course materials to teach” (NSeiAi.1.13.6). Ten of these interviewed instructors noted the provision of only student assistant support was not enough to deal with many tedious tasks in e-learning and some instructors would quit their development of e-learning if this support was withdrawn. They also complained the university did not provide enough disk space to store their e-learning course materials and requested them to remove their course materials from the university e-learning system. A non-science e-learning instructor remarked:

In fact, it is not enough to only provide student assistant support because lots of tedious tasks are needed to be done by the student assistant. Some student assistants may feel tired and not like to continue, so instructors quit the development. Moreover, when the Computer Center requested us to backup and remove our course materials from the university e-learning system by ourselves, we decided to use our own platform only because I felt it is not adequate to the spirit of e-learning. It was a very strange policy. (NSeiKi.2.6.2)

Simultaneously, the instructors indicated that a lack of institutional support inhibited the adoption of e-learning because of the additional preparation needed. They thought this was what had happened with some science instructors. They said it was often difficult for science instructors to get reliable student assistant support because science students received a subsidy from the Ministry of Education (see Section 5.3.2). Science e-learning instructor A indicated:

I think some instructors in College of Science like to use e-learning but they have no student assistant support and poor facilities, so they give up. A good e-learning course needs to spend more time and effort to develop. It is hard to be done by only one person. Therefore, the support of manpower and equipment from university is very important. (SeiAi.1.8.3)

### 5.4.3 Pedagogical factors

This section will describe the pedagogical factors that influenced instructor use of e-learning. Some pedagogical influences for instructor use of e-learning have been described and synthesized in instructor's teaching methods and effective strategies in Section 5.2.3. Instructor perceptions of pedagogical challenges were also described in Section 5.3.2. In order to obtain more information on pedagogical aspects in e-learning courses, the instructors also described pedagogical factors in the interviews. The following will describe the pedagogical factors that affected instructor use of e-learning.

All the interviewed instructors said they needed to spend more time and effort on their e-learning teaching because it was significantly different from traditional classroom teaching. The instructors pointed out that in e-learning the role or main responsibility of instructors had changed from an instructional designer to discussion guide. As science e-learning instructor D remarked, "I need to change my role to be a discussion guide and problem-solver rather than only be an instructional designer or the practitioner for my teaching strategy" (SeiDi.4.5.1). A non-science e-learning instructor reiterated this point. In addition, she emphasized the added technology requirements associated with e-learning. She pointed out, "Instructors are not just responsible to prepare their course materials to teach in e-learning but also need to become a problem solver to help their students to solve all the related technical problems within their e-learning environment" (NSeiKi.12.4.6).

The lack of instructional design capability and technology knowledge and skills were seen as influences on instructor use of e-learning. A science e-learning instructor remarked:

Although personal will, capacity, and time are three important factors that influence the instructors' teaching in e-learning, we still need to consider the instructors' capability to use multimedia or other technologies in their instructional design. For example, instructors may teach well but may not be a good video director. Usually they don't know how to conduct a video class or write a good course curriculum for e-learning teaching. (SeiA.6.3.2)

They suggested that one strategy to enhance instructor use of e-learning practice would be to demonstrate e-learning system functions and to teach instructors how

to develop their e-learning instructional design. They thought this approach would be helpful for science instructors. Some comments were:

The instructors must be re-trained on how to use multimedia to develop their e-learning courses especially for science education. So, science instructors should attend some seminars or demonstrations and learn how to use and develop e-learning courses. (SeiEi.3.5.7)

An effective strategy of enhancing e-learning practice is to broadcast the benefits of e-learning and teach instructors how to develop their e-learning instructional design especially for persuading science instructors to use e-learning teaching. (NSeiMi.5.1.4)

Eight instructors also pointed out that some instructors may not be comfortable with being video-recorded. Science e-learning instructor C explained:

I am afraid my face will become uglier because of the quality of video facility. It will decrease my students' good impression of me. Moreover, it depends on the instructors' attitudes whether they want to be video-recorded with all their gestures in class and for this to be open to the public as a testimony. Maybe they just like their written words in the blackboard to be video-recorded. Moreover, the images on the video always move forward and backward and it makes us feel uncomfortable when we look at the video. (SeiCi.3.3.3)

The instructors reported they spent a lot of time and effort in modifying videos of class teaching. A non-science e-learning instructor stated, "Sometimes I need to exclude the jokes or the 'byword' or some ugly images (pictures) from the class video. All these tedious tasks take me lots of time and effort. I don't like to revise it" (NSeiCi.3.5.6).

All the interview instructors thought there was a greater need for before class preparation with e-learning. A science e-learning instructor stated, "E-learning needs more time to prepare course materials well before and after class and also needs to spend more effort to think about the courseware, content, and pedagogy" (SeiAi.3.3.1). Some of them indicated they spent much time transferring their old transparencies into PowerPoint files or developing new PowerPoint files for their e-learning courses. Non-science e-learning instructor Q said, "In the beginning I spent much time transferring my old transparencies into PowerPoint files or putting my course materials into PowerPoint files which include figures, texts, equations, and pictures. The figures and pictures are very important to my class" (NSeiQi.2.5.1). This was seen as of greater significance for those instructors who relied on their reputations to carry them through the face-to-face teaching. For these instructors, e-learning required a major change in their teaching approach. Science e-learning instructor A remarked:

Usually some older and famous instructors like their lecture teaching style because they do not need to prepare all the course materials before the class. Sometimes they prepare the lecture materials just one night before the class. For teaching e-learning courses, they must be well prepared. The instructor must prepare the syllabus, well-designed curriculum, and all services on program for an e-learning course before the class begins. (SeiAi.9.1.3)

However, twenty e-learning instructors thought other instructors would resist any changes to their teaching approach. Science e-learning instructor E stated, “The instructors often persist in their attitudes and perceptions of teaching and learning and they would not like to change their teaching methods and styles” (SeiEi.5.8.6). They also discussed the particular pedagogical issues in terms of the characteristics of the course/subject attributes and the influence of size of the classes when they went to revise or redesign their course materials in e-learning. Science e-learning instructor F argued that course design depends on the course/subject attributes. He stated:

Each different subject/course has different ways to share the course materials. All the instructors must redo or revise their course materials onto the e-learning system. For instance, one instructor let his student assistant help him scan all the textbook’s figures/pictures into his PowerPoint files to teach a General Chemistry course. (SeiFi.3.2.3)

Some science courses might not be appropriate for e-learning teaching because of their course/subject attributes, such as the inclusion of abstract science knowledge and formulae. Some comments were:

It is hard to express abstract science concepts in e-learning because these need some body-language to explain. For instance, in inorganic chemistry I usually use my fingers to express the rotary motion. Moreover, for the use of formulae, I use a traditional teaching style in which I write on the blackboard/whiteboard and then video-record it. It is difficult for me to design and express well in e-learning teaching. (SeiCi.3.5.6)

Maybe in College of Science there are lots of formulae to be used and explained to the students and it is hard to express this well in e-learning courses. (NSeiSi.2.25.2)

By way of contrast, science e-learning instructor B did not agree that abstract knowledge in science was hard to develop via e-learning. Animations, simulations and pictures could be used. He stated:

I don’t think the course contents and curriculum which contain science abstract concepts will be hard to develop in e-learning. On the contrary, the abstract concept of course content is easier to express well in an e-learning course if you use many animations, simulations, pictures, and figures to explain clearly. (Sei.Bi.2.26.2)

Furthermore, science labs did not necessarily cause problems, videos, pictures and demonstrations could be used instead. Science e-learning instructor A explained:

I think different Colleges have different needs. However, I don't think the subject or content attributes in science education such as lab operation will cause any troubles in developing e-learning courses. For example, we saw lots of lab operations or outdoor science education videos on the 'Discovery' channel. By using camera or audio/video equipment, we can catch lots of real actions or pictures to teach our students. (SeiAi.6.2.3)

Science e-learning instructor B also described the use of simulations and virtual experiments for science labs. He stated:

Chinese Technology University has a set of software for student lab experiments on the computer. It has not only simulations but also lab equipment on the computer. The students only need to click the mouse to choose one of various selections and the system will do all the different virtual experiments for you. (SeiBi.2.26.3)

There was some feeling that e-learning was better for general rather than advanced courses. Hence, science e-learning instructor A suggested that basic or general courses should be developed and taught in e-learning and the more specific and advanced courses should continue to be taught in face-to-face style.

If the course subject has more basic knowledge or concepts, it should be encouraged to teach in e-learning in order to avoid the instructor spending too much time to teach it repeatedly. If the course subject such as graduate course is too specific to teach in e-learning, then it had better use more face-to-face teaching. Otherwise, it will cost the instructors much time and effort in developing and teaching in e-learning for university students. (SeiAi.9.2.1)

The instructors identified the differences between compulsory and elective courses. They suggested it would not be worthwhile to develop elective courses for e-learning because the content often changed and student numbers tended to be relatively small. Science e-learning instructor A noted:

I think lots of compulsory courses such as Physics, Calculus in College of Science are appropriate to teach in e-learning. The contents of elective courses usually change very often and variously, so it is not good for e-learning. Moreover, the students taking the elective course are few, too. (SeiAi.9.3.1)

The instructors noted many compulsory courses could be developed in e-learning and many students could take advantage of this benefit because the compulsory course was often a big size of class. Science e-learning instructor A speculated that around one third of the courses at NRU could be developed in e-learning, but pointed out, "it also depends on the instructors' will". Science e-learning instructor B agreed:

The compulsory courses belong to the basic core courses. The elective courses are more advanced courses. The advantage of the compulsory course is that the students must take and study them. They have no choice, so they need to study hard to pass it. I feel the effectiveness of e-learning on the compulsory course will be better and more students will

get this benefit because the compulsory class is usually a big class for more students to take. (SeiBi.4.3.2)

Referring to instructor perceptions of their students, all the instructors considered most students are not active learners so they needed to use different teaching approaches to improve the students' learning. Simultaneously, the instructors found the effectiveness of e-learning to be better for diligent students but of no use for passive students. A non-science e-learning instructor remarked:

The students usually are passive learners. We have found the effectiveness of e-learning outcomes is good for those diligent students but no use for those passive students. If the students dare to choose my course, they will be active learners and they will improve themselves very well. I think the students must be active learners and require themselves do their best in their study, otherwise the learning outcomes will be better no matter what kind of teaching styles are. (NSeiDi.6.3.2)

Science e-learning instructor A reiterated the relationship between the students' learning attitudes and teaching approaches. He stated:

I think most of students still come to class if they are active learners. If the students are passive or lazy, then they still do not come to class no matter what you use, what kind of teaching methods. I do not worry that students will not come to class if I put the videos and all my course materials on the web. (SeiAi.1.2.1)

Science e-learning instructor A did not give his students any assignments or quizzes because the participants were not only university students but also community people. He explained:

Because my participants are not only the university students but also the community people, I need to make my course materials easy to read and understand just as the newspaper reporter does. Thus, I do not use any Mathematics Formulas and/or English words in my class. There are two open-book exams (mid-term and final) and no assignments for this course. I prepared two exams' questions and count all students' grades. (SeiAi.3.1.3)

However, other instructors gave many quizzes to their students in order to stimulate them to preview online materials before class and to encourage them to attend class (see Section 5.2.3). They saw this is a way to improve their students' learning outcomes.

Sixteen instructors noted they had video-recorded their classroom teaching and six instructors video-recorded their student performances in class. They revised the videos before putting them onto the system, and their students could download and review the videos. Some of them indicated that in addition to video-recording

their lectures they also provided additional professional videos for their courses (see Section 5.2.3).

Concerning online discussion, nine interviewees provided this function but they thought it was not very effective. Science e-learning instructor A stated:

This course provides an online discussion area but it is not effective. Every time in class I give at least five minutes to let them ask questions, therefore all the students in the different universities can see and listen synchronously just like a video conference. The students also can ask the student assistant questions after class. (SeiAi.3.1.2)

A non-science e-learning instructor noted:

In my e-learning course, they can discuss on online discussion area or ask questions by using email. However, the students seem not use online discussion very often and maybe they are not used to ask questions in this way because it takes time to type in and it is hard to describe the questions and answers well online. (NSeiNi.3.1.7)

Science e-learning instructor B did not use online discussions. He thought he did not need this function because he already had many discussions in class. He also worried about network connections and his students were not far away from campus. He explained:

I have put all my course materials on the system and spend lots of class time in discussion so I don't use online discussion. Simultaneously, I worry about the network problems which include some students who do not have computers or can not connect to the system. Moreover, all my students are NRU students on campus and they can come to class to have a discussion. They do not need to stay at home and discuss online. (SeiBi.6.7.9)

The instructors thought it was important that there was two-way communication between them and their students and face-to-face discussions were best for this. A non-science e-learning instructor said:

I feel face-to-face discussion is better than online. I think in the class if the teacher only transfers their knowledge to their students in one direction; it will be boring and few interactions among them. I think I had better put my knowledge transfer part on the system and increase more interactions and discussions in class. (NSeiPi.5.3.5)

Science e-learning instructor A noted some specific courses such as 'Satellite Information and Life' also could be taught explicitly and in depth by using colloquial words or phrases. He described:

When I taught this general 'Satellite Information and Life' course in both distance education and e-learning ways, I always think about how to use colloquial words or phrases to explain this specific field of knowledge explicitly and in depth for all of my students particularly who come from the community. I did lots of seminar presentations or speeches before. I think a speech or a lecture is similar to a part of 'general education' course although their participants are very different. (SeiAi.7.4.2)

Ten interviewed instructors also indicated that they used many online case studies and examples that related to student daily life to motivate their interest and improve their learning outcomes. Science e-learning instructor A stated, “I give many online case studies and examples that are related with our daily life, such as ‘Satellite Guided System’ for car drivers and so on” (SeiAi.2.2.7). A non-science e-learning instructor also noted, “I also gave many online case studies or examples in my ‘Electricity and Life’ course” (NSeiMi.5.6.3).

#### **5.4.4 Technology factors**

Technological factors included the factors surrounding issues of familiarity with new technology and technical problems encountered by instructors in their development of e-learning course and ongoing involvement of online interactions with the students, for example, network bandwidth, computer facilities and storage and technology operation. All these factors have been described in detail in the perceived technological challenges in Section 5.3.2. The interviewed instructors concurred that a lack of instruction and technology literacy influenced their use of e-learning. Some comments were:

The instructors do not have enough knowledge and skills in technology. The instructors must be re-trained in how to use multimedia to develop e-learning courses. Usually the instructors do not know and would not like to spend much time and effort on solving technical problems. (NSeiHi.5.6.6)

E-learning practice does not just emphasize the development of the platform and software but also the development of course content (courseware). Everyone must make good use of the technology in each of the parts to improve practice. (SeiCi.2.39.2)

#### **5.4.5 Other factors**

Other factors include the influences of external professional, private, public factors. Some instructors noted they had been affected in their use of e-learning by the external professionals, private commercial resources providers and public demand. Some of these influences for instructor use of e-learning have been described and synthesized in instructor’s teaching methods and effective strategies in Section 5.2.3. Instructor perceptions of challenges from the external professionals, private commercial resources providers and public demand were also described in Section 5.3.2. In order to obtain more information on these three aspects in e-learning courses, the instructors also described other factors in the interviews.

The external professional factor included the influences from all formal or informal professionals outside the university such as formal educational professionals, formal government advisers and inspectors, and external informal associations. Some highly professional well-designed e-learning courses provided by international universities such as MIT in USA also have influenced student expectations of e-learning development and availability of resources. Thus, they also felt pressures in their development of e-learning courses.

The private factor included the influences from all commercial resources providers outside the university such as textbooks and e-learning curriculum publishers, commercial educational websites, films, slides, figures, CD/VCR, audios/videos or TV channels, commercial discipline companies or in-service training courses, e-learning platform and courseware providers or regular support mechanisms (e.g., computer broadcasting system). Nearly a half (48%-13) of the interview instructors indicated they utilized the CDs provided by textbook publishers to teach in e-learning because the CDs contained the PowerPoint files of course materials. A non-science e-learning instructor noted, “We like to use the book which had attached the CDs as a textbook for the course because the publisher had made all the course materials into PowerPoint files. Thus, we can save much time in developing e-learning courses by ourselves” (NSeiCi.4.6.2). However, one science e-learning instructor noted, “We know currently only few textbooks or reference books are written and everyone in the world uses them. The more basic one is, the more it needs. We don’t need to write our own textbook unless we want to supplement more materials in it, otherwise we will adopt one of written textbooks to be our textbook or reference book” (SeiBi.7.1.1). Further, this instructor reiterated the importance of language in the private factor by saying, “A majority of instructors use same English textbook as other international instructors. However, our mother language is not English, so we have no hope to write a good English textbook to sale” (SeiBi.9.1.1). This indicated private commercial publishers also influence instructor use of e-learning.

The public factor included the views and concerns of non-government sources beyond the university such as the perceptions of the community people, parents, media and public opinion. Some instructors indicated the expectation of student learning from the community people and or parents have influenced their development of e-learning. Moreover, the social demands for flexible learning and services also affected the university and instructor in their use of e-learning.

Thus known external professional, private, and public factors are needed to be taken account in their development of e-learning.

#### **5.4.6 Section summary**

This section has discussed seven factors influencing instructor use of e-learning. All the respondents considered personal will and capacity were two of the most concerns, especially for the College of Science instructors. They noted personal characteristics (e.g., personality traits, preferences); perception of benefits and challenges of e-learning; and attitudes towards technology use, education, learning, and e-learning could be motivators and inhibitors to their use of e-learning. Some instructors mentioned the convenience of use of the university e-learning system for organizing their teaching materials, and managing student assignments and academic records; and concerns about convenience for student learning. These comments were coincident with the perceptions of benefits of e-learning for themselves and students (see Section 5.3.1). The benefit of technology adoption also influences instructor adoption of e-learning. Many instructors saw technology as a productivity tool because they considered PowerPoint, Word-processing, and electronic grading made their academic work more efficient and effective. Some instructors noted they sought to learn about technology not because they wanted to use it in teaching but because they had a personal project they wanted to accomplish with it, or because they wanted to monitor or participate in the technology-related activities of their students. They suggested that some (science) instructors would need to change their attitude and perspectives if they were to adopt e-learning. Instructors also needed to improve their personal capability in design and development of e-learning courses, and interaction with their students online.

All instructors indicated the changes of national policy have significantly impacted on the university policy and the university has redefined its goal to emphasize research and also changed its tenure system, so instructors had diverted their attention from teaching and focused more on their research and promotion. All the instructors implied they found NRU did not have an overall detailed plan for e-learning development and the policy context in support of e-learning was ambiguous and lacked consistency and authority. The instructors noted the provision of technical support from the university was important to their use of e-learning, especially the technical support staff from the Computer Center and student assistant support. They saw the provision of support as an indication that e-learning was valued within the university and therefore worth pursuing. They noted a lack of institutional support would inhibit the adoption of e-learning because of the additional preparation needed, especially for science instructors.

All the instructors thought e-learning teaching is different from traditional teaching in three aspects: instructor's role change to become more of a facilitator, knowledge and skills needed for e-learning instructional design and technology, and need to be well prepared before class for e-learning teaching. However, instructors may be reluctant to change. Moreover, while the interview instructors were able to list the benefits of e-learning for them, the students and the university, they raised a number of pedagogical issues such as how e-learning is different from the traditional teaching, the impact of science course/subject attributes on course design, the influence of class size (ratio of instructor and students), and teaching approaches. Each instructor had their own ideas about their class teaching approaches such as assignments and quizzes. Some instructors noted they did not give assignments or quizzes depending on the students in class. Some instructors mentioned the need for explicit explanation of 'specific' field knowledge/words using common and colloquial words for their students particularly those who came from the community because the course belongs to the distance education and e-learning course. Furthermore, instructor perception of the students' learning attitude was seen as a significant influence on the use of different e-learning teaching approaches. They all suggested that instructors, including science instructors, needed to be re-trained on instructional design and technology skills for e-learning.

## 5.5 Suggested university changes and enhancement strategies

This section sets out instructor suggestions for enhancing e-learning practice. One of the data sources was from the question to the instructors about the suggested university changes needed for the e-learning practice. The other one was from the responses of the questionnaire and interviewed instructors to the question about useful strategies for enhancing e-learning practice.

### 5.5.1 University changes

The questionnaire respondents were asked whether or not it would be helpful to enhance e-learning practice if the university made some changes. The respondents needed to indicate the appropriate degree to each statement. Five degrees were: strongly disagree, disagree, neutral, agree and strongly agree. One instructor did not answer all parts of this question. There were eight subtopics about the university possible changes: increase promotion ratio; increase incentive pay; request all instructors to use; provide more manpower support; provide more system functionality; provide more demonstrations on good courses; provide more incentives (e.g. teaching awards); and provide more seminars to share experiences. The instructors could also write any additional comments or suggestions on the university changes. Each response was coded against these eight subtopics. Five dominant categories were grouped from these eight sub-topics. Table 5.21 shows the responses of the first dominant category ‘more manpower support’ and of the second dominant category ‘more system functionality’.

Table 5.21

*Manpower support and functionality of e-learning system*

	Provide more manpower support		Provide more functionality on e-learning system	
	N (=66)	% of N	N1 (=67)	% of N1
Strongly agree	26	39%	23	34%
Agree	24	36%	20	30%
Neutral	7	11%	13	19%
Disagree	7	11%	6	9%
Strongly disagree	2	3%	5	7%

The first dominant category ‘more manpower support’ indicated the university should provide more student or staff technical support for their e-learning

teaching. A majority (75%) of instructors strongly agreed (39%) and agreed (36%) the university should make this change. The second dominant category ‘more system functionality’ indicated the university e-learning system should provide more useful system functionality, such as automatically computing student grades. Nearly two thirds (64% of 67) respondents strongly agreed (34%) and agreed (30%) that the university should provide more system functionality for their teaching in e-learning.

Table 5.22 shows the responses of the third dominant category ‘more incentives’.

Table 5.22  
*Responses of more incentives*

	Provide more incentives awards		Increase incentive pay		Increase promotion ratio	
	N (=67)	% of N	N1 (=68)	% of N1	N2(=67)	% of N2
Strongly agree	19	28%	18	26%	11	16%
Agree	21	31%	18	26%	19	28%
Neutral	14	21%	16	24%	14	21%
Disagree	8	12%	10	15%	15	22%
Strongly disagree	5	7%	6	9%	8	12%

The third category ‘more incentives’ included the university e-learning system needed to provide more incentives awards such as teaching award or faculty fellows; more incentive pay such as more extra hour-pay; and an increase in the evaluation ratio of tenure promotion. Overall, more than half of the instructors agreed and strongly agreed the university needed to provide more incentives awards (31% and 28%) and more incentive pay (both 26%) to encourage their e-learning teaching. Nearly half of the sixty-five respondents agreed (28%) and strongly agreed (16%) the university needed to increase the evaluation ratio of teaching e-learning courses in the tenure promotion policy. However, over one third of the sixty-five respondents strongly disagreed (12%) and disagreed (22%) with increasing the tenure promotion ratio of teaching e-learning courses.

Table 5.23 shows the responses of the fourth dominant category ‘more help’ and the fifth dominant category ‘policy change’.

Table 5.23  
*Responses of more help and policy change*

	More help				Policy change	
	Provide more demonstrations on good courses		Provide more seminars to share experiences		Request all instructors to use	
	N (=68)	% of N	N1 (=67)	% of N1	N2 (=67)	% of N2
Strongly agree	15	22%	10	15%	6	9%
Agree	19	28%	16	24%	17	25%
Neutral	22	32%	27	40%	14	21%
Disagree	10	15%	9	13%	16	24%
Strongly disagree	2	3%	5	7%	14	21%

The fourth dominant category shown in Table 5.23 was ‘more help’ which included providing more demonstrations on good courses and more seminars to share experiences. Overall, half of the instructors agreed (28%) and strongly agreed (22%) the university needed to provide more demonstrations to help their e-learning teaching. Not many instructors agreed (24%) and strongly agreed (15%) the university needed to provide more seminars and to help their e-learning teaching. The fifth dominant category shown in Table 5.23 was ‘policy change’ which was that the university could request all the instructors to use the e-learning system. Nearly half (45%) of the sixty-five respondents strongly disagreed (21%) and disagreed (24%) the university should require all instructors to use e-learning system. Similarly, few instructors strongly agreed (9%) and agreed (25%) the university should request all the instructors to use e-learning. This result is reinforced by the e-learning instructors’ interviews in which they indicated they had academic freedom so they could not be forced to use e-learning. The instructors suggested the university should change the policy to encourage them rather than force them to use.

### 5.5.2 Instructor experiences and perceptions

This section synthesized the suggested strategies for enhancing e-learning practice from the questionnaires and interviews. In order to obtain additional suggestions for changes in e-learning practice, the instructors were asked to describe some useful strategies to enhance e-learning practice (see Q31 in the Appendix J). Nearly three fifths (59%) of the sixty-nine instructors described their e-learning experiences and perceptions. Four dominant categories were developed from seven sub-categories. Each response was coded against these categories. Some

responses were counted in two or more categories. Table 5.24 shows the responses of suggested useful strategies for enhancing e-learning practice.

Table 5.24

*Frequencies of useful strategies to enhance e-learning practice*

Category	Useful strategies	N (=41)	% of N
Policy	Encouragement policy	16	39%
	Manpower support	10	24%
	Well-defined university e-learning goal	9	22%
	Funding support	5	12%
	Feedback from students and instructors	4	10%
Technology	Technology support	13	32%
Pedagogy	Course design	3	7%
Other	Other comments	2	4%

Based on the interview descriptions of e-learning experiences and perceptions of e-learning, seven dominant categories of suggested changes were identified. These categories were: policy, technology, pedagogy, personal, external professionals, private commercial issues, and public. The following will synthesize the responses of the questionnaire and interview instructors.

**Policy aspect**

Nearly two fifths (39%) of the forty-one questionnaire respondents indicated the university should have an encouragement policy to enhance e-learning practice; for example, increase evaluation ratio of personal e-learning teaching and departmental e-learning practice; provide more incentives or increase pressure on instructors; encouragement by department or university Development Center; and provide more seminars, demonstrations to broadcast the benefits of e-learning or show the good e-learning courses. Nearly one fourth (24%-10) reported the university should provide more manpower support which included technical support staff and student assistant, more advanced or online support assistance, and training for manpower support. Over one fifth (22%) indicated the university should define the university e-learning goal and its scope well, such as what kinds of course subjects are suitable, who should use e-learning, evaluation policy for encouragement, and set up the development policy. Few instructors reported the university should provide more funding to buy adequate e-learning related facilities (12%) and provide the student feedback (e.g., student evaluation of e-courses) to the instructors (10%) in order to improve their e-learning teaching.

The university also needed to take feedback or suggestions from instructors and students.

In addition, regarding extra support services needed for e-learning practice, the respondents to the questionnaire were also asked to describe what other support services should be available in their e-learning courses (see Q23 in Appendix J). Nearly two-fifths (38%-26) of the sixty-nine instructors described the needs in their e-learning experiences and comments. Over two fifths (42%-11) of those twenty-six respondents identified manpower support services as being necessary in their e-learning teaching. These responses mentioned that technical staff or student assistant support should be available for their e-learning practice especially high quality technical support staff. One respondent noted:

High quality technical support staff is very important and necessary to the instructor. The reason why I did not use so much e-learning system is because I had difficulty to put my teaching material onto the e-learning system even with the help of technical support staff. (QI.23.155)

Moreover, another respondent indicated the university should consistently provide the student assistant support for e-learning teaching, “The University should provide consistent help for solving technical issues in depth, especially for the transformation between different file formats such as video transformation online” (QI.23.78). This implied student assistant is an important individual help for them.

Some extra support such as one-on-one technical support and training for using and operating those multimedia facilities, more adequate e-learning facilities or related software, more new e-learning related information and resources, and concern of the copyright of some course materials were also identified. Some comments were:

If possible, each instructor has one student assistant to help developing e-content and in-person step-by-step training at instructor office will be appreciated. (QI.23.258)

Not all the classrooms have enough e-learning equipment, so it needs more funding to buy those facilities and related software. (QI.23.306)

Some course materials in Chemistry have a copyright problem. We could teach those materials in class but could we put them on the website and open to the public? (QI.23.63)

Similarly, all the interview instructors commented that the NRU did not have an overall detailed plan for e-learning development. They argued that the university

administrators were responsible for this and that there should be an overall plan for e-learning development within the university. Science e-learning instructor A highlighted this:

I suggest the university needs to have an overall detailed e-learning development plan which includes what kinds of courses are to be designed, how many courses, how many years, who will participate, how to teach, how to process and cooperate, how to do the instructional design, and so on. It should be a responsibility of those administrators to plan and practice well. They should take the instructors' suggestions, solve the problems for the instructors, and make good policy for them. (SeiAi.2.14.1)

They all suggested the university should have a clear goal and well-defined e-learning policy and also could continuously support them and their students in their use of e-learning.

The instructors also identified the importance of leadership in conducting an e-learning development program. They suggested the university needed to recruit an intelligent leader who was knowledgeable and enthusiastic about e-learning practice and then set up teams to help the leader to plan and implement e-learning across the university. A science e-learning instructor remarked:

It is very important to have a program conductor to plan the overall detailed e-learning development program and distribute all the team work well. Therefore, the university needs to recruit an intelligent leader who has much knowledge and desire in e-learning practice and some groups of teams to help the leader to plan and develop. This leader should implement this e-learning practice well and lead all the instructors to meet the university requirements. (SeiBi.2.12.2)

In the same manner, science e-learning instructor A also indicated a university leader was needed to manage the integration of university resources and to encourage departments to cooperate to develop e-learning practice. He suggested:

From the university's view, the Office of Academic Affairs, the Network and Computer Center, and the Office of General Affairs should cooperate to develop e-learning practice. The university leader needs to integrate all the university resources such as budget, equipments, spaces, and manpower for e-learning practice. For example, all related science courses should be conducted and taught by College of Science in some large classrooms. (SeiAi.1.14.3)

All the interviewed instructors also suggested the university should pursue a policy of reducing instructor teaching load in order to encourage those instructors who worked under time constraints and research pressures to begin using e-learning. A representative comment was:

I think most of non e-learning instructors will tell you they don't have much time to do it as their first sentence. And then, they will say they don't want to spend much time on teaching because they have much pressure on research. Therefore, if there is a policy to encourage

the instructors to reduce their teaching load such as if the instructor teaches one e-learning course in this semester then it can be counted as ten hours teaching per week. And then, the instructor will prepare well and teach hard on this e-learning course. (NSeiAi.5.9.4)

Another suggestion for how instructors might reduce their teaching load was that they cooperate to develop and teach an e-learning course. They said the university could get many students together in a class and have three or four instructors to share teaching for this big class. This would save much money for the university because the university did not need to pay much extra hour-pay for many instructors who taught in many small classes in e-learning and this also could reduce their teaching load. A science e-learning instructor stated:

I suggested to the department head that our department instructors can cooperate to complete some major courses in e-learning and use those e-learning courses to teach. For example, all the university students can take the same General Physics course and preview the course materials on the web and then discuss with instructors in class. (SeiBi.2.10.1)

Some instructors asserted that the university policy should encourage a cooperative e-learning teaching approach, especially in the College of Science and Medicine. A non-science e-learning instructor stated, “The University should make the policy to encourage team work and course-design planning within the university and even with other institutions outside the university. E-learning can not be done by only one instructor but by a group or a team” (NSeiMi.7.4.2). Moreover, science e-learning instructor A also noted, “If I was the Director of the General Education Center, I would encourage instructors who have the same interests and characteristics to cooperate in teaching one course and to develop it into e-learning” (SeiAi.9.4.8).

The instructors continually suggested the university could request each College to convert some of their courses to e-learning each year. In particular, some science instructors indicated many compulsory courses in the College of Science were suitable for e-learning development because many university students needed to take them. Science e-learning instructor D remarked:

The University can request each college gradually to complete some courses or certain percentages of their department courses every year. Especially, some common compulsory courses in the College of Science are highly appropriate to be developed in e-learning because many university students need to take them. The effectiveness and efficiency of e-learning teaching will appear higher. (SeiDi.8.5.1)

Additionally, the instructors also argued e-learning development does not need to be limited to within the university. They argued for cooperation with other external professionals or universities. A non-science e-learning instructor stated, “However, e-learning does not need to be developed and or practiced within the universities only. We can do it via cooperation among enterprises, governments, associations, and universities” (NSeiNi.5.1.8).

A science e-learning instructor indicated that NRU, as a research-oriented university, had a responsibility and the capacity to develop high quality e-learning courses. He asserted that it should do better than a teaching-based university, not only in research but also in teaching. He pointed out that this relied on the university having efficient and effective strategies for e-learning:

The responsibility of the research-oriented university is doing their best on their research and teaching. NRU has a lot of excellent and capable staff. Why not develop the e-learning? We can and must do it better than those instructors in teaching-oriented universities. Generally the instructors in a research-oriented university do the research well but it does not mean they cannot teach well, on the contrary, they can and should teach better than others. For solving this problem, the key point is to consider the efficiency and effectiveness of your strategies. (SeiAi.2.13.1)

### **Technology aspect**

Nearly one third (32%) of the sixty-nine respondents commented that the university should provide good enough e-learning related technology and support. These included user friendly, fully functionalized and good performing e-learning system; good quality of network environment and multimedia facilities; enough network bandwidth, fast speed for image presentation and network management; enough and adequate computer storage space, equipment and software; more online database and videos; and good facility management. Further evidence in regard to extra support services needed for e-learning practice, is that half (50%) of twenty-six respondents suggested the same technological support services should be available in their e-learning teaching. Some comments were:

The university should improve e-learning system performance especially while many students upload assignments and tests/exams simultaneously. Moreover, providing a more easy-to-use and fully functionalized system is necessary and convenient for e-learning instructors such as online assessment and grading system, easier video transfer process, various modules or templates and so forth. (QI.23.178)

The e-learning practice needs good and adequate e-learning equipment and a good network environment which should have enough network bandwidth, fast speed for presenting images or file transfer, good video quality and so on. (QI.23.268)

### **Pedagogy aspect**

Very few (7%) of the forty-one respondents noted the university should provide more technical support in course design or the instructors needed to provide more drills or interesting topics to their students in order to encourage or attract student use of e-learning. Similarly, eight interviewed instructors indicated that support for e-learning course design, demonstration of good e-learning courses in public and internal professional support from their colleagues were necessary for them. They reported different course (subject) design needs different kinds of support services for different instructors. One representative comment was:

Technical support is necessary especially for e-learning course design because different fields had different needs to present the course materials. It needs more communication between technical staff and instructor. How to use technology to present the essence of the course subject is an important issue to be considered. (NSeiPi.8.2.3)

These respondents also indicated good e-learning course demonstrations were necessary for them to learn how to design a good e-learning course and share experiences with the designer. They said they needed enthusiastic experts to help them solve all e-learning related problems. They also suggested the university needed to provide some awards or recognitions in public for those good e-learning instructors to encourage other instructors to engage in the e-learning teaching.

### **Personal aspect**

Two instructors did not provide any suggestions but gave their perceptions of e-learning practice. One respondent said, “Whenever the e-learning environment such as good e-learning system and network quality becomes mature and well-developed, then the instructors naturally and gradually would like to use e-learning because it becomes a trend and more benefits of e-learning are perceived” (QI.23.200). Similarly, the interviewed instructors indicated the instructors needed to change their personal perceptions and attitudes to adapt to this new e-learning trend and learn how to use new technology to develop e-learning courses and manage ongoing involvement online. As science e-learning instructor A said, “Personal will and capacity are important for instructor use of e-learning. I think all the instructors need to accept this new trend and learn how to develop e-learning courses by utilizing new technology or multimedia facilities” (SeiAi.8.5.6). Simultaneously, the interview instructors noted the students learning attitude also influence their use of e-learning so they suggested

the students needed to change to become more active, diligent and self-managed learners (see Section 5.3.2).

### **External professional aspect**

Some instructors indicated the support for e-learning from external professional support was necessary for them. Eight percent of twenty-six respondents in regard to the extra support services considered professional support was necessary for e-learning instructors no matter whether they were internal, or external professionals, national or international ones. Some respondents said they needed the enthusiastic experts to teach them how to design and or help them solve all e-learning related problems. One respondent remarked,

We hope we could have external professional help, same as the foreign book publishers provided the well-designed online course materials for their instructors, and then the instructors could easily revise them in the way they like. (NSeiOi.5.6.2)

### **Private aspect**

Nearly a half (48%-13) of the interview instructors said they have used commercial videos or CDs provided by private publishers in their e-learning teaching in order to improve their teaching quality and student learning outcomes. However, the instructors indicated they could not get all the resources or products of e-learning curriculum publishers or private commercial resources providers especially the international online e-learning courses or e-copies of popular textbooks. Thus, they suggested the university needed to help them to get more extra resources for their development of e-learning courses.

### **Public aspect**

Some instructors reported e-learning is a fast growing trend so everyone needs to adapt to it for the current information age. They indicated the wider community had social demands for flexible learning and flexible services from the university and instructors. They suggested the university should consider these concerns and challenges and must really understand the public needs and demands in order to compete with other universities or other institutions. They also suggested the university needed to encourage instructors to cooperate with other universities, enterprises or the community via e-learning teaching. They noted e-learning

teaching is a good strategy to cooperate with the public and increase the university reputation and the instructors could be a good agent in this cooperation.

To sum up, the questionnaire and interview respondents described the suggested changes for themselves, students, and the university based on their e-learning experiences, perceived benefits and challenges of e-learning, and factors influencing their use of e-learning. These suggested strategies for enhancement of e-learning practice included policy, technology, pedagogy, personal, external professional, private commercial and public aspects. The suggestions to the university included: providing an overall detailed e-learning plan and well-defined e-learning goal; providing more incentives or an encouragement policy to attract instructors to use e-learning; continuously providing student assistant support and high-quality of manpower support to help instructors to develop their e-learning courses; providing more funding to buy more adequate and high quality e-learning related facilities and software; providing the student feedback to the instructors and also taking feedback or suggestions from instructors and students to enhance e-learning practice; and providing more technical support and resources whether from internal or from external professional or private commercial publishers for their e-learning instructional design and development. The instructors also noted they needed to change their personal perceptions and attitudes to e-learning and learn how to use e-learning well. They also expected the students could change their learning attitude to become more active, diligent and self-managed learners.

## **5.6 Chapter summary**

This Chapter has described four aspects of instructor experiences and perceptions of e-learning. These are e-learning experiences, perceived benefits and challenges, factors influencing instructor use of e-learning and suggested e-learning enhancement strategies. This section summarizes the data from questionnaires and interviews about instructor perceptions and experiences in their e-learning.

A majority of questionnaire and interview respondents were professors and taught at non-science and engineering-related colleges. Overall, the instructors were relatively inexperienced with e-learning and had taught only one or two e-learning

courses. They rated themselves as having a lower level of e-learning ability if they had fewer years experience in e-learning. The instructors indicated the provision of online course materials including lecture notes, supplementary references and online quizzes, tests or assignments were the major teaching method and effective strategies to improve their students learning outcomes through a blend of e-learning and face-to-face teaching. The instructors considered providing audios/videos as part of their e-learning course materials to be a useful tool by allowing their students to review lessons. Synchronous or asynchronous interactions were thought to improve their communication with their students especially via email, bulletin board and online discussion forums. The instructors also noted collaborative projects or assignments and the online posting of student projects reports could help students interact asynchronously and learn more from both instructors and peers. The instructors reported they used these varied teaching methods and tools to improve their teaching because they had had help from technical support staff, student assistants and administrative support staff along with training from university. Especially, they noted student assistants could help them to develop e-learning courses, solve technical problems, interact with the students and manage student academic records. They said they would face many challenges and quit the use of e-learning if they did not have student assistant support.

Instructors perceive that e-learning practice for the university, instructor, and student has its own benefits and challenges. The questionnaire and interview respondents perceived the benefits of e-learning for the university included:

- Increasing the quality of teaching and learning;
- Increasing university reputation and competitiveness;
- Improving the interactions among students and instructors;
- Lowering average costs per course per student;
- Increasing institutional cooperation or partnerships; and
- Providing an income source for the university or the department.

The benefits for the instructors themselves included:

- Improvement of instructor teaching and teaching quality (e.g., easy to update and manage course materials);
- Flexibility of time and place of teaching;
- Improving interaction with students and easier sharing of experience with others;

- Increasing personal reputation; and
- Saving in course cost and time (e.g., save paper costs).

The benefits of e-learning for the students perceived by the instructors were:

- Flexibility of time and place of learning;
- Increase in student ICT knowledge and skills;
- Improvement of student learning and learning outcomes; and
- Improvement in interactions with instructors and peers and motivation of student participation.

The findings noted the instructors experience challenges to do with pedagogical issues of e-content; personal time management and role change; and personal expertise with ICT use and access to the requisite technology. These challenges were:

- New curriculum design and new teaching approaches, new types of assessments and interactions online;
- Lack of personal motivation (e.g., teaching overload, time constraints, role change, psychological barriers);
- Lack of personal capability (e.g., technical knowledge and skills for technology use and pedagogical design); and
- Lack of easy access and high quality access to the necessary equipment, and e-learning system.

The challenges for the university perceived by the instructors included:

- Lack of sufficient budget and manpower support;
- Ambiguous e-learning policy and goals;
- Distrust between the university and instructors;
- Leadership; and
- Language problem for internalizing e-learning courses.

The perceived challenges for the students included:

- Lack of personal active learning attitude and learning approaches;
- Lack of easy access to the necessary equipment and high quality e-learning computer facilities; and
- Lack of personal technical skills to access technology and for communication.

The factors influencing instructor use of e-learning were categorized as personal, policy, pedagogical, technological, external professional, private commercial and public impacts. Instructor personal factors that encouraged or hindered their use of e-learning included:

- Personal will (e.g., personal characteristics; perception of the benefits and challenges of e-learning for students and instructors; and attitude to education, learning , e-learning, and technology use); and
- Personal capabilities (e.g., technical knowledge and skills and time management ability).

The policy factors for the instructors were:

- National and university e-learning policy impacts;
- National/university/departmental leadership; and
- Support services.

The pedagogical factors for the instructors included:

- Course organization and attributes;
- Class size;
- Role change;
- Teaching methods considered appropriate; and
- Teaching tools available/able to be accessed and used.

The technological factors for the instructors were related to:

- The university e-learning system;
- Computer facilities; and
- The network technology.

Other factors identified were:

- The provision of professionally produced e-learning materials where these were prepared or published by individuals and companies outside the university; and
- The opinions of the public or community.

The reasons why some instructors do not use e-learning fitted the aforementioned categories. A number of themes were evident in instructor responses as to useful strategies for enhancing e-learning practice. These included:

- Well-defined university e-learning goals and policy;
- University policy and practices to encourage the use of e-learning;
- The provision of technical and pedagogical support (e.g., more technical support in course design and ongoing involvements, funding for adequate e-learning related facilities);
- Feedback to instructors who were using e-learning; and
- The changes in instructor and student personal perceptions and attitudes.

In a word, university instructors had their academic freedom to decide their personal teaching approaches, so instructor personal will and capacity were the

key influences and the main reasons in their use of e-learning. However, they also could be affected by the policy, technology, pedagogy, and pupil factors in the social context. Other factors, including the external professional, private and public factors, were also considered. The instructors indicated especially the university policy could influence their use of e-learning, so they suggested the university needed to make some changes for enhancing e-learning practice such as changes in the university policy and provision of more extra support services (e.g., technical support or resources) for their e-learning teaching. They also noted the instructors and students needed to change their personal perceptions and attitudes to adapt to this e-learning trend in the current information age.

# **Chapter 6 Student perception of e-learning**

## **6.1 Introduction**

The previous chapter described e-learning backgrounds and perceptions of e-learning experiences of instructors. In this chapter, students' opinions of e-learning are discussed. The data discussed in this chapter were obtained from 376 student questionnaires which included closed and open-ended questions and from 33 students in eight focus group interviews. The data is presented in four sections. The first outlines the background and experiences of the student participants, the second demonstrates student perceived benefits and challenges of e-learning, the third describes the factors influencing student use of e-learning, and the fourth outlines the suggested changes in e-learning practice. The final section is the chapter summary.

## **6.2 Academic background and e-learning experience**

This section synthesizes student demographics and experiences in e-learning. The demographics include descriptions of the respondents' college, study level, familiarity with e-learning policy, preferred learning style, and the relationships of these factors. Student background in e-learning includes e-learning courses taken, years of e-learning experience, self-rated e-learning ability, and the relationships of these factors. Student e-learning experiences describe the e-learning teaching methods and effective strategies students have experienced in their e-learning courses. Not all the students responded to all the questions in the questionnaire, so the numbers of respondents in each table are different.

### **6.2.1 Respondent demographics**

This section synthesizes student general information from the questionnaires and interviews. A majority of respondents to the questionnaires (84% of 376) and interviews (76% of 33) were in non-science colleges: Engineering, Medicine, Electrical Engineering and Computer Science, Social Science, Planning and Design, Management, and Liberal Arts. A majority of respondents were undergraduates (94%-352 of questionnaire respondents; 82%-27 of interviewees).

Over four fifths of questionnaire respondents (83%-305) and interviewees (90%-30) answered they were not familiar with national or university e-learning policy. Only a few students were familiar with either one or both policies. The interviewees reported that they did not pay attention to the national or university e-learning policy because they considered their instructors often had their own student assistants or teaching assistants to help them in e-learning teaching and some of their instructors might prefer to teach in e-learning. This implied the students might not be affected by the national or university e-learning policy.

When the students were asked about their preferred learning style, the responses in the questionnaires and interviews were different. Over two fifths of questionnaire respondents (43%) indicated they liked to learn alone, but two fifths of interviewees (42%) preferred to learn in a group. When asked about instructor teaching mode in face-to-face and e-learning, a majority of questionnaire respondents (70%-263) and interviewees (82%-27) preferred a blend of face-to-face and e-learning teaching. A few students favoured face-to-face instruction alone, 26% and 18% respectively in the questionnaire and interview. Only 3% of questionnaire respondents liked e-learning alone. No student from the interviews liked to have e-learning only. The implication here is that a majority of the students appreciated blended learning.

Based on cross tabulation of preferred learning style and teaching mode (shown below in Table 6.1), a majority of the students who preferred face-to-face instruction (50% for both questionnaire and interview students) or e-learning alone (62% for questionnaire students) liked to learn alone. However, not many students who preferred a blend of face-to-face and e-learning liked to learn alone (39% and 33% respectively for questionnaire and interview students). In contrast, over three fifths (62%) of questionnaire respondents whose preference was for a blend of face-to-face and e-learning liked to learn with a partner (25%) or in a group (37%). Similarly, over two thirds (67%) of respondent students from the interviews who preferred blended learning also liked to learn with a partner (48%) or in a group (19%). This implied a majority of those who preferred blended learning most preferred to learn with their partner or a group.

Table 6.1  
*Cross tabulation of learning and teaching mode preference*

Learning preference	Teaching mode preference							
	Face-to-face only		Face-to-face and e-learning		E-learning only		Total (N=372)	
	N	% of Col	N	% of Col	N	% of Col	N	% of Col
Alone	49	50%	101	39%	8	62%	158	43%
With a partner	27	27%	64	25%	3	23%	94	25%
In a group	23	23%	95	37%	2	15%	120	33%
Total	99	100%	260	100%	13	100%	372	100%

To sum up, a majority of respondent students came from non-science colleges. Overall, the respondent students were not familiar with national and or university e-learning policy. A majority liked blended learning (260/372). Of those who preferred a blend of face-to-face and e-learning teaching, nearly two thirds (62%) liked to learn in groups or pairs, not alone.

### 6.2.2 Background in e-learning

This section synthesizes the student background in e-learning. It includes descriptions of e-learning courses taken, years of e-learning experience, self-rated ability to use e-learning and the relationship of these factors with study level, and years experience in e-learning.

Most students were inexperienced with e-learning. They had taken fewer than three e-learning courses and had had less than two years experience. Over two fifths (68% and 63%) of students reported they had taken either one or two e-learning courses. A majority (89% and 72%) of students had had less than two years experience in e-learning. As might be expected, a cross tabulation of students' years learning in e-learning and e-learning courses taken shows the fewer years experience in e-learning the students had, the less e-learning course(s) they had taken.

Overall, a majority of students rated themselves as having a reasonably high level of e-learning ability. Over a half (52% and 66%) of students rated their e-learning ability at the intermediate level (43% and 45% respectively) or higher (9% and 21% respectively). A majority of lower study-level respondents from questionnaires rated their e-learning ability as beginners and lower than

intermediate level: 71% of 79 freshmen and 60% of 85 sophomores. However, the higher study-level of respondents rated they had intermediate or higher level of e-learning ability. Over three fifths of respondents such as juniors (64%), seniors (63%), masters (61%) and all PhD students rated they had intermediate or higher level of e-learning ability. In contrast, a majority of undergraduate respondents from interviews rated their e-learning ability as being intermediate or between intermediate and expert level. For example, all freshmen and sophomores rated themselves as intermediate users. Over two thirds of juniors (75%) and seniors (66%) rated themselves as having an intermediate or higher level of e-learning ability. A Chi-square test and Phi values indicated there was medium (for questionnaires) or strong (for interviews) positive relationship between student's self-rated e-learning ability and their study level (respectively, Chi square=57.412, df =20, p=0.000, Phi value=0.392 and Chi square=38.238, df =15, p=0.001, Phi value=1.076). This showed that lower study-level respondents rated their e-learning ability lower than high study-level respondents.

More inexperienced respondents from the questionnaires rated themselves as having lower ability in e-learning. For instance, over two-fifths (41%-94) of one year e-learning respondents rated themselves as beginners. Over half of two years (57%-57) or three years (57%-16) e-learning respondents rated themselves as having an intermediate level of e-learning ability. A majority of four years e-learning respondents rated themselves as intermediate (46%) or between intermediate and expert (46%) level. A Chi-square test and Phi value showed there was a significant and medium relationship between student's years experience in e-learning and self-rated ability in e-learning. (Chi-square =113.313, df =16, p= 0.000, Phi = 0.553). That meant questionnaire respondents with fewer years experience rated themselves with lower ability in e-learning.

A majority of interviewees rated themselves as having intermediate or higher level of e-learning ability although they did not have many years experience in e-learning. For example, nearly two thirds of respondents who had one or two years experience in e-learning rated themselves as intermediate (both 46%) or higher (15% and 18%) level users. A Chi-square test and Phi value from the focus group interviews showed there was no significant relationship between the

student's years experience in e-learning and self-rated ability in e-learning. (Chi-square =6.972, df =9, p= 0.640, Phi = 0.460). This indicated the students from interviews having fewer years experience in e-learning did not mean they had a lower level of e-learning ability.

### 6.2.3 Student e-learning experience

The students' reports of the e-learning teaching methods and the most effective strategies their instructors had used in e-learning courses are synthesized and described in this section.

#### E-learning teaching methods experienced and found helpful

The students were asked to describe the teaching methods they had experienced and found helpful. The students in the questionnaire could choose or respond more than one teaching method. The categories of responses were same as the categories in Chapter 5 (see Section 5.2.3). Table 6.2 summarizes student responses. The order of selection for what they had experienced was similar to the order of percentage to what the students found helpful, except for videos of lessons and online discussion.

Table 6.2

*Frequencies of teaching methods experienced and found helpful*

Teaching methods		Have used		Found helpful	
Main category	Response category	N (=367)	% of N	N1(=367)	% of N1
Course materials	Lecture notes	334	91%	313	84%
	References	299	82%	276	74%
	Online quizzes, tests or assignments	190	52%	120	32%
Audios/videos	Videos of lessons	139	38%	200	54%
	Videos of student presentations	65	18%	102	28%
Synchronous interactions	Online discussion	188	51%	177	48%
	Online group discussion	89	24%	126	34%
Asynchronous interaction	Student projects /reports	222	61%	173	47%
	Collaborative projects	197	54%	154	42%

The responses from eight focus group interviews were developed into thirteen categories based on the choices in Question 8 of the student questionnaire (see Appendix K). Across the eight focus groups, students indicated they had had different e-learning experiences in different e-learning courses. As a student in Group B explained, "It all depends on the instructors. Some instructors use online assignments or tests only. Some have extra course materials in the videos online" (SgBi.1.1.3). In general, most students had experienced the use of online course

materials, audios/videos, and synchronous and asynchronous interactions. Table 6.3 summarizes the teaching methods discussed in the different focus groups.

Table 6.3  
*Teaching methods discussed in the focus groups*

Category	Teaching method	Number of groups
Course materials	Lecture notes online	8
	Supplementary references online	8
	Online assignment	7
	Online quiz/test	4
Audios/videos	Video of lessons	5
	Video of student presentations	3
	(Computer) video conference	2
	VOD (video on demand)	1
Synchronous interaction	Online discussion	5
	Online group discussion	3
Asynchronous interaction	Bulletin board, email, Q and A online	8
	Student projects/reports online	7
	Collaborative projects	6
Other techniques	Use computer technology or incentives	6
	Course evaluation form	3

### ***Course materials***

A majority of respondents in the questionnaires and interviews reported they had been provided with lecture notes online (91% and eight groups, respectively) and supplementary references online (82% and eight groups, respectively). Most found them helpful (84% and eight groups, and 74% and eight groups, respectively). Over half (52%-190) of questionnaire respondents and at least four focus groups (seven groups for assignments and four for quizzes) had experienced online quizzes, tests or assignments which were used by their instructors to encourage them to review the course materials and do more exercises. The focus group students perceived the aim of all the online materials was to give them flexibility of learning and improve their learning outcomes. As a student in Group A explained:

Our instructors put all their lecture notes in PowerPoint files, references, and previous tests online. In order to motivate us to preview and review the online course materials and do more exercises, sometimes our instructors give online assignments or quizzes or tests before/in/after class. I think the purposes of these teaching methods are great to stimulate us to study online course materials and improve our learning outcomes. (SgAi.3.5.6)

Five focus groups and 32% of 367 questionnaire respondents found online assignments, quizzes and test banks helpful for their learning, especially before exams and or when they had been too lazy to attend a class or study hard. Some students in Group A reported they did online assignments or exercises in class so

their instructors could know whether they really understood the lectures or not. They noted their instructor would adjust his/her teaching approach if they did not understand. Some typical comments from questionnaire were:

We had listening comprehension tests online in our English class so we needed to review course materials and do exercises online very often. (QS.9.205)

The instructor gave online quizzes or tests and also provided online test banks or previous test questions to let us do more exercises. (QS.9.306)

The instructor gave assignments online and demonstrated how to do the assignments and provided the designated format online, so we could easily to complete assignments correctly. (QS.9.151)

Students also noted they could access the answers immediately after they submitted assignments, quizzes or tests online. A student in Group F noted, “We had answers online immediately ... so we could check whether or not we really understood and what we needed to enhance more” (SgFi.4.6.2). Online assignments or quizzes or tests were considered helpful to support student preview/review of online course materials and improve their learning outcomes.

Five focus groups indicated they found online syllabi and references helpful for their learning progress and understanding. They noted a definite outline of the course structure could help them arrange time to preview or review course materials before and or after class and hence they could manage their study program better and learn more. Moreover, when instructors provided reference websites, textbooks or hints online they could follow these up. One student in Group E noted, “Our Biology instructor provided some reference websites and reference books to let us study more, especially when he did not have enough time to explain the course content in detail in class” (SgEi.2.4.8).

### ***Audios/videos***

The students had used audios/videos to review or share the seminar findings with peers. Nearly two fifths (38%-139) of the questionnaire students and five focus groups previewed or reviewed audios/videos of lessons online. Nearly one fifth (18%-65) of the questionnaire students and three focus groups had viewed videos of student presentations or performances online. Furthermore, two groups of students indicated they had experienced computer video-conferencing instruction. One group noted one instructor required them to access VOD (video on demand)

from the university library video database to review course-related materials. These respondent students suggested that they considered audios/videos a useful tool to review lessons and had learned more from the interactions that happened in the face-to-face teaching. Some representative comments were:

We have reviewed a “C Programming Language” audio/video lesson. The instructor used the audio-video function to record her voice to match with the PowerPoint file synchronously. (SgEi.2.1.5)

The instructors video-record the class teaching and upload video files online to let us review any time, any place and at our own pace. If we review the videos of the lessons repeatedly, we may understand or find the problems where we need to learn more. Therefore, videos of lessons are helpful for our learning. (QS.9.358)

Some instructors use videos of commercial products for teaching. For example, we saw the video of “Helicopter operation” and the video of “Chinese martial arts”. (QS.9.139)

Overall, student comments indicated the provision of audios/videos could help their learning by allowing them to review lessons and learn from the interactions that happened in the face-to-face teaching.

### ***Synchronous interaction***

Respondent students had experienced synchronous and asynchronous interactions with peers and their instructors. Over half the questionnaire respondents (51%-188) and five groups had experienced synchronous online discussion to talk with and exchange ideas with instructors and peers. They considered synchronous interactions enhanced their learning because they provided feedback and clarification of course ideas or content. Students noted they could ask follow-up questions which their instructors did not have time to answer or explain in class. One student in Group C noted, “Our Economics instructor put some interesting topics into the online discussion forum to let us discuss ... he also let us ask questions or discuss the subject content in the forum especially when he did not have time to answer or explain in class” (SgCi.3.6.5). In addition, the students valued their instructors responding promptly to their queries, clarifying ideas, from test answers and assignments and posting related materials or answers to tests or assignments in the online discussion forum so they could discuss more online. They noted some of their instructors spent much time and effort in online discussion to interact with them. A representative comment was:

Whenever the students posted the questions on the online discussion forum, our instructors would answer them as soon as possible. Sometimes when instructors did not have enough time to explain the answers of tests or assignments clearly in class, they might put all the

related materials or questions to be discussed in more detail in the online discussion forum. Usually instructors were ready online (SgCi.1.1.10). The instructors need to spend much time and effort to interact with the students and answer student questions in the online discussion forum. (SgCi.3.12.4)

The students also indicated some instructors had their student assistants or teaching assistants help them manage the online discussion and provide prompt responses to them. However, only quarter of the questionnaire respondents (24%-89) and three groups of students had participated in synchronous online discussion in organized groups with their instructor and peers.

### ***Asynchronous interaction***

Nearly two-thirds of the questionnaire respondents (61%-222) and seven focus groups had participated with peers in online projects and reports. Over half (54%-197) of respondents and six groups had undertaken collaborative projects. Focus group students considered they had learned more by sharing experiences with their peers and by doing projects together. The students also considered they could learn more and better from viewing peer projects and or reports online and from interactions or feedback from their instructor or peers on the online projects or reports. In addition, all eight focus groups reported they could interact with their instructors or peers via a bulletin board, email and or ask questions in the online Q and A area. These respondents noted some instructors did not provide an online discussion forum but rather used email or a bulletin board to interact with their students. A student in Group H described this:

Some e-learning courses do not provide online discussion forums so instructors use e-mail or a bulletin board to interact with us. Similarly, we ask questions or interact with our instructors via email. (SgHi.3.5.3)

### ***Other techniques***

In responding to the question about experiences of e-learning teaching, six groups of students reported their instructors had also used other teaching methods to help their learning. These included using a computer broadcast system to monitor their computer screen in class; using the Macromedia Flash program to make animations to explain experiments, cases or examples; using university e-learning system functions (e.g. assignment submission online) to manage student progress, using an online roll-call or awards as incentives. Three groups of respondent students mentioned that their instructors also used online course evaluation forms.

These approaches had been noted on the questionnaire by some respondents. A Chi-square test and Phi value indicated there were minor relationships between the teaching methods experienced and found helpful for learning in student online projects or reports (Chi-square=7.785, df=1, p=0.005, Phi=0.144), collaborative online projects (Chi-square=13.218, df=1, p=0.000, Phi=0.187), and online quizzes and assignments (Chi-square=36.657, df=1, p=0.000, Phi=0.312).

### **E-learning strategies described as being effective**

In line with the focus of the study, students were asked to describe the effective e-learning strategies their instructors had used and nearly three fifths questionnaire respondents (57%-213) and all eight focus groups did so. The following describes their rating of the strategies their instructors had used in the online component of courses.

#### ***Course materials***

A majority of respondent students from the questionnaire (92%) and all eight groups from the interviews indicated course materials provided online was the most helpful and effective strategy their instructors had used in the online component of a course. As explained earlier, a main benefit was that these materials could be viewed and reviewed repeatedly and at the student's convenience until they felt they understood what was required. Moreover, online course materials could help them focus on contents in class as less worked taking very detailed notes. Some typical comments were:

We are not afraid that we cannot take all the course notes in time in class because we can review the course notes online after class. The online course materials can save us much time to reorganize all the course contents and let us easily concentrate on the lectures in class. (QS.9.101)

Our instructors put all their course materials online ... If we found we did not really understand or missed out some parts of course content in class, we could repeatedly review the online course materials at our own convenience. We consider these online course materials are most helpful for our learning. It is the most effective strategy to improve our learning outcomes. (SgCi.3.11.4)

Three students in Group F and some questionnaire respondents noted one instructor used PowerPoint to present figures, pictures and examples of industrial product design and also to explain the main design concepts or key aspects of these products. They reported this instructor also used Macromedia Flash to create

animations to describe the design methods needed for their design projects. Again, the students valued the ability to review these materials until they understood what was involved. As a student in Group F remarked:

Our instructor used PowerPoint to present many figures, pictures, examples, or cases to explain the course content in class and online. It is really helpful for us... In order to demonstrate how to design and draw those figures, our instructor also used the Macromedia Flash program to make animations to show all the detailed steps. We could review and learn how to design and draw the figures for our projects. All these course materials help us to understand the course content better. (SgFi.2.4.2)

Some students indicated online course materials were most helpful because their instructors provided additional examples or cases and these helped them better understand the course content. Four groups commented favourably on online course notes which included real-life examples. Students in Group E reported the use of actual social events and news in their Social Sciences courses motivated them to study and take part in discussions. They said they had an instructor who used examples of economic or political issues such as the national budget or a judicial review in their Politics and Economics course. They reported they could learn how to analyze and/or criticize these situations by reviewing online course notes. Students in Group D described a general education course Satellite Information and Life, in which their instructor used pictures and cases to explain the applications and benefits of satellite information in their daily life. One of the students in Group D said:

Our instructor presented many satellite pictures and cases in class and online. ... He explained how to apply satellite information into our daily life and also described the benefits. For example, the satellite information used in the Geographic Information System (GIS) could help the government to solve the heavy traffic problems. ... In fact, our instructor put many applied cases online which included uses in tourist information, education, environmental information, engineering, and marketing. We could download these to preview or review. We found these course materials very interesting and helpful for us to understand the course content in more detail. (SgDi.5.10.4)

Another view was that instructors assessed online assignments or gave online quizzes as online roll-calls so students would attend the class. Similarly, some questionnaire respondents and three focus groups noted the tests also included the contents of online supplementary materials and video of lessons which were not taught in class so it motivated them study more and hard. Students said usually they were required to preview and review online course materials before and after class but some students did not, so instructors used many online quizzes

before/in/after class to motivate them preview/review and concentrate in class.

Some typical comments were:

The tests also included the contents of videos of lessons which were not taught in class, so we need to preview them before class for online quiz and review them for tests. (QS.9.256)

Our Physics instructor put his course materials online and required us to preview it before class. When the class began, he gave us an online quiz and then discussed its answers and the course content. Before the class ended, he also gave us another online quiz to check whether or not we had paid attention to the lecture and to see what we had learned. We found this was an effective strategy to force us preview course materials and not be too lazy to attend the class so we might study hard for this course. (SgBi.3.6.5)

### ***Audios/videos***

Over a quarter (28%) of students from questionnaires and five groups from interviews considered audios and videos were also effective to help them learn better. Five groups of respondents indicated online audio/video of lessons or student presentations, videos of commercial products, or audios with PowerPoint course content were helpful for their e-learning courses. Students noted the benefit of audio and video provision was that they could download and view or review audios/videos repeatedly and at their convenience. Students noted especially when they could not remember or understand all the procedures of formulae conduction or computer programming design, they needed to review video/audio files after class at their convenience. Some representative comments were:

The instructor recorded her audio explanations of course contents with PowerPoint presentation online. Because the audio/video and PowerPoint file could be accessed synchronously, so we could review the content clearly. (SgCi.1.3.1)

We had audio/video e-contents in the Computer Drawing course. We could listen and view detailed steps and then learn how to draw our industrial design assignment or project. (SgHi.2.2.3)

We need to upload our audio/video files online to present our reports. (QS.9.155)

Our instructor provided all the audio/visual files for his e-learning courses at the Multimedia Center of the university library so we could access them from university library video database online. (QS.9.58)

One questionnaire respondent noted that pre-recorded videos of lessons online were convenient, not only for their review but also convenient and flexible for their instructor's time management, especially when the instructor must be off campus on the lecture day. Moreover, he indicated using video conference teaching was also another choice for the instructors when they were off campus, and sometimes the instructors could invite instructors in another universities or

research institutes to cooperate in teaching the e-learning course together. He remarked:

The instructors can pre-video-record their lessons and let us view at any place or even use video-conferencing style to teach the course with other instructors. It is convenient for the instructors and the students, especially when the instructors are out of campus. (QS.9.88)

Two groups of students noted they had computer video-conferencing experiences. They had many instructors who came from different universities and or specialized institutions. They noted they could face the instructors and ask them questions in class similar to in F2F instruction. A student in Group F noted, “We had one course that used computer video-conference teaching. It is a real-time online distance teaching. We could face our instructors and ask them questions in class” (SgFi.1.1.4). These two groups of students also noted computer video-conference teaching had better interactions than those in the general Distance Education (DE). They noted usually video-conferencing courses initiated for student assistants, so there were not too many students in a class. They reported instructors could use good seminar room with good facilities so their instructors could easily control the class situations. A student in Group A noted, “When instructors provided a video-conference teaching in a good seminar room, we could use microphones to ask questions anytime, but some DE instructions did not have this” (SgAi.1.2.2). These two groups of students noted video-conference teaching was another effective strategy for them to obtain another kind of learning experience in which they could learn from different university or institutional instructors.

### ***Synchronous interactions***

Over one fifth (21%) of questionnaire respondents and only three groups considered synchronous interactions such as online discussions was an effective teaching method to improve their learning and interactions between them and their instructors and with their peers. Online discussion was said to be an effective forum to improve their interactions, partly because they could look back at previous postings. A representative comment was:

We found “online discussion” was beneficial for us because we could post our questions and answers there and discuss with instructors and peers. This method was better than e-mail because we could see all the procedures of our discussions and review them. (SgAi.2.4.3)

Discussion forums became more interesting and engaging when instructors used simulations and provided guidance or strategic support and assistance to help the students assume control of their own learning and reflect upon and readapt activities accordingly. Three groups of respondent students indicated some general education e-learning courses provided very interesting online discussion forums such as in the Plants and Life, and Electricity and Life e-learning courses. These respondent students indicated their instructors used very effective strategies, such as simulations, to organize and carry out the activities to attract their engagement in online discussion. They noted online discussion forums provided them a place to ask questions, discuss ideas and share experiences with their instructor and peers. A representative comment was:

We found online discussion was very interesting and beneficial for us. We had a very interesting 'general education' course which named 'Plants and life'. That instructor developed online discussion very well. We liked to discuss with our instructor and peers and we learned much from them. The instructor and all the students could post their questions on discussion forum and everyone selected one plant name to represent them and they could ask each other some questions about those plants. Everyone needed to be familiar with his/her chosen plant and answered all the questions about his/her selected plant. This method stimulated us to learn all information about our chosen plants... (SgBi.1.1.6)

The aim of synchronous interactions such as online discussion was to improve interactions among instructors and students and improve student learning. These case-study respondent students considered online discussion was very attractive and effective in their e-learning courses, especially when their instructors required their engagement in online discussion and also assessed their performance in online discussion. The descriptions of all three groups of students implied instructors must pay much attention and effort in online discussion and interaction with students and then students could be motivated and guided to learn more efficiently in e-learning.

### ***Asynchronous interactions***

There were different responses from questionnaires and interviews on perceptions of asynchronous interactions. Six groups of respondents from interviews noted asynchronous interactions such as a bulletin board, or email, or Q and A area, or student (collaborative) projects online was an effective strategy but only few questionnaire respondents (11%) considered asynchronous interactions was effective. These asynchronous interactions were said to be effective in supporting

the interactions among them and or addressing the lack of knowledge or course content. Six groups of students noted some instructors used a bulletin board or email to interact with them. They indicated their instructors provided emails to them so they could interact with their instructors when necessary after class such as make appointments or ask questions. They reported their instructors frequently posted messages on the bulletin board to notify them about the class information such as up-to-date course materials or class schedules. They found this could result fewer interactions in e-learning. Some representative comments were:

If our instructor had new materials or some emergent information to notify us, he or she will put messages on bulletin board. Usually we check bulletin board at least once per day. Simultaneously, any one of our classmates knew that notice they also passed those messages to all of us. (SgCi.1.4.4)

Usually we checked the bulletin board very often. We could obtain much information from our instructors such as the time schedule or the content for test. We also looked forward to see whether or not some new materials or class notes were online. (SgBi.2.5.1)

They noted their instructors provided an online Q and A area so they could ask questions. Their instructors also put popular Q and A records online so they could learn more from what their peers had asked, especially when they were shy or did not know how to ask the questions. Students said this method could encourage students to think or learn how to ask the questions and interact with their instructors or peers. This showed that asynchronous interaction on Q and A area or records could help them learn more and better by way of interactions and course content.

Three groups of respondent students indicated provision of student project reports or collaborative project reports online was also an effective strategy to improve their e-learning. They noted their instructors put all or good students' reports online which included the interactions or feedback from their peers or instructors. They reported the feedback or comments from their instructor or peers were helpful for them to learn more and better. A student in Group E noted, "Our English instructor put all or good students' reports online. We could see what the instructor's comments were on those reports. ... We could learn more from the instructor's comments and share experiences with peers" (SgAi.2.6.8). A student in Group D also reported, "Our Mechanical Engineering instructor gave us collaborative projects in the 'Computer Aided Design' course so we could learn

with our peers by doing the collaborative projects” (SgDi.3.5.2). These comments suggest that asynchronous interactions on student project reports or collaborative project reports also could help or improve student learning.

### *Other strategies*

Students from questionnaires and interviews had similar comments on other effective strategies. Few respondents (8%) from questionnaires mentioned that some instructors used other strategies to improve their learning quality such as synchronous distance teaching, monitoring computer screen, roll-calls and demonstration of practical operations. Five groups from interviews reported their instructors used some effective strategies to attract their engagement in e-learning to improve their learning outcomes such as monitoring computer screens, video conferencing, demonstrations of practical operation, online quizzes, roll-calls in class, and assessing their performances or awarding additional marks in the online or e-learning components. For instance, the respondents from both questionnaires and interviews indicated their instructor used the computer monitoring system to control their computer screens to be synchronized with the instructor’s screen so they could concentrate on the lectures. As a student in Group B noted:

We had e-learning course in the Computer Center classroom and our Physics instructor monitored all the computer screens when he showed his e-contents. When he required us to do some exercises, he switched the broadcasting screen to individual screen. Therefore, students could concentrate on the lectures and learn better. If our instructor did not monitor our computer, we might wander in the Internet and not listen to the lectures. (SgBi.5.8.3)

All five groups of students indicated their instructors demonstrated how to use e-learning system at the beginning of semester so they would know how to access the online components. They noted this was very important and effective for them in their e-learning. These five groups of students and some questionnaire respondents also reported some instructors demonstrated the practical operations in class and/ or put demonstrations online so they could review them repeatedly and learn better. A student in group D remarked:

Our instructors demonstrated how to use e-learning system in the computer room when the semester class started, so we could learn how to access online course materials ... They also demonstrated the practical operations of the experiments in class and or put online so we could learn better and really understand the course contents. We considered the instructors guided us how to operate and explain all the detailed steps and related information was an effective teaching approach (SgDi.5.3.8).

All these five groups and some questionnaire respondents indicated their instructors considered their students would become lazy and passive due to the provision of the e-content so their instructors used roll-call or online quizzes in class to push them to attending the class. They noted this was an effective strategy for those lazy and passive students to learn better. One student in Group E described this:

Many instructors used roll-call or quiz in class to keep their students attending the class sessions because the instructors were afraid of provision of the e-contents would let their students become lazy to attend the class. We considered it was an effective strategy to force students to attend the class. (SgEi.5.2.7)

Four groups of respondent students indicated their instructors also assessed their performances in online discussion or awarded additional marks to attract their engagement in online discussion. A student in Group B noted, “Most students were active in online discussion but still had few students were passive and not engaged in the online discussion. In order to improve their engagement, our instructor also assessed our performances in online discussion” (SgBi.1.2.1).

All the strategies above, monitoring student computer screen, (online) roll-calls, quizzes, and awarding additional marks were considered to be effective to keep students concentrating on the class lectures, participating in F2F instruction and or online components of e-learning and then improving their learning outcomes.

#### **6.2.4 Section summary**

A majority of students from questionnaire and interview respondents were males, undergraduates, and non-science majors. Overall, a majority of students were relatively inexperienced with e-learning. They had taken fewer than three e-learning courses and had two or fewer years experience in e-learning. However, they rated themselves as having a reasonably high level of e-learning ability. A majority of respondents were not familiar with either national or university e-learning policy suggesting they had not been affected by these policies in their use of e-learning. A majority of respondents preferred a blend of face-to-face and e-learning teaching; of these students, two thirds preferred to learn with a partner or in a group.

The students noted their instructors used different teaching methods and strategies to motivate their engagement in e-learning and to improve their learning outcomes. Nearly all students noted the provision of online up-to-date course materials in the form of lecture notes, syllabi, cases, real-life examples, references, online quizzes or tests or assignments as being helpful to motivate their engagement in e-learning, strengthen their intention to view or review the materials at their convenience, and assist them understand the course content. The provision of audios/videos allowed students to review lessons and learn from the interactions in the face-to-face teaching. Some students noted audios/videos had provided the flexibility of teaching and learning for the instructors and students, especially when the instructors were off campus.

Synchronous and asynchronous interactions were effective to improve student learning and provide more opportunities to interact with peers and their instructors in e-learning. They could support different aspects of learning such as addressing lack of knowledge and learning strategies to access online or talk in online discussions, and coping with fewer interactions and inappropriate learning attitudes in their e-learning practice. Students said their instructors and peers could provide immediate feedback and clarification of course ideas and content in synchronous interactions (e.g., online discussion). Students could ask follow-up questions which their instructors did not have time to answer or explain in class. Students noted their instructors spent time and effort in online discussion so it motivated their interactions with instructors and peers and improved their learning, especially when their instructors required their engagement and also assessed their performance in online (group) discussion. Discussion forums became more interesting and engaging because instructors used simulations and provided guidance or strategic assistance to help students assume control of their own learning, then reflecting upon and readapting activities accordingly. The students asserted they could learn more and better from working collaboratively with peers and viewing peer projects/reports online and the feedback from their instructor or peers on the online projects/reports. They noted they could interact with their instructors or peers asynchronously via a bulletin board, email, or asking questions in an online Q and A area. Other techniques such as using university e-learning system functions (e.g. assignment submission online), roll-calls or

awards as incentives were used to manage student progress and to attract their engagement in e-learning. The aim of these teaching approaches was to stimulate students to concentrate in the face-to-face class lectures and review online course materials so they could improve student learning outcomes. And the reason was to enhance student interactions with their instructors and peers.

E-learning in this study refers to the online component of blended learning. As such it has its own benefits and challenges. The following section describes student perceptions of the benefits and challenges of e-learning and the main differences they perceived between e-learning and face-to-face instruction.

### **6.3 Perceived benefits and challenges of e-learning**

The focus of this section was to obtain students' perceptions and experiences of the benefits and challenges of e-learning and these will be considered as factors influencing their use of e-learning. This section sets out perceived benefits and challenges of e-learning practice from the quantitative questionnaire and qualitative interview data.

#### **6.3.1 Perceived benefits**

Data on the benefits of using e-learning came from closed questions in the student questionnaire and the focus-group interviews. Questionnaire students were asked to select benefits from a list and then go back to put a second tick beside the benefits they considered important for their use of e-learning. Of the 376 respondents to the questionnaire, 363 answered the question asking them to select the benefits of the e-learning in a blended learning course format. Three hundred and fifty-two of these respondents also indicated which benefits they found important. Based on the data analysis of student selections of e-learning benefits from the questionnaires and the descriptions from the focus-group interviews, five categories of e-learning benefits were identified: flexibility of learning, increased ICT knowledge and skills, better student learning and learning outcomes, improvement of interaction and savings in course cost and time. The questionnaire responses are summarized in Table 6.4 below.

Table 6.4  
*Frequencies of benefits for the students and found important*

Category	Benefit	Respondents		Found important	
		N (=363)	% of N	N1 (=352)	% of N1
Flexibility of learning	Flexibility of learning	334	92%	271	77%
Increase ICT knowledge and skills	Improve ability to adapt the information age	251	69%	175	50%
Improve student learning and learning outcomes	Easily manage assignments or reports	240	66%	154	44%
	Help to identify their understanding	168	46%	102	29%
	Improve their learning quality	154	42%	103	29%
	Improve motivation	127	35%	76	22%
Improvement of interaction	Improve interactions with instructors	173	48%	115	33%
	Improve participation and cooperation	142	39%	91	26%
	Improve interactions with peers	139	38%	89	25%

### *Flexibility of learning*

Flexibility of learning was the benefit of e-learning most commonly perceived by students. A majority (92%-334) of questionnaire students and all eight student focus groups identified flexibility of time and place of learning a benefit of their use of e-learning resources. Seventy-seven percent rated it as the most important benefit. The flexibility of e-learning offers greater ongoing access to course materials for student review any time, any place and at their own pace. As has been discussed, students reported e-learning as a convenient way for them to verify and familiarize themselves with course materials and content, particularly before exams. Online material was also helpful if students were absent from class. A student from Focus Group C summarized these benefits:

We can review the course content at our convenience. Sometimes we could be absent from class and review unfamiliar parts of class work after class or before a test ... especially for the theory course, we could not remember or understand all the procedures of a proof or solution processes so we needed to review the video files after class. (SgCi.2.6.1)

### *Increased ICT knowledge and skills*

Over three fifths (69%-251) of students and six groups of interviewees regarded the improvement in their ability to use technology adaptable to the information age as a benefit arising from their use of e-learning. Overall, half (50%-175) of the students said it was important. Interviewees said e-learning could help students increase their ICT knowledge and skills to adapt to the current information age and become life-long learners. As a student from Focus Group C said:

The application of e-learning includes many kinds of learning activities online and it needs high literacy of technical knowledge and skills to engage in. Our instructors provide us various online course materials and different types of interactions so we need to learn how

to use different sorts of computer technologies and multimedia facilities to access them. We think e-learning could increase our ICT knowledge and skills to adapt to the current 'information age' or 'knowledge economy age'. Although many e-contents are not related to our current course study, we are very interested on them and we hope we can learn them for a life long. (SgCi.4.6.8)

### ***Improve student learning and learning outcomes***

The benefits included ease in managing assignments or reports; help in identifying their particular areas of understanding; improving the learning quality; and improving motivation were identified. Sixty percent (240) and five groups of interviewees noted e-learning made it easier for them to manage their homework or reports with 44% (154) respondents saying this was important for them. Interviewees said the e-learning system allowed them to submit their homework or reports online and their instructor often required them to submit it before the due date. They noted this benefit forced them to manage their study program and improve their learning outcomes. They said they could keep all their academic work online. Nearly half (46%-168) of the students indicated greater opportunities for self assessment, which had in turn helped them identify content areas they understood poorly. They could then do more relevant study. Twenty-nine percent (102) of students said this was important to them. Some students identified an improvement in student learning quality (42%-152), with 103 (29%) saying this was an important benefit. Respondents also reported e-learning could improve student motivation to study (35%-127), with 76 saying this was an important benefit of their use of e-learning. These benefits suggested e-learning could provide students with different sorts of independent learning approaches and help them become more active, self-motivated and self-managed learners and, as a result, they thought their learning outcomes were better.

### ***Improvement of interaction***

Nearly half (48%-173) of the questionnaire respondents and four focus groups reported e-learning had improved their interactions with course instructors, with 44% (154) questionnaire respondents saying this was important. Respondent interviewees said they often asynchronously (e.g., email) or synchronously (e.g., online discussion) interacted with their instructor outside the class. Nearly two fifths (39%-142) of questionnaire respondents noted e-learning had improved their class participation and cooperation. A quarter (26%-91) reported it was an

important benefit. Interviewees noted their instructor provided collaborative projects or online group discussions to motivate student participation and cooperation in e-learning. Some students reported improved interaction with their peers (38%-139), with 25% (89) describing this as important for them. Interviewees reported e-learning provided them with more opportunities and different sorts of interactions with their instructors and peers than face-to-face instruction, especially after class.

### ***Savings in course costs and time***

Focus group students reported another benefit of the online quizzes, tests and assignments associated with e-learning was that they could save students money on course paper. Students also noted that they received online answers and results immediately after they submitted them so they did not need to print out the question and answer sheets. Furthermore, students indicated e-learning could save instructors time and effort in printing out lecture notes, question and answer sheets for the quizzes, tests and assignments and it also saved the university money. This benefit is significant for the university, instructors and students in terms of money and time. There was also an implication that students were motivated to learn because of the immediate response of answers to assignments, quizzes, and tests.

All benefits mentioned above were synthesized from a question asking students to select e-learning benefits from a list in the questionnaire and the descriptions of benefits from focus-group interviews. In sum, student perceived e-learning benefits were e-learning offered flexibility in time and place and own pace of learning; increased ICT knowledge and skills appropriate for the current information age and learn long-life learning; helped the use of more active and independent learning approaches; provided more opportunities and different sorts of interactions; and saved money and time for students, instructors and the university.

### **6.3.2 Perceived challenges**

This section sets out the descriptions of the challenges students faced in their e-learning courses. The data is from eight groups of students in interviews and the

221 students who responded to an open-ended question in the questionnaire. Based on respondent descriptions and the literature, sub-categories were synthesized from questionnaire and interview responses. Two dominant categories, personal and technology, were grouped from those sub-categories and will be described in more detail next.

### **Personal challenges**

Personal challenges are the problems students face in using the e-learning system and/or e-learning course materials. These included the requirement for a different, more active learning attitude and a new type of interaction approach; the time taken; a preference for face-to-face instruction; and the nature and extent of e-learning course materials. Students indicated personal issues affected their views of e-learning resources.

#### ***A different and more active personal learning attitude is needed***

E-learning demanded students become more active, diligent and self-managed learners. Over two thirds (69%-152) of questionnaire respondents noted that they needed to change their learning attitude and role in the e-learning environment. Some students from the questionnaire noted they found e-learning's demand for self discipline challenging with requirements of good time management (43%) and good personal organization ability (22%). Some students in the questionnaire reported they did not have an active and diligent learning attitude, so if the online component was not required for course completion (31%), or assessed (24%), they might not use e-learning resources. Some illustrative comments were:

E-learning is different from face-to-face learning. The instructor has changed their teaching approaches and role in e-learning so we also need to change our learning attitude, role and learning approaches to adapt to the e-learning. Usually students are passive and lazy in their study. However, e-learning often demands we need to become more active and diligent and have good time management and organization ability because it always takes students much time and effort to engage in the online learning activities. So we need to change our learning attitude and manage our study program well otherwise we will face many challenges in our e-learning. (QS.20.298)

Our instructor often uses many different effective strategies to motivate our engagement in e-learning such as course assignment completion before the due day or assessing our performance in online discussion, so we need to become more active and diligent to meet our e-learning course requirement. (QS.20.352)

E-learning can provide many various course materials and different ways of interaction and assessment online so we need to learn different learning approaches and have good time management ability for our e-learning especially for online assessments. Usually e-learning

takes us much time and effort to access and interact online so we need to change our learning attitude and become more active, diligent and self-managed learners in e-learning. (QS.20.68)

All eight focus groups listed the necessity of a course credit for their degree as well as personal interest and learning attitudes to e-learning as factors that influenced their decision to take courses involving e-learning resources because they knew e-learning required extra time and effort to study before or after class. Students feared they were not diligent and active learners, thus in some cases sought to avoid e-learning courses, particularly when instructors rigorously required participation in online discussion, quizzes, tests or assignments, and asked students to preview or review audios/videos. They noted their learning outcomes were reduced if they were not active and diligent learners. A typical comment was:

We face the challenge of a role change for students and instructors. Personal learning attitude is different from that in the traditional F2F instruction. Students must become more active and diligent learners. The information we learned is not just from the instructors but also from others. We need to have self-controlled ability to manage our e-learning time and progress. (SgCi.5.3.2)

Students considered the provision of comprehensive e-content might decrease their attendance and or concentration on lectures in class. They also noted increased pressure to keep up with their peers as they were able to observe their progress online through, for example, progress in online assignments or discussions. Conversely, they reported a reduction in pressure from their instructors (e.g. roll-call in class) and felt this could be de-motivating, perhaps allowing them to become lazy. Therefore, students noted they needed to actively manage their e-learning time and programme well. Students in six of the eight focus groups suggested online discussion could become uninteresting and ineffective if their instructors did not make full student engagement in online discussion compulsory. Four groups of students also doubted the effect of awarding additional marks for student performance in online discussion. They noted students in Taiwan seldom actively ask questions but instead wait for others' questions. They proposed students might not know how to ask questions. Combined, these issues suggest students perceived their learning attitude impacts upon their use of e-learning, particularly with respect to the need to be more pro-active and organized.

### ***A new interaction approach is required***

A new interaction approach was required because e-learning instructors adopted different pedagogical approaches to work with the new media in e-learning. One third (33%-72) of questionnaire respondents noted the need for a new interaction approach as a challenge. Student psychological barriers were also considered an important challenge, influencing student use of e-learning resources, particularly participation in online discussions. These barriers included fears of others accessing their personal information (36%), discomfort with e-learning tools or methods (25%) and fears of expressing opinions in public (18%). Some questionnaire respondents indicated they felt uncomfortable facing inhuman computers to ask questions or have discussions with their instructors and or peers. They noted they missed being able to monitor facial expressions and voice tone. A student noted, "In e-learning interaction or discussion, we only can communicate by using words but no facial expressions or body or tone language" (QS.14.36). Some also mentioned the importance of the role of the instructor in efficiently helping them to overcome learning barriers and solve problems when challenges arose.

The students from the focus group interview indicated they experienced two new kinds of interactions in their e-learning courses that presented challenges to them. These interactions were synchronous and asynchronous interactions. Synchronous interactions included online discussions or chat (online group discussion). Some students experienced time-match problems in online group discussion. Asynchronous interactions included online feedback from their instructors or peers on their projects or reports or interactions via email, a bulletin board, or online Q and A. They indicated they faced different demands in communication methods and quality. Some said they faced the challenges of no prompt response, slow and incorrect access. Others had difficulty including figures, formulae and symbols in their contributions to online discussions. Some typical comments were:

The interactions among instructors and peers within e-learning became fewer and worse than the interactions in F2F because the e-learning instructors cannot always respond in a timely manner and the current technologies do not allow the interactions access correctly and fast enough to up-to-date (SgBi.4.3.5).

When we ask questions or discuss with instructors and peers online, it is difficult to express our questions or ideas clearly, especially for mathematical formulae expressions or science symbols (SgEi.5.2.6).

Furthermore, some students in the focus groups noted students might be reluctant to ask or answer questions or discuss topics with their peers or instructors online due to possible embarrassment or harassment by peers. They also noted some students might consider they lacked privacy in some e-learning courses because they could not use pseudonyms online.

### ***A preference for face-to-face instruction***

Student preference for face-to-face instruction also posed a challenge to student use of e-learning resources. Some questionnaire respondents (35%) reported that their preference for face-to-face instruction inhibited their use of e-learning technology. Some students in all eight focus groups also suggested working from a textbook was faster than viewing videos or other materials online, so they preferred face-to-face learning and mainly studied the textbook.

### ***Accessing online resources can be time-consuming***

Student questionnaire and focus group responses indicate students do indeed believe e-learning resources may aid their learning. However, accessing and using these resources can be time consuming, particularly if the resources are badly organized. Students noted they needed to spend time viewing the videos of lectures and course materials and participating in online discussions. Six of the focus groups remarked that while they appreciated instructors posting supplementary material, this took extra time to view. Videos more than an hour long were identified in particular as requiring extra time to view and understand.

A representative comment was:

We feel very tired because we need to watch the video and write down notes simultaneously. And sometimes we need to rewind the video tapes if we have missed something. Usually it takes double or triple the time of a face-to-face class time. (SgBi.1.2.2)

Science students indicated they had heavy learning loads in science e-learning because their instructors provided additional e-content. They noted they needed to repeatedly review videos of lessons after class, especially for formulae based

lessons, because abstract concepts were not easily understood although their instructors explained the ideas one by one in class.

Four focus groups also indicated they felt navigating and responding to the interactive elements of the online component and figuring out how to use the supporting tools was time and effort intensive. The effort involved in this more 'technical' aspect may compromise the mental resources they had available for comprehension and achievement of the learning goal itself. It may also lower their motivation and lead to them becoming disengaged. To avoid this, students suggested that instructors should include guidance on how to navigate and use course materials as part of online course materials. Students noted navigation of e-learning systems themselves could be difficult due to their complexity and a frequent lack of clear and well-designed guidance and instruction.

Some students in all eight of the focus groups complained about the time taken to upload assignments from the Internet and complete online assignments or tests that included many science symbols or mathematical formulae. They reported e-learning required students to spend considerable time typing assignment or test questions and answers into the computer. Due to the time involved in this, many students reported they preferred to hand in written assignments or tests, especially those that involved a large number of science symbols or mathematical formulae.

### ***The nature and extent of e-learning course materials***

Students also faced challenges due to their preference to work from hard copies of resources. For example, some students in all eight focus groups noted they preferred to have printed course materials or textbooks because it was more convenient for them to read or review the course content in the library. Written material was identified as especially preferable to e-content that was poorly designed and over-supplied. Five of the student focus groups reported feeling easily tired if required to look at the small computer screen for a long period of time to review online course materials. They also had concerns that it may be detrimental to the health of their eyes. Some student questionnaire respondents raised similar issues. Furthermore, they feared a widespread move to solely

web-based study may lead to a lack of student respect toward instructors and a lowering of university values and standards.

Three focus groups of students indicated some instructors did not like to put their course materials or videos online or open them to other students or the public. They thought these instructors might be worried about the copyright of their course materials and videos. This suggests students perceive instructor perceptions of intellectual property issues to do with e-content as a hindrance to the availability of e-learning resources.

When students were asked to describe the challenges they faced in their e-learning courses, nearly half (48%-107) of the questionnaire respondents noted the new learning approaches required, course attributes and assessment changes were problematic. Six focus groups reported their instructor usually explained faster than usual in their science e-learning courses because he/she had already put all the formulae statements on PowerPoint files. Students noted they needed to get used to various types of e-content and differences in course attributes influenced their use of e-learning. In addition, the assessment of their learning outcomes was often different from that in F2F instruction. They also worried about the dishonesty and unfairness on their online assignments or tests because some students used cut and paste methods to copy peers' answers.

### **Technological challenges**

Technological challenges are broadly defined as challenges surrounding issues of familiarity with new technology and technical problems encountered by students, for example, network bandwidth, computer facilities, and storage and technology operation. Here four categories of technological challenge are discussed: easy access to necessary computer equipment, technical skills to access computer technology and the e-learning system, technical skills for communication, and the quality of e-learning computer facilities and technology.

### ***Technical skills to access the computer technology and the e-learning system***

Students need to be proficient with the technology required for e-learning. Just over a quarter (27%) of the student questionnaire respondents indicated they

lacked the necessary technical skills to properly engage in e-learning. They noted the complex nature of the e-content demanded high technical literacy. Students felt they needed not only to be familiar with new technologies but also to be able to deal with technical problems encountered, such as network bandwidths, computer facilities and storage and technology operations. Many students reported they were indeed comfortable using the e-learning system (60%) and several that the technology motivated them to use e-learning (37%). Conversely nearly a quarter (23%-50) of the questionnaire respondents found the technological requirements challenging due to a lack of familiarity with the university e-learning system and the recently up-dated ICT facilities, as well as with multimedia operation. Similarly, six of the student focus groups reported their peers had difficulties using e-learning systems due to a lack of technical skills. Typically, students reported overcoming these problems by asking peers for help.

#### ***Technical skills for communication***

One third (33%-72) of questionnaire respondent students indicated they struggled to communicate their ideas in online discussion when this involved the use of figures or pictures. They were only able to post text and not figures or pictures in the online discussion forum of the university e-learning system and so sometimes they could not express their ideas clearly. They had difficulty with their online writing skills and typing ability, particularly identifying Chinese characters, formulae and symbols as slow to type. Thus, they proposed the university should improve their computer facilities or the e-learning system interface by providing, for example, digitizing tablets, drawing tablets or network online talk programs like MSN and Skype. Respondents indicated they also worried about the difficulty of typing formulae or symbols in online assignments or tests due to their own lack of personal technical skills and ability. They mentioned it was important instructors efficiently help their students overcome such learning barriers.

#### ***Easy access to necessary computer equipment***

Over one third (34%) of questionnaire students identified a lack of easy student access to the necessary computer equipment as a challenge to their use of e-learning. They required more VOD computer facilities on campus and would also like to be able to do this at home. Specific equipment was necessary for some

aspects of e-learning teaching, particularly for video-conferencing. Two of the student focus groups stated that they often spent some time at the beginning of lectures waiting for the computer video-conferencing equipment to work around all the cooperating universities. Students expected all the cooperating universities to provide functioning classrooms and facilities for e-learning.

***The quality of e-learning computer facilities and technology***

All eight student focus groups indicated the quality of the audio/video files or tapes they could access online affected their learning and even changed their learning attitude. They reported that the present quality of audio/video files and tapes for e-learning was poor. Sometimes they were unable to see the images or content clearly or hear the audio. Access to computers with the requisite processing speed so the content could be speedily accessed was also a limitation for some students. They noted that very often the complex nature of the e-content required their computers to have a graphics card, high processing speed and, often, specific software. Moreover, some students indicated they lacked the high quality network and facilities required to upload assignments online. Four of the focus groups and over two fifths (44%-54) of the questionnaire respondents agreed that technological support services should be available to assist their use of e-learning technologies. These students noted they needed access to more adequate and higher quality e-learning related computer technology, peripherals and other multimedia accessories. A stable, reliable, easy-use, fully functional and high performance e-learning system was considered necessary. A high quality network for e-learning practice involving a high enough network bandwidth, fast speed for image presentation, good network management, and enough computer storage space was also considered important.

While access and quality of access was identified as an issue by most students, the nature of access and quality issues was not universal. Students in the focus groups who had an up-to-date laptop requested a wireless environment, whereas others who could not afford to buy laptops hoped the university could provide the advanced technology. Some students indicated miscellaneous multimedia accessories were necessary to improve their learning efficiency and quality such

as video-recorders, scanners, and multimedia or audio-visual facilities for interaction or online Q and A.

### **6.3.3 Section summary**

This section has described student perceptions of the benefits and challenges of e-learning, and its main differences from face-to-face instruction. Respondent students perceived benefits and challenges in e-learning were related to personal, and technological issues. Five categories of e-learning benefits were identified: flexibility of learning, increased ICT knowledge and skills, better student learning outcomes, improvement of interactions and saving in course cost and time.

Students reported they faced personal, pedagogical and technological challenges. Students said a different and more active personal learning attitude and new types of interaction approaches were needed. They noted accessing online resources could be time-consuming. Students were also concerned about the nature and extent of e-learning course materials and their instructor's attitude to the copyright of e-content. A preference for hard copies of resources, well-designed e-content supplied appropriately, eye strain, and lack of student respect toward instructors and the university were concerns. The need for new learning approaches, course attributes and assessment change were the most problematic pedagogical challenges. Furthermore, even though the Taiwan government has worked to provide widespread public access to computers over the last decade, students in both the questionnaire and focus group interviews noted they had experienced difficulties accessing the requisite technology for participation in e-learning. A personal lack of easy access to these technologies, as well as a lack of skills necessary to use available computer and communication technology, had hindered student use of e-learning resources. Even when students did have access to computers, there could be issues to do with the quality of this access, for example other technologies (e.g., good quality of audio-video facilities or network) related to e-learning practice were sometimes required.

Face-to-face instruction and e-learning each were considered to have their own advantages (i.e. benefits) and disadvantages (i.e. challenges) and these were considered as their differences. The respondent students indicated e-learning

might lead them change their learning attitudes to be more active and diligent and could improve their personal time management and organization skills. They also noted that in their face-to-face instruction they had better interpersonal interactions between them and instructors; more privacy; more immediate responses in learning; more concentration on the lectures; and learning quality than e-learning and it was appropriate for more advanced technical courses. Respondents considered e-learning had more flexibility in learning so they could review course materials repeatedly at their convenience. They noted e-learning might be suitable for general common courses and it could save much cost on waste paper and travelling. However, e-learning required costs to buy necessary or better computer technology facilities and also required better personal technical skills to access e-learning courses. Disadvantages of face-to-face teaching can be overcome by e-learning function, but e-learning can not replace some aspects of face-to-face instruction.

## **6.4 Factors influencing the use of e-learning**

In addition to describing their experiences and perceptions of benefits and challenges they had faced, students were asked to identify factors that influence their use, or not, of e-learning. The aim of these questions was to gain a more detailed insight into why and how students participate in e-learning. This section sets out factors that influence student use of e-learning. Several themes emerged from the quantitative and qualitative data. The four most dominant were most evident when students described their uses and expectations of e-learning and have been grouped as personal, pedagogical, technological and policy factors. Some other minor factors, external professional and private factors, are also described in this section.

### **6.4.1 Personal factors**

Students discussed a number of factors pertaining to their own preferences, interests and attitudes as influences on their use of e-learning. These were student personal interests and preferences in taking e-learning classes and using e-learning, personal learning attitude, learning load, and perceptions of benefits and

challenges in e-learning. The perceptions of benefits and challenges in e-learning were discussed in detail in Sections 6.3.1 and 6.3.2.

### **Personal factors that encourage student use of e-learning**

Student commentary from the questionnaires and interviews included mention of student perceptions of e-learning benefits, personal interests and preferences in taking e-learning classes and using e-learning, personal learning attitude, and learning load as influences on their choice of e-learning courses and or use of e-learning. Questionnaire respondents were asked to select from a list of personal factors those that encouraged them to use the university e-learning system and then to go back and put a second tick beside the factor they considered the an important influence on their use of e-learning. They could tick many as applied. Of the 376 respondents, 368 replied to this question. Three hundred and sixty-three students indicated the factor they found to be an important influence. All eight focus groups indicated personal factors such as interests and attitudes to e-learning as influences on their taking and using e-learning.

A majority of students from questionnaires reported they were affected by the benefits of e-learning of being able to learn more flexibly (74%), improve their learning efficiency (64%) and quality (60%), and improve their personal grades (44%). All these benefits were considered as important factors in their use of e-learning, 62%, 53%, 38%, and 39% respectively. Some students indicated their learning attitudes were affected by the requirements from their instructors (51%) and, or pressures from their peers to use e-learning (29%). These two aspects of e-learning attitude were considered as important factors to their use of e-learning, 39%, and 25% respectively. Some students (41%) considered taking more responsibility in their e-learning practice also influenced their use of e-learning and nearly two fifths (37%) of respondents thought this would be considered as an important influence. A Chi-square test and Phi (effect size) value showed there was a significant relationship between student personal factors as influences on their use of the university e-learning system and those factors being important (all Pearson Chi-Square Asymptote Significance equal to  $0.000 < 0.005$  and Phi values approximately between 0.2 and 0.4).

Some respondents to the questionnaire indicated other personal factors such as personal curiosity or motivation from instructors who used the university e-learning system frequently, convenience in managing their assignments and review of course materials and videos, and ease of keeping those well-organized course materials for a long time influenced their use of e-learning. Meanwhile, other respondents indicated the technology such as a fast speed of network and Internet led them to learn more and easily search more online course or test related information to improve their learning on other non-major subject fields. Further evidence of personal factors that encouraged student use of the university e-learning system came from responses to a question on perceived benefits of e-learning (see Section 6.3.1).

However, findings from the interviews indicated personal interests and learning attitudes might most influence their usage in e-learning. All eight groups of students considered whether courses were offered as credits towards degree, then they noted personal interests and learning attitudes to e-learning influenced their taking and using e-learning. They noted that personal interest in the course contents were more important than other incentives or supports in e-learning components. As a student in Group C stated, “We liked to see what the course contents were and then decided to take it or not. It all depended on our personal interests on that e-learning course or not” (SgCi.2.7.5). Personal learning attitudes also would influence their choice of e-learning courses. They noted their learning outcomes would become lower if they were not active and diligent learners although they knew e-learning had its benefits such as flexibility of learning, improvements of their learning efficiency, quality, and even their personal grades. As a student in Group A explained:

We considered personal learning attitudes would influence student choices of e-learning courses. If students could study hard in class no matter instructors provided their course materials in e-learning or not, it would be fine. However, if the students were lazy and they did not attend the class, they might get into troubles. Usually those lazy students always thought they would review the videos or online materials later and at their convenience so they might be absent from the class. However, those lazy students did not review all the online materials before exam. ... Therefore, they might choose non e-learning (i.e. only face-to-face) courses. (SgAi.2.5.1)

### **Personal factors that hinder student use of e-learning**

In the questionnaires, students were asked to select from a list of personal factors that hindered their use of the university e-learning system. Of the 376 respondents, 367 replied to this question. Some students indicated they were hindered in their use of e-learning by personal ability, psychological barriers, preferences, and passive lazy learning attitudes in their use of e-learning. Some students indicated they had challenges of self-discipline ability in the requirements of good time management (43%) and good personal organization ability (22%) in their e-learning practice. Some students reported their preference of face-to-face instructions (35%) inhibited their use of e-learning. Psychological barriers also hindered their use of e-learning, issues such as fear of others accessing their personal information (36%), discomfort with e-learning tools or methods (25%) and fear of expressing opinions in public online (18%). Some students reported they did not have an active and diligent learning attitude, so if the online component is not required to complete (31%) and is not assessed (24%), they might not use e-learning. This showed that personal ability, psychological barriers, preferences, and learning attitudes would hinder student use of e-learning.

Similarly, eight groups of students from interviews indicated personal interests, learning attitudes, learning loads, time constraints, preferences, and other personal challenges would hinder their use of e-learning. They indicated personal interests and learning attitudes might most influence their usage of e-learning. All eight groups of students noted usually they would see whether the course content was interesting to them and then decide whether or not to take it. They all noted that a majority of students were lazy and passive in learning. They reported if students could be active to study hard before/in/after class at usual time rather than during the exam period, they might not need to spend much time studying hard in rush hours before exams. A student in Group C remarked:

Usually we studied hard in class, so we did not spend much time on reviewing course materials online every time after class. Majority of students did not preview or review course materials until before exam and it was impossible to complete reviewing all course contents because they did not have enough time to prepare all their courses at that short period. Therefore, they should study hard at usual time. The key aspect is the students must be active, diligent, and self-disciplined learners. (SgCi.2.5.3)

Some instructors rigorously requested their students preview or review extra course materials online. When this happened students felt their learning loads were too heavy so they might not choose that e-learning course. This suggested students needed to have active and diligent learning attitude and to have good time management ability to overcome these personal challenges. Eight groups of students also indicated some of them were reluctant to spend much time online to view videos and participate in online discussions. They indicated time constraint was a problem in viewing videos and engaging in online discussions.

Student preference for face-to-face instruction and reading textbooks also influenced their use of e-learning. Some students in eight groups noted viewing the textbook would be faster than viewing videos or other materials online, so they preferred to choose face-to-face and mainly studied the textbook. If students felt they could get more of face-to-face, they also would choose face-to-face instruction. Some other personal challenges also hindered students using e-learning such as eye strain, easily becoming absent-minded and falling asleep, psychological barriers and personal access or skills to necessary computer technology. The more detailed personal challenges have been described in Section 6.3.2.

#### **6.4.2 Pedagogical factors**

This section will describe the pedagogical factors that influenced student use of e-learning. Pedagogical influences for student use of e-learning have been described and synthesized in instructor's teaching methods and effective strategies in Section 6.2.3. In order to obtain more information on pedagogical aspects in e-learning courses, in the questionnaire students were asked to select from a list of course, organization factors that encouraged their use of the university e-learning system. Of the 376 questionnaire respondents, 367 replied to this question. Three hundred and fifty-five students indicated which factor they found to be an important influence. All eight focus groups of students also described pedagogical factors in the interviews. The following will describe the course organization factors that encouraged their use of e-learning.

## Course organization factors that encourage using e-learning

The questionnaire responses are summarized in Table 6.5 below.

Table 6.5

*Frequencies of course organization factors and found important*

Course organization factors	Influence		Found important	
	N(=367)	% of N	N1(=355)	% of N1
Well-organized course materials	308	84%	244	69%
Course notes offered before class	298	81%	235	66%
Detailed online syllabi	273	74%	185	52%
Clear links between F2F and online support materials	265	72%	189	53%
Rapid instructor response	255	70%	182	51%
Prompt online comments on assignments	198	54%	141	39%
Prompt online comments on online discussion	188	51%	108	30%
Online quizzes	72	20%	71	20%

A majority of questionnaire responses indicated well-organized course materials (84%) and course notes offered before class (81%) dominated. These two aspects were considered as important factors for their use of e-learning, 69%, and 66% respectively. Nearly three quarters of the students reported online syllabi (74%), clear links between face-to-face and online support materials (72%), and rapid instructor response (70%) to student questions were the second group of important factors for their e-learning. Over half of those who identified an important influence identified that the factors in second group were important to them, 52%, 53%, and 51% respectively. Over half of the respondents had been influenced by prompt online comments on assignments (54%) and online discussion (51%), and about one third of respondents considered these two factors would be considered as an important influence, 39% and 30% respectively. One fifth (20%) of respondents were influenced by the online quizzes which might force them to study their courses and also 20% of those who responded to this question thought this would be considered important for them in using e-learning. A Chi-square test and Phi (effect size) value showed there was a significant difference and a small relationship in the course organization factors which influence students' use of e-learning and found those factors important (all Pearson Chi-square Asymptote Significance equal to  $0.000 < 0.005$  and Phi values approximately between 0.2 and 0.4).

Similarly, five groups of students from interviews noted complete well-designed course organization and materials online was most important to their use of

e-learning. Five groups reported it might be useless to encourage student use of e-learning by awarding additional marks because it could not attract students to use e-learning actively. They noted students would like to use e-learning actively whenever their instructors could design well-structured e-learning courses and proposed many interesting learning activities in their e-learning courses. This failure to contextualize the learning activities suggested that learners might not see the relevance of the concepts or theories presented and become disengaged.

### **6.4.3 Technology factors**

The delivery and accessibility of e-learning content were considered influences in student use of e-learning and they were often impeded by technology problems. E-learning facilitates the convenience and flexibility of learning as resources are no longer confined to libraries, but are instead more universally accessible via the Internet. However, e-learning also presents students with a number of technological challenges. These can include limited access to required computer hardware and software, limited technical knowledge and expertise, the quality of computer facilities and technology and a well-designed e-learning system. These technology factors will be described next.

#### **Computer facilities and technology**

The 368 questionnaire respondents reported that technology motivated them to use e-learning (37%) and encouraged their use of e-learning, with 28% of those saying this is an important factor in their use of e-learning. A Chi-square test and Phi (effect size) value showed there was a significant relationship in the responses of students' to the technology factors influence on their use of the university e-learning system, and found those factors important (all Pearson Chi-square Asymptote Significance equal to  $0.000 < 0.005$  and Phi values approximately between 0.2 and 0.4).

About one third of questionnaire respondents indicated they were hindered in their use of e-learning by technology challenges such as the lack of easy access to necessary computer equipments (34%) and lack of technical skills (27%). These lacks restrained their use of the university e-learning system. Similarly, the eight focus groups indicated some students did not have the necessary computer

hardware and software to access the e-learning system and they also had personal technical skill challenges in their use of e-learning. Eight groups also indicated that the quality of audio/video files or tapes affected student learning attitude because currently the quality of audio/video files or tapes for e-learning was not good and sometimes they could not see the images or contents or hear the sounds clearly. The detailed technological challenges students faced are described in Section 6.3.2.

### **E-learning system**

Students from 368 questionnaire respondents reported that comfort with the university e-learning system (60%) encouraged their use of e-learning, and 38% of those who identified this considered it as an important factor in their use of e-learning. Four groups of students indicated a flexible and well-designed e-learning system would encourage instructors and or students to use e-learning. They reported the university should provide a more flexible user-friendly e-learning system so their instructors could easily manage their e-content on their personal website and process student user accounts and student academic records in e-learning. Some students in these four groups noted the e-learning system design should be more flexible for instructor's choice to open their course materials to the public. Meanwhile, they noted it was also flexible for students to use e-learning. They noted students could easily access to their preferred e-learning courses and obtain all related e-learning information via the university e-learning system. This suggested their motivation might be decreased and they could become disengaged due to lack of a user-friendly e-learning system.

### **6.4.4 Policy factors**

This section sets out the policy factors influencing student use of e-learning. These include support factors and support services that were used and were expected available for students along their online courses. Student views and expectations of university support, incentives or encouragements to use e-learning and supplementary materials will also be described.

### **University provided support found to be useful**

The majority of respondents to the questionnaire indicated the factors provided help from peers (84%) and help from the instructors (71%) dominated. Some students were affected by a one-page user's guide (56%), help from teaching assistants (44%), and help from technical support staff (41%). Some students had been influenced by training from the university (30%), gaining counselling service from the Computer Center (28%), and the help from the student assistant (18%). However, the students from the eight groups interviewed indicated they were most influenced by the help from their peers and then from the teaching assistants or student assistants. Some students also obtained their help from their instructors.

All eight groups of students interviewed and some respondents to questionnaires had had e-learning experiences with student assistants. They all indicated that student assistants helped their instructors to video-record their classroom lectures in audio/video or computer video-conference teaching and some of them also helped their instructors assess student assignments. However, four groups of students indicated the university stopped providing student assistant support now, so some e-learning courses did not have videos of lessons. Moreover, five groups of students indicated their instructors had problems in getting reliable and competent student assistants, so their instructors needed to spend much time on reproducing the videos. Six groups of students explained the university and instructors might lack experience in measuring how much time and effort instructors really needed for e-learning development and teaching. Therefore, students expected university could understand this problem and continuously provide student assistant support to help instructors.

### **University support desired**

In order to obtain information regarding extra support services needed for e-learning practice, the questionnaires and interviews asked students to describe what other support services should be available for them in their e-learning courses. Nearly one third (32%-122) of students responding to the questionnaire and eight groups from interviews described their needs in their e-learning experiences. Four policy-related response categories: resources, technology,

interactions and encouragement policy were developed and will be described in turn.

***Resources: Course materials, e-learning platform, software and others***

The resources category includes provision of e-learning related resources, software or system function improvement, and space or other resources. These aspects involve three influencing factors: university support system (policy), e-learning resources from external online or other universities (external professionals) and private commercial resources (private). Half (50%) of the students who responded to this question from questionnaires and four groups of students from interviews indicated the university should provide more extra support such as more adequate e-learning related resources (e.g. printed or online course related materials), more and better software or system functions (e.g. online-help software or search system), and space or extra support resources (e.g. a specific classroom to view videos or for computer video-conferencing teaching) for their e-learning. The e-learning related resources and more and better software or system functions are often provided by external professionals or private commercial resource providers so these issues will be described in Section 6.4.5. Part of the university support system for students has been described in Section 6.4.4. Here extra needed supports for better e-learning environment such as specific space and training will be described.

Some questionnaire and interview respondents expected the university could provide more e-learning related resources such as a specific classroom so they could view videos of lessons to make up missed lessons or discussions. They hoped the university could provide them more e-learning related training courses and related website introduction and links, and a good e-learning instructor's personal website to view those e-learning courses.

***Technology: Access and quality***

The technology category indicated the need for an easily-accessed e-learning system and all good quality related technology in their e-learning practice. Four groups from interviews and over two fifths (44%-54) of questionnaire respondents described the technological support services which should be available in their

e-learning. These responses noted they needed more and better quality of e-learning related technology, peripherals or other multimedia accessories. They needed a stable, reliable, easy-use, fully functionalized and good performing e-learning system; and a good quality network for e-learning practice such as enough network bandwidth, fast speed for image presentation, and good network management were considered as necessary. They also noted adequate e-learning equipment and enough storage space were important to their use.

However, those students who had an up-to-date laptop, requested a wireless environment, whereas others could not afford to buy laptops so they hoped the university could provide the advanced related technology. Some students indicated miscellaneous multimedia accessories were necessary for improving their learning efficiency and quality such as scanners, video-recorders, and multimedia or audio-visual facilities for interactions or online Q and A. Four groups of students from interviews also expected the university could provide more VOD computer facilities and hoped that they could view VOD at their living places. Dedicated e-learning classrooms and facilities were necessary for e-learning teaching, especially for computer video-conferencing teaching. Two groups of students stated they usually spent a certain period of time waiting for settling down the computer video-conference teaching environment among all the cooperating universities where they used various classroom functions and facilities. They expected all cooperating universities could provide specifically equipped classrooms and facilities for their e-learning. All these concerns are similar to previous descriptions of technology factors in Section 6.4.3.

#### ***Interaction: Synchronous and asynchronous***

The interaction category indicated all kinds of manpower support for all kinds of technological operations or learning improvements and better interaction areas or facilities support. Some respondents to questionnaires and interviews identified that peer or student assistant help and even face-to-face instruction or inquiry services after class should be available for their e-learning practice. The respondents expected the university could provide them with better functions and facilities for online interactions in the e-learning system such as real-time multi-person audio-visual interaction, and online private discussion and message

board. Some respondents noted they needed an area to share their e-learning experiences among peers, whether they are the experienced users or new users. They also wished they had the telephone inquiry services for their e-learning.

### ***Incentives***

The encouragement policy category included all suggestions for broadcasting the concept or benefits of e-learning to the students or instructors, and incentives or encouragements to enhance the e-learning practice. The respondents from interviews reported the university needs to provide some incentives such as encouragements and credits towards their degree for the students. Eight groups of respondents reported that if students would not like to take or use e-learning, then all the efforts in e-learning development and practice would be wasted and meaningless. Five groups of students indicated currently only e-learning instructors encouraged them to use e-learning but the university seemed not to. Five groups of students from interviews and four students from questionnaires expected the university could broadcast the benefits of e-learning to the students and encourage them to use e-learning frequently by providing more incentives. They noted this encouragement would motivate more students to accept e-learning practice.

Three groups of students indicated that currently the university did not offer students credits towards their degree for those self-disciplined courses. They noted many good international online courses or commercial e-learning courses provided by online universities or external professionals on the web. They expected the university could encourage them by affording the flexibility to access and or select those online qualified courses. Some students expected the university could accept certain credits towards a degree from those qualified by e-learning or online courses so students could complete their degree earlier. They indicated the university should start to consider how to encourage the students to engage in e-learning such as providing more self-disciplined environments especially for those active and diligent students.

#### **6.4.5 Other factors**

Some other factors were also described as influences by the students. This section describes external professional and private factors. Some of these influences for student use of e-learning have been described and synthesized in student's experiences of teaching methods and effective strategies in Section 6.2.3. Student perceptions of challenges from the external professionals and private commercial resources providers were also described in Section 6.3.2. In order to obtain more information on these two aspects in e-learning courses, the students also described other factors in the interviews.

##### **External professional factors**

Some online supplementary materials provided by external professionals might be helpful for student learning. Three groups of students and some students in the questionnaire stated they liked MIT (Massachusetts Institute of Technology in United States) online e-learning courses and expected the university could translate those e-contents into Mandarin versions. They also expected university instructors could develop highly professional well-designed e-learning courses. However, all these respondent students faced an irreconcilable conflict about the expectations of their instructors developing professional e-learning courses by instructor themselves because they knew their instructors had time constraints, research pressure and skills-lack problems. Such further tensions were discussed in Section 6.3.3.

##### **Private factors**

Supplementary materials provided by private commercial resources providers also might be helpful for student learning. With e-learning, learning could take place any time and anywhere; and resources were no longer confined in the university library but were accessible through the Internet. However, four groups of students and some students from questionnaires noted that their instructors usually gave them a list of reference books but few reference websites, or audio/video files/tapes, or VOD (Video on Demand) for their e-learning courses. Therefore, these students expected to get more support or resources for their learning from their instructors and the university library. Although the university library has provided many resources such as online journals, online databases, some e-books

and so forth, they still expected the university could provide more copies or e-copies of popular textbooks or reference books which are provided by e-learning curriculum publishers or commercial resources providers. Some students also indicated they needed to have clear and apparent online-help guide in a webpage or be provided with a one-page user's guide to solve these problems and to improve their motivation and efficiency in the use of e-learning.

#### **6.4.6 Section summary**

The findings from questionnaires and interviews noted some factors including personal, pedagogy, policy, technology and other factors have influenced student use of e-learning. Key influences were personal factors such as student perceptions of e-learning benefits and challenges, credit adoption towards degree, student personal interests or views of e-learning, student learning attitude and learning load were positioned as most important influences on their decisions and performances in taking and or using e-learning. Further evidence of personal factors that encouraged and hindered student use of the university e-learning system came from responses to a question on perceived benefits and challenges of e-learning (see Sections 6.3.1 and 6.3.2). Well-designed e-learning course organization was an important pedagogical factor for student engagement in e-learning and students also needed instructor guidance and support in their e-learning courses. Technology factors included limited access to required computer hardware and software; limited technical knowledge and expertise; the quality of computer facilities and technology and a well-designed e-learning system. Policy factors included university providing support services such as help from student assistants and technical support staff or training from the university. Students especially expected that the university could continue the support of student assistants for them and their instructors. Other support services such as extra resources, technology, interactions and incentives were described. Online supplementary materials provided by external professionals or private commercial resources providers also influenced student use of e-learning. They indicated the university should start to consider how to encourage the students to engage in e-learning.

## **6.5 Suggested enhancement strategies for e-learning**

This section outlines student suggestions for enhancing e-learning practice. Based on student descriptions of their e-learning experiences, perceived benefits and challenges of e-learning, and factors influencing their use of e-learning, four dominant categories of suggested changes were identified and are described below. These categories were personal, pedagogical, technological and policy aspects. Some minor issues such as external professionals and private commercial issues will also be described.

### **6.5.1 Personal aspects**

Over two thirds (69%) of respondents suggested that students needed to change their learning attitude and role in order to improve their learning outcomes, quality and efficiency. Students found that the time flexibility of learning came with a cost so they must become active, diligent and self-managed learners in order to actively manage their learning time and progress well. Students also identified good time management (43%) and personal organization ability (22%) as necessary for effective student e-learning practice. They said their learning outcomes would be reduced if they were not active and diligent learners and did not have good time management and organization ability to overcome personal challenges.

Students indicated the importance of the role of the instructor in helping them to overcome learning barriers and solve problems when challenges arose. For instance, students worried about the difficulties in putting figures, or typing formulae and symbols in their contributions to online discussions or in online assignments or tests due to their own lack of personal technical skills and ability. Students noted the effort involved in this more technical aspect might compromise the mental resources they had available for comprehension and achievement of the learning goal itself. Thus, students expected their instructor would understand this and help them overcome such learning barriers. Students recognize they may need to change their personal learning attitude for e-learning and expected to get help from their instructor to improve their learning efficiency, quality and outcomes.

### **6.5.2 Pedagogical aspects**

Because e-learning teaching is different from face-to-face instruction, students said they needed to adapt to new teaching strategies and get used to various types of e-content and new assessment in their e-learning environment. Students suggested that a well-designed e-learning course was an important pedagogical aspect for their engagement in e-learning. Students also wanted instructor guidance and support in their e-learning courses. They felt navigating and responding to the interactive elements of the online component and figuring out how to use the supporting tools was time and effort intensive. Thus, students suggested that instructors should include guidance on how to navigate and use course materials as part of online course materials.

### **6.5.3 Technological aspects**

E-learning facilitates resources no longer being confined to libraries but instead more being universally accessible via the Internet. However, this presents students with a number of technological challenges. Students noted their motivation to use of e-learning might be decreased and they become disengaged due to a lack of the required, and high quality, technology support. The complex nature of the e-content often demanded high technical literacy. Students felt they needed not only to be familiar with new technologies but also able to deal with any technical problems. They considered the university should provide more, and better, e-learning related facilities such as multimedia equipment and computer hardware and software around the campus, especially in their dormitories. They wanted access to a wireless network environment for flexibility of place. Moreover, due to all the cooperating universities using various different classroom functions and facilities, students expected the university to ensure there were specifically equipped and functional classrooms and facilities for their e-learning. Students indicated all these technology support services or miscellaneous multimedia accessories were necessary for improving flexibility of time and place learning, and learning efficiency and quality.

### **6.5.4 Policy aspects**

Respondents asserted that the university needed to provide more and better support for their instructors and for students. For support of instructors, the

university should understand the time and effort needed for instructors to develop e-learning and teaching and should provide continuous student assistant support to their instructors for e-learning teaching. For themselves, firstly students suggested the university library should provide more resources such as VOD and e-books, software and system function improvement, space and other resources including more copies of popular text and reference books. Secondly, they noted the university should improve their access to e-learning courses by providing more and better e-learning related facilities and functional classrooms around all the campuses (see previous technology aspects). Thirdly, students suggested the university could provide a space for them to access peer or student assistant help, and even face-to-face instruction after class in e-learning practice. To enhance student interactions with their instructors and peers, students suggested the university should provide better functionality and facilities for online interactions in the e-learning system such as real-time multi-person audio-visual interaction, online private discussion and message boards. Moreover, they expected a telephone inquiry service. Finally, they expected the university to provide some incentives to encourage more students, especially active and diligent students, to use e-learning. Some ideas were broadcasting the benefits of e-learning, providing more online self-educated credits towards degree, and providing access to professionally supplementary materials.

### **6.5.5 External professional aspect**

Students reported some international online supplementary materials provided by external professionals were helpful for their learning (see Section 6.4.4). They would have liked the university to provide access and, or translate this e-content into Mandarin. They also expected university instructors to develop highly professional well-designed e-learning courses for them, although they realized many instructors were not capable of this (see Section 6.3.3).

### **6.5.6 Private commercial aspects**

Students said supplementary materials provided by private commercial resources providers were also helpful for their learning (see Section 6.2.3). Students noted that their instructors usually gave them a list of reference books or websites, or audio/video files/tapes, films, slides, or VOD for their e-learning courses.

Although the university library provides many resources such as online journals, online databases, some e-books and so forth, students still suggested the university should provide more copies or e-copies of popular textbooks or reference books which are provided by e-learning curriculum publishers or private commercial resources providers. Some students also noted they could have clear and apparent online-help guide in a webpage or have a one-page user's guide to solve these problems. Students reported these private commercial resources could motivate them to use e-learning and improve their learning efficiency and outcomes.

## **6.6 Chapter summary**

This Chapter has described four aspects of respondent student experiences and perceptions of e-learning. These aspects were student academic background and experience of e-learning, the perceived benefits and challenges of e-learning, factors considered to influence student use of e-learning, and suggested e-learning enhancement strategies. This section summarizes the key points made by students from questionnaires and interviews in relation to these aspects.

A majority of respondent students from questionnaire and interviews were undergraduates, and non-science majors. They were not familiar with either national or university e-learning policy, implying students might not care about or be affected by these policies in their use of e-learning. A majority of respondents preferred a blend of face-to-face and e-learning teaching and preferred to work with a partner or in a group. Overall, a majority of students were relatively inexperienced with e-learning. They had taken one or two e-learning courses and had two or fewer years experience in e-learning. However, they rated themselves as having a reasonably high level of e-learning ability.

The students noted their instructors used different teaching methods and strategies to motivate their engagement in e-learning and to improve their learning outcomes. The teaching methods including the provision of online up-to-date course materials and audios/videos, and improvement of synchronous and asynchronous

interactions were identified as effective strategies to motivate their engagement in e-learning and improve their learning outcomes and learning quality.

E-learning practice for students has its own benefits and challenges. The perceived benefits of e-learning for students were:

- Learn flexibly in time and place and at their own pace; similar to instructors in flexibility of teaching in time and place for instructors;
- Increase their ICT knowledge and skills to adapt to current 'information age' and learn to be life-long learners;
- Help them have different but more active and independent learning approach and attitude to improve their learning quality and outcomes;
- Provide more opportunities and different sorts of interactions to enhance their interactions with instructors and peers;
- Motivate their participation and cooperation in their learning; and
- Save cost and time for students to print out the course notes and sheets.

The perceived personal and technological challenges of e-learning for students were:

- Requirement for a different, more active learning attitude and a new type of interaction approach;
- A preference for face-to-face instruction;
- Time taken to access e-content and interact online with others;
- Tensions on the nature and extent of e-learning course materials (e.g., new types of learning approaches and assessments online, course/subject attribute, learning overload, instructor attitudes, eye strain, and psychological barriers);
- Difficulty to meet different instructors' teaching approaches and expectations;
- Lack of personal capabilities (e.g., technical knowledge and skills, and good time management and personal organization ability); and
- Lack of easy access and high quality access to the necessary equipment and e-learning system.

A number of factors influenced student use of e-learning. The personal factors that encouraged or hindered student use of e-learning were:

- Student perceptions of e-learning benefits and challenges;
- Personal will (i.e., personality traits or attitude to learning, e-learning as motivation);
- Student personal capabilities (e.g., technical knowledge and skills, and management and organization ability); and
- Incentives (e.g., extra grading marks, credits adoption towards degree).

The pedagogy factors for students were:

- Course/subject attribute;

- The complexity of navigation of e-learning systems and a frequent lack of clear and well-designed guidance and instruction;
- Demand for well-designed and complete e-learning courses; and
- Demand for instructor guidance and support in e-learning.

The policy factors for students were:

- Provision of incentives (e.g., credits adoption towards degree); and
- Provision of support for students (e.g., various up-to-date multimedia facilities, extra resources, and technical manpower support especially for student assistant).

The technology factors for students were:

- The access to necessary computer hardware and software, and e-learning system; and
- The quality of computer technologies and e-learning system.

Other factors for students were:

- Online supplementary materials provided by external professionals or private commercial resources providers (e.g., e-books; online references; websites; information database); and
- Extra resources provided by the university library.

Suggested changes that might enhance e-learning practice for the instructors and students were:

- Changing instructor and student perceptions and attitudes towards e-learning; and
- Providing well designed e-learning courses to the students (e.g., including guidance from instructors on how to navigate and use course materials as part of online course materials).

Suggested changes that might enhance e-learning practice for the university were:

- Providing extra support services (e.g., the provision of more resources such as VOD, e-books, more copies of popular text and reference books in the library; the improvement of software and system function; telephone inquiry service; access to and or translation of online supplementary materials provided by external professionals or private commercial providers into Mandarin);
- Providing more incentives (e.g., more seminars/training courses held to demonstrate the benefits of e-learning and the nature of effective e-learning courses; more online self-educated credits towards degree);
- Providing better e-learning related facilities and functional classrooms around all the campuses (e.g., wireless network, real-time multi-person audio-visual interaction); and
- Reducing technical problems.

# Chapter 7 Summary

## 7.1 Introduction

This chapter summarizes the findings of the study. Section 7.2 addresses the first and second research questions about participants' perceptions and experiences of e-learning practice including benefits and challenges of e-learning and factors influencing e-learning practice. Section 7.3 addresses the third research question about possible strategies for enhancing e-learning practice. Section 7.4 summarizes the findings.

## 7.2 Participant perceptions and experiences of e-learning

The first and second research questions for this study, which are the focus of this section, were:

- 1) What do university administrators and technical support people at the NRU perceive as the benefits of, challenges of and influences on e-learning practice?
- 2) What are instructor and student perceptions and experiences of what makes for effective e-learning in a national and research-oriented university in Taiwan?

Chapters 4, 5 and 6 addressed these two questions about administrator, support person, instructor and student perceptions and experiences of e-learning practice. The findings of the study indicate that all the participant groups share a similar understanding of how e-learning was developed and implemented by the university. Their perceptions of benefits and challenges of e-learning and the influences on e-learning practice were also similar. The study provides some insights into the role administrators and support people might play in bridging the gap between the university and instructors in the development of effective e-learning practice. A successful e-learning practice not only depends on the provision of technical infrastructure but also relies on the involvement and cooperation of university administrators, technical support people, instructors and students. Hence, all participants' experiences and perceptions of e-learning were sought on the benefits and challenges of e-learning and the factors that influenced their use of e-learning.

### **7.2.1 Participant perceptions of benefits of e-learning**

The findings of the study indicate that all participants – university administrators and support people, instructors and students – considered that e-learning was a beneficial addition to face-to-face courses. Participants' perceptions of the benefits of e-learning had many similarities and three categories of perceived benefits were developed. These were benefits of e-learning for the university, instructors and students.

The first set of perceived benefit of e-learning was for the university. All administrators, technical support staff and a majority of instructors considered the e-learning courses with significant multimedia content that could be delivered to large numbers of students and the community increased the university's reputation and competitiveness. A good reputation was thought to attract students through a brand image, special features and other factors of interest to students. These findings have many parallels with studies by Fornaciari, Forte, and Mathews (1999), Shoniregun and Gray (2004) and Whalen and Wright (1999) who found institutions with higher reputations tend to avoid price-based competition and instead focus on earning student loyalty through the uniqueness and distinctive value of their service and efficiencies of e-learning can also contribute to a low cost leadership strategy. The administrators and a majority of the instructors noted e-learning has a potential to make or save the university money in terms of enrolment increases, student revenue increases, and improved learning (see Sections 4.2.3 and 5.3.1). An associated advantage related to return on investment was that e-learning could save time and cost in printing and distributing course materials and assessments. These findings of the cost-effectiveness of e-learning also resemble those of other studies (see for example Geisman, 2001; Shepherd, Martz, Ferguson, & Klein, 2002). All administrators and some instructors noted e-learning could attract student enrolment especially from off-campus or incorporate staff-training for the enterprises so it could be a good way to foster relationships and cooperation with the wider community and other universities. In sum, the findings indicate individuals employed by the university saw benefit from e-learning for the university as a whole.

The second set of perceived benefit of e-learning was for the instructors. A majority of participants from each participating group considered the convenience of multimedia in e-learning and the potential of the Web to search and access could motivate instructors to adopt e-learning because it provided flexibility of teaching and learning in time and place for them and their students. The benefits of easy to manage course materials and student academic records, the reuse of course materials, and improved instructor interaction with students were thought to improve instructor teaching efficiency and quality, a view that resonates with those found in studies by Armstrong (2000) and Daugherty and Funke (1998). Moreover, a majority of participants noted e-learning could improve instructor ICT knowledge and skills and some instructors indicated it could increase their personal reputation by making their courses accessible to other universities and or the community. A good personal reputation was thought to be able to increase instructor opportunities to win research projects, cooperation with other professionals and enterprises. Similar to the benefits of saving paper costs for the university, all participants noted e-learning could save instructor time and cost in printing and distributing teaching and assessment materials. In sum, the findings indicate individuals in each of the participant groups saw benefits from e-learning for instructors as part of what might contribute to instructor personal motivation to adopt e-learning teaching and to benefits for the students and the university as a whole.

The third set of perceived benefit of e-learning was for students, and the benefits were similar to those described for instructors. A majority of participants in some groups, with the exception of the student assistant group, indicated the main benefit of e-learning for the students is the flexibility of learning. They noted instructors put course materials and audios/videos online before and after class and provided more opportunities for synchronous and asynchronous interactions so students could learn more flexibly in time and place. This finding parallels those of Lao and Gonzales (2005) and Tiene (2000) who found students appreciated being able to view and review e-content at their convenience and at their own pace. The student assistants and some instructors and students, however, noted that the flexibility of learning could adversely affect the learning outcomes of any lazy and passive students because they may not attend class and or view

e-content before and after class. All participant groups asserted e-learning could benefit and increase student motivation to learn and teach students the importance of self-discipline, learning accountability, and good time management skills. The finding that students need to be self-motivated and organize their own learning including making provision for the time, space and equipment necessary in their use of e-learning is supported by the work of Daugherty and Funke (1998) and Tang (2000). Simultaneously, all participant groups noted e-learning could provide more opportunities and different sorts of interactions to enhance their interactions with instructors and peers and it also could motivate their participation and cooperation in their learning. Moreover, e-learning could increase student ICT knowledge and skills to adapt to the current information age and learn to become life-long learners. These findings are supported by many studies (e.g., Churach & Fisher, 2001; Focus on Internet News & Data [FIND], 2003). Again, a majority of participants from each group noted e-learning could save students much money and time in printing the answer sheets, project reports and or lecture notes. In sum, the findings indicate e-learning can help students have a different but more active and independent learning approach and attitude to improve their learning outcomes and increase their self-managed capacity to be a life-long learner.

### **7.2.2 Participant perceptions of challenges of e-learning**

The findings of the study indicate that although e-learning was perceived to have many benefits, individuals from all the participant groups considered the university, instructors and students also faced challenges from the online component of blended learning courses. Participants' perceptions of the challenges of e-learning had many similarities and three categories of perceived challenges were developed. These were challenges of e-learning for the university, instructors and students.

The first set of perceived challenge of e-learning was for the university. Administrators, technical support people and some instructors noted that although the government and university had invested money and effort to provide the requisite infrastructure, facilities, and platform for e-learning, many instructors and students resisted the use of the e-learning. In terms of ongoing support for

e-learning use, the main barrier for the university was said to be a lack of funding to provide up-to-date technologies and manpower support for instructors and students (see Sections 4.5 and 5.3). The findings that the cost of the infrastructure and personnel expenses was a primary barrier to developing the e-learning parallel those of Shoniregun and Gray (2004), Levine and Sun (2003) and Mayberry (2001). Moreover, a majority of instructors and technical support staff indicated lack of effective leadership in e-learning and ambiguous e-learning policy and goals were challenges to the university. They noted ambiguous e-learning policy and goals and lack of a knowledgeable and supportive e-learning leadership had led to mutual distrust and misunderstanding between university and instructors and also challenged instructor development of e-learning courses and technical support staff management of e-learning platform (see Sections 4.2.5, 4.3.3, 5.3.2 and 5.4.1). These findings resemble those studies by Berge and Lin (2001), McGraw (2001) and Moloney and Tello (2003) who found successful e-learning practice required a well-documented e-learning strategy that set out the overall direction and objectives for e-learning. In sum, the findings indicate individuals employed by the university perceive challenges from e-learning for the university as a whole and that these were considered to be of a policy nature and factors influencing instructor and student use of e-learning.

The second set of perceived challenge of e-learning was for the instructors. All technical support people and a majority of instructors and students involved in the study pointed out that e-learning not only relies on multiple ICT technologies but also that technology innovation is ongoing and so instructors are continuously faced with personal, technological and pedagogical challenges. The findings indicate that 'computer anxiety' (see also Christiansen & Knezek, 2002) is an obstacle in the early stages of e-learning adoption as described by some instructors who said they had fears in technology use such as they did not know how to operate multimedia facilities and transfer their video-recorded lesson onto e-learning system. However, even when anxiety is reduced, there is still a need to integrate technology into teaching itself. Instructor commentary indicated they were still questioning whether technology devalues their profession (see Section 5.3.2), and enables students to learn as well as face-to-face instruction (see Section 5.2.3). Adams (2002) and Berge and Lin (2001) also found instructors

identified these psychological barriers. On a more practical note, a majority of instructors noted the time needed to prepare e-learning lessons and interact with students was a challenge to their use of e-learning. The time and effort needed for instructional design with new media to produce e-content and in online interaction was reported to have decreased instructors' motivation to use e-learning as has been reported by Beggs (2000) and Adams (2002). Overall, the findings of the study indicate that in the face of ongoing technology demands instructors not only feel they lack time but some also experience challenges from their personal expertise and beliefs to the incorporation of technology into course design.

The assertion from a majority of instructors was that e-learning was significantly different from face-to-face instruction and so they needed to adopt different pedagogical approaches (see Section 5.2.3). However, all the technical support people and a majority of the instructors and students indicated that actually most instructors had little or no formal training in the effective use of technological resources in e-learning (see Sections 4.3.4 and 5.2.3). The general perception was that they would benefit from training in this, either from the university and or external professionals. The contention that training is important to create a shift in teaching practice is supported by Barley (1999), BECTA (2003), and Palloff and Pratt (2001).

Despite general arguments for increased flexibility, a majority of the instructors in this study noted the multimedia facilities and e-learning platform provided by the university did not have much flexibility in course development and they experienced inconvenience due to limits on time use and system function (see Sections 5.2.3 and 5.3.2). University standardization of hardware, software, and related tools reduced instructional options and this conflicted with some instructor interpretations of academic freedom (see also Brzycki & Dudt, 2005). The variety of technology tools and applications available also exacerbated technical support problems. All technical support people indicated they faced challenges in learning or updating their knowledge and skills (see Section 4.3.3). In addition, some student assistants complained low wages reduced their willingness to help instructor develop e-learning course. Thus, some instructors noted they lacked a reliable and competent support from student assistants and or technical staff.

Administrators and a majority of instructors and students noted the course attributes impacted on instructor course design and interaction in e-learning, particularly for science courses (see Sections 4.2.4, 5.4.3 and 6.3.2). An easy use and high quality interface and functionality was said to be required for graphs, figures, and even voice online and also to address the challenge of typing Chinese characters and science formulae and symbols online. In sum, the findings indicate individuals in each of the participant groups perceive challenges from e-learning for instructors that might hinder instructor personal motivation to adopt e-learning teaching. These include lack of time, support, pedagogical and technical skills, and easy and high quality access to infrastructure and e-learning platforms.

The third set of perceived challenge of e-learning was for the students. Students were said to face personal and technological challenges similar to those faced by instructors. A majority of students noted they needed to spend considerable time to preview/review e-content and interact with their instructors and peers online (see Sections 6.2.3 and 6.3.2). This was said to lead to learning overload. Along with this, the findings indicate e-learning is considered most beneficial for active and diligent students with a high degree of self-management ability and good technical skills for online access and interaction. These findings resemble those studies by Berge and Lin (2001), Geisman (2001) and Crabtree (2006) in emphasizing student personal learning attitude and capacity could be challenges for student use of e-learning. Some students also faced same technological challenges such as typing formulae and science symbols and putting figures or graphs online (see Section 6.3.2). In sum, the findings indicate individuals in each participant group saw student learning overload, passive learning attitude, poor capacity of self-management and poor technical skills as personal challenges, and lack of easy and quality access as technological challenges.

### **7.2.3 Tensions between perceived benefits and challenges**

Instructor and student perception of benefits and challenges of e-learning were described in detail in Chapters 5 and 6. Here the tensions identified between instructor and student reported benefits of and challenges to e-learning are discussed.

The findings of the study point to four tensions for instructors between the benefits and challenges of e-learning: time flexibility and the need for time management; reusable course support materials and work load; increased interactions via online and required time; technology and technical skills; and support people and their capability. Time flexibility for teaching also meant instructors could face time management problems due to expectations of immediate responses. While instructors valued and expected to provide their students complete up-to-date well-organized online course materials and appreciated being able to reuse such material, they found the production of this material required a significant amount of time and effort. In particular, the preparation of audio/video of lessons was time consuming and could increase their workload to such an extent that they did not like to teach in e-learning. This was especially so for those who said they were comfortable with traditional classes. They could also lack the requisite technology and or personal technical skills to respond in a timely manner. As mentioned earlier, instructors and students could face difficulties putting in formulae, science symbols or even typing Chinese characters in online. This required extra time, technical skills and better computer technology. Instructors noted they lack time and technical knowledge and skills to develop their e-learning course by themselves so they required technical support people to help them in their development of e-learning. However, they noted the university only had two technical support staff for university e-learning practice and also it was hard to get student assistant support from the university. Moreover, although they got help from technical support people, the capability and attitude of support people was another problematic issue. This is a paradox for the instructors between the provision of technical support and the expectation of capable and supportive technical support people.

Similarly, student commentary indicated tensions between the benefits and challenges of e-learning. While students appreciated being able to move through a course at their own pace and enjoyed the time and place flexibility of e-learning, they found this came at a cost; it required a high degree of self-management ability (see also Hantula, 1998). Students were required to become more active, diligent and self-managed learners if they were to improve their learning outcomes and the quality and efficiency for their use of e-learning. Students also

valued and expected the provision of complete up-to-date well-organized online course materials from their instructors and many said they used these materials to improve their course performance. However, the need to read a large volume of online course materials could result in eye-strain and a heavy learning load. In fact, some students claimed comprehensive resources online could reduce student concentration and attendance at lectures. Thus, a paradox existed between the expectation of complete up-to-date well-organized online course materials and student learning overload. Synchronous and asynchronous interactions were said to provide students with opportunities for social interaction. Students reported this could improve their interactions with instructors. However, before this could happen many challenges had to be overcome including instructors not giving timely responses and students lacking the required technology and personal technical skills to communicate online.

Overall, instructors and students faced tensions around time flexibility and personal time-management; issues around the value of and time to produce and use online course support materials; and the value of online interactions, and the time and technology skills.

#### **7.2.4 Participant perceptions of influences on university e-learning**

The findings indicate a number of factors have influenced the emergence of e-learning. In all, seven influences were identified in this study (see Sections 4.5, 5.4 and 6.4). They were categorized as policy, personal, pedagogical and technological factors and three other factors of external professional, private and public. These influences are generally congruent with the perceived benefits and challenges detailed above which is perhaps not surprising given perceptions of benefits and challenges can be considered enablers and inhibitors to e-learning practice.

##### **Policy factors**

National policy in Taiwan seeks to promote and guide the introduction of e-learning. This policy, along with that of the university itself, provides the context for administrator, technical support person, and instructor and student experience of e-learning. The policy factors identified within this study include

national and university policy impacts, university organizational and cultural change, leadership, administrative and technical support, reputation and financial issues.

University e-learning practice has been promoted and guided by national e-learning policy. The university has faced organizational and cultural changes for e-learning practice such as a new e-learning support unit and an increase in technical people in the university, collaborative instruction online with other universities, and a new relationship with the community via e-learning. These changes influenced instructor and student teaching and learning. However, the findings also indicate changes to national policy impacted significantly on the university and when the university redefined its goals to emphasize research and changed its tenure system so, too, instructors focused more attention on research because of its links to promotion (see Sections 1.2 and 5.4.2). All administrators, technical support staff and a majority of instructors and students noted the lack of a well-defined university e-learning policy and goals had influenced instructor adoption of e-learning. As mentioned in Sections 4.5, 5.4 and 6.4, the recommendation was for a well-documented e-learning policy and strategy and the appointment of a dedicated organization or high-level prestigious person whose role was to encourage instructor and student use of e-learning. Other research studies (e.g., Becta ICT Research, 2004; Berge & Lin, 2001; McGraw, 2001; Moloney & Tello, 2003) have also indicated that without a knowledgeable and supportive leader, a shared vision for e-learning, and an explicated strategic plan, implementation programs can meet with difficulty.

In this study, the lack of consistency in support for e-learning as evidenced by the provision and withdrawal of student assistant support also inhibited the adoption of e-learning. Ongoing administrative and technical support and recognition of instructor effort are important factors to encourage the use e-learning (see also Brzycki and Dudt, (2005), Stuart (2004) and McLean (2006).

As described earlier in Sections 4.2, 4.3 and 5.4, university reputation and financial issues were thought to influence how the university approached the instigation of e-learning. The findings indicate some considered NRU's reputation

attracted students as did the capable instructors and rich resources (see Sections 4.2.2, 4.3.5 and 5.5.2). They indicated many capable instructors at NRU with higher reputation could design and teach some specific e-learning courses whereas other universities could not provide this. They also considered NRU had responsibilities to help other universities, enterprises, and the community by providing a good e-learning environment (see Section 4.2.3). In sum, a majority of participants employed by the university perceived effective leadership, well-defined e-learning goals and policy, administrative or technical support, university organization and culture, reputation and financial issues are important political factors as a whole to entice instructors and students to use e-learning.

### **Personal factors**

As set out in Chapters 4, 5 and 6, factors pertaining to instructor and student personal will and capacity played a crucial role in the implementation of e-learning. The findings suggest that instructors initiate and participate in e-learning for a variety of purposes, confirming the claim by Dillon (1989) that instructor participation depends on a variety of personal reasons “ranging from diversity of experience to altruism toward the non-traditional learner” (p. 42). In addition, the successful design and teaching of any course hinges on instructor personality, preferred teaching approaches and attitude to education, learning and e-learning (Matuga, 2001). Commentary from all the technical support people and a majority of instructors and students indicate instructor and student personal characteristics (e.g., personality traits, desire and preference) for use of e-learning are motivations that significantly influence their usage of e-learning. Some instructors and students in this study eagerly grasp opportunities to experiment with e-learning practice, whereas some prefer to wait and evaluate the efforts of peers before committing themselves and others reject this innovative practice. This indicates those who are confident and adventurous are more likely to be self-motivated, and respond quickly and positively to the e-learning innovation than more cautious, conservative ones. This finding resembles those studies by Mehlinger (1995), Rogers (1995) and Stratford (2000) who found personal personality traits was an indicator to change. Moreover, the science e-learning instructors noted science instructors might be more interested in research and producing research scientists so they did not want to spend much time on teaching

or e-teaching and teaching students in general science education. Similarly, the administrators, technical support staff and a majority of instructors and students considered science students were likely to learn by doing experiments and in the laboratory.

The findings of the study indicate personal attitudes towards the use of technology, education as a public good/right, and towards learning and e-learning are influential. Instructors and students agreed that the technology use not only could motivate them due to its convenience but also cause some challenges (e.g., embarrassment and computer anxiety) on their engagement in e-learning. Thus, personal attitude towards the use of technology is an influence to their adoption of e-learning. Instructor personal attitude towards education as a public good/right was an important influence on the use of e-learning by some instructors who wanted to broadcast their e-content to off-campus students and or the public.

Instructor and student attitude toward learning, as set out in Chapters 5 and 6, indicate a majority of instructors perceive themselves as ‘providers of knowledge’ rather than ‘facilitators of learning’ as described by Cuban (1986) and Norton, McRobbie, & Cooper (2000). This view is consistent with instructors focusing on providing their lecture notes and drill and practice exercises online and providing feedback and rewards such as extra marks to students. Similarly, comments from a majority of students which focused the value of complete course materials for viewing, reviewing and memorizing to ensure they could get good results or marks is generally consistent with a behaviorist view of learning (see Crabtree, 2006). However, along with this, the findings also indicate both instructors and students saw a need to change their teaching and learning attitude and acquire new and more independent teaching and learning skills for use in e-learning.

The findings indicate some instructors held a personal constructivist view of learning. These instructors spoke of the value of the problem-solving type of learning in realistic and investigative situations to support student personal discovery and experimentation. They provided some supplementary online resources such as online references, websites, tutorials and information databases in the belief these would provide students with additional chances for personal

discovery of knowledge. In this case, students were said to learn by personal discovery, although the general opinion was that this was most effective for those active and self-regulated students (see Section 5.2.3). Other studies have reported findings that resemble these (Christensen, 2003; Farres & MacDonald, 2006; Hung, 2001) in suggesting a personal view of learning is an important factor influencing the adoption of e-learning. Alongside this, some instructors could be seen to have a social constructivist view of learning that values collaborative learning as evidenced by the provision of synchronous and asynchronous online discussions and collaborative projects. These provided for students discovering different perspectives and developing shared meanings. The students valuing interaction and discussion (see Section 6.4.1) is congruent with their perceiving learning as a social activity, thus instructor and student attitude to learning appears as a crucial factor in the forms of e-learning in teaching and learning that are seen as valuable and hence provided by teachers and engaged in by students. In sum, the findings indicate that instructors and students perceptions of the influences on their use of e-learning is consistent with a combination of behaviorist, personal and social constructivist views of learning and that aspects of each are of value in instructional design and learning.

Commentary from a majority of participants indicates administrators, technical support staff, instructor and student personal attitude towards e-learning was an influence on the implementation of e-learning. In this study, this influence is encompassed by perceptions of the personal benefits and challenges of e-learning. The benefits have been detailed in the Section 7.2.1, but, in brief, they include flexibility in the time and place teaching and learning, and an increase in interaction. The findings of the study indicate instructor and student attitudes are important because university instructors have the academic freedom to teach as they prefer and university students are not usually required to engage in e-learning to complete a course.

The second aspect of the personal influence identified within the study pertains to instructor and student personal capacity. This refers to their personal technical knowledge and skills to utilize technologies in e-learning and their time management ability. As others have found (see for instance, Brzycki & Dudt,

2005; Hootstein, 2002), a lack of this capability coupled with ongoing technology innovation were said to undermine an instructor and student both mentally and physically as they sought to implement e-learning. For example, as mentioned in Sections 5.3.2 and 6.3.2, a majority of instructors and a small portion of students lacked familiarity with the university e-learning system and the recently up-dated ICT facilities, as well as with their multimedia operation. All the technical support people and a majority of instructors and students noted the complex nature of the e-content demanded high technical literacy and reported a majority of instructors and some students lacked the technical skills necessary to properly engage in e-learning. For instructors this included a lack of the knowledge and skills needed for e-learning course development and teaching. Others have also found instructors sometimes lack pedagogical and technological skills and this acts as a barrier to e-learning (e.g., Palloff & Pratt, 2001; Waldron, Dawson, & Burnett, 2005). Furthermore, technical support people, instructors and students suggested good time management ability is required (see Sections 5.4.6 and 6.3.3). Time and effort are needed to improve instructor teaching and student learning quality and efficiency. To sum up, as others have found (see for example Brzycki and Dudd, 2005; Honig, 2006; Spillane, 1999; Schifter, 2000), instructor and student personal will and capacity is crucial for educational reform as exemplified in this study by the use of e-learning in blended learning.

### **Pedagogical factors**

The pedagogical factor relates to the nature of effective e-learning teaching and learning approaches. The findings have raised a number of pedagogical issues which include how e-learning is different from the traditional teaching and learning, new teaching and learning approaches required, the impact of science course/subject attributes on course design, the influence of class size (i.e., ratio of instructor and students), the importance of instructor presence and social interactions, and that well-designed course organization required. This study also noted instructor and student personal will, capacity and time would influence their instructional design and learning in e-learning.

All participant groups declared e-learning was significantly different from face-to-face instruction because instructors and students needed to work with new

media in their e-learning. They noted the differences were found in the delivery and access of course content, time and effort required for courseware, content and pedagogy, and the changes in role and responsibility of instructors and students. Most instructors and students had experienced the use of online course materials, audios/videos, asynchronous and synchronous interactions, and other effective teaching techniques in their different e-learning courses (see Sections 5.2.3 and 6.2.3). As mentioned earlier in personal factor in this section, instructor and student attitude to learning influence their teaching and learning approach which was based on different learning objects and different learning theories for the appropriate instructional context. The findings of the study suggest instructors and students need to adopt new curriculum design, new teaching and learning methods, new ways of assessment, and new interaction approaches. These findings are supported by the study of Hung (2001) who found instructors seem to be pedagogical engineers and needed to be responsible to plan a lesson with most relevant instructional approaches and technologies in their development of e-learning.

The commentary from all participants noted the characteristics of course/subject attributes and the size of the class have influenced instructors' pedagogical concerns. A majority of instructors noted some science courses might not be appropriate for e-learning teaching because of their course/subject attributes such as the inclusion of abstract science knowledge and formulae. Sevilla and Wells (2000) also found many lab classes in the physical or biological sciences were difficult to convert to Web delivery. In addition, a majority of instructors noted that, due to the class size, the general compulsory courses are more suitable for e-learning development than those advanced elective ones. The findings from a majority of participants indicate personal perceptions of e-learning, university policy and support also influenced instructors' pedagogical concerns (as described in Section 7.2.1).

In online course organization, to establish a productive academic environment with an emphasis on social interactions and instructor presence between instructors and students is challenging and particularly important. All administrators and a majority of instructors and students noted the

student-instructor social interaction was an important pedagogical concern. They noted through interaction with instructors, peers, and course content, students had opportunities to negotiate meaning and connect new concepts to previous knowledge. Thus, as mentioned earlier, instructors with social constructivism philosophies had provided chances of synchronous and asynchronous interactions for student's collaborative learning such as online discussion and collaborative projects. This finding resembles with those studies by Shea, Swan, Fredericksen, and Pickett (2001) and Hülsmann (2004) who found lack of interactivity and the limited scope of course offerings are weak points of traditional distance education. Thus, how to improve interactions between instructors and students in e-learning is a pedagogical concern for instructors in their development of e-learning courses. Associated with a concern for social interaction, student commentary suggests that when studying online a sense of online community is important. Students acknowledge they need emotional and social support for learning and recognize a safe, tolerant, respectful, supportive climate of learning as essential. This can encourage them to overcome emotional barriers to participation such as shyness and the inhibition of writing and sharing their ideas with others in the course. Moreover, the findings indicate that for students a strong sense of a learning community was associated with a strong teaching presence from instructors exhibited and contributed to a sense of shared purpose, trust, connectedness, and learning (Shea, 2006). Some instructors and a majority of students indicated students who did not have adequate access to their instructors felt that they learnt less and they were also less satisfied with their courses. Thus, the role of instructor has changed to that of a discussion guide and problem-solver. The view of student social interaction in a sense of online learning community and instructor presence is supported by many studies (e.g., Khoo, Forret, & Cowie, 2003; Shea, 2006).

The findings suggest an effective e-learning environment consisting of well-designed course organization, complete orientation and syllabus information are essential to help orient students to the course, to the instructors, and to what will be expected of them. Both instructors and students noted the provision of well-organized course materials offered before class, detailed online syllabi, clear links between F2F and online support materials, and rapid instructor responses

were most effective teaching strategies and most influenced their use of e-learning. The findings, indicating a clear and coherent course structure is important to enable students to understand the overall aims of the course and improve the quality of their learning outcomes, are supported by many studies (e.g., Fredericksen, Pickett, Shea, Pelz, & Swan, 2000; Khoo, Forret, & Cowie, 2003; Trigwell & Prosser, 1991).

Instructors in this study utilized a combination of different teaching methods to attract student engagement in e-learning such as providing online course materials, audios/videos, synchronous and asynchronous interactions (see Sections 5.2.3 and 6.2.3). Instructors thought these teaching methods were helpful to improve student learning outcomes and their teaching efficiency and quality. For example, instructors with behaviorism strategies thought complete course notes and videos of lessons could help student understand and memorize the course content and online assessment gave students more drill and practice. Further, a review of video of lessons and video of student presentation also could provide instructor and student a chance to reflect on their own practice and co-construct their ideas, knowledge, and interactions (see also Shulman and Shulman, 2004). On the other hand, instructors with personal constructivism beliefs considered online supplementary resources provided student a chance for personal discovery of knowledge. The students who were interviewed and surveyed also had this kind of thought. Thus, the findings from both instructor and student groups converge to indicate that e-learning is not a “gift-wrapping” of traditional course materials online (Fischer, 2003) and an effective learning environment consists of well-organized and complete orientation and a clear and coherent course structure to enable students to understand the overall aims of the course and improve the quality of their learning outcomes.

### **Technological factors**

The findings of this study highlight that e-learning relies on multiple technologies in isolation and as a network. *E-learning* described by participants in the study indicates learning is accomplished over the Internet via various types of delivery systems such as online videotape, audio/video, CD-ROM, email, or satellite television program. Technologies can provide information about the learning

content and or assist in the management of such information (Lim, 2002, 2003; Saljo, 1999). Thus, e-learning practice was seen to be an educational reform based on ICT technologies. The use of a mix of computer and other technologies to deliver instruction across time and place constraints and to provide access to information resources is consistent with studies elsewhere (see for example OECD, 2005; Wallhaus, 2000). A majority of participants indicated the rapid advances of ICT technologies have led to worldwide globalization and knowledge economy and have impacted national and university e-learning policy and practice. They asserted e-learning is a trend that could not be ignored. They viewed it as tools for assisting instructor and student teaching and learning based on the national policy.

Technological factors in this study are taken to include issues of access to the requisite technologies and factors surrounding the technical problems encountered when using the e-learning system. The findings suggest the nature and quality of access to technology is an issue for most instructors and students although the nature of the access and quality challenges they faced varied considerably (see Sections 5.3.2 and 6.3.2). The complex nature of e-content requires instructors and students to have access to a range of hardware and software such as graphics cards, computer facilities and storage and, often, specific software. Administrators and technical support staff indicated new technologies are always on the horizon and the university struggled with a budget shortfall to keep their technology up-to-date. The data in Chapters 4, 5 and 6 showed over half of the instructors and students were comfortable with the university e-learning system and were encouraged to use e-learning. However, a small portion of instructors and students noted a stable, reliable, user-friendly, fully functional and high performance e-learning system and graphic interface was important for their development and or use in online assessment and or online discussion. The findings indicate political insufficient budget influence the provision of required technologies and this technological problem would impact participants' use of e-learning in personal and pedagogical aspects (discussed earlier in personal and pedagogical factors).

The findings of the study suggest that when building an e-learning infrastructure it appears it is important to address government and university existing culture, governing principles, processes, structures and goals that will contribute to e-learning success or failure. This finding resembles many studies (see for example McGraw, 2001; Becta ICT Research, 2004; Moloney and Tello, 2003). As has been pointed out, the findings of the study indicate e-learning practice involves the use of multiple technologies and if these are to be available for use in teaching and learning they need to be purchased, configured and maintained. Instructors and students need help to learn how to use them. These activities require the engagement and collaboration of diverse groups of people. The findings of this study support the view that administrators, technical support people, instructors and students are actors playing different roles in e-learning practice and they need to help each other working as a team. These findings have parallels with those studies by Brzycki and Dudt (2005), Daugherty and Funke (1998) and Salomon and Perkins (1998). In sum, the findings indicate participants perceive e-learning as mediated by a network of technology and as collaborative learning.

### **Other factors**

Other factors include the influences of external professional, private, public factors. The external professional factor included the influences from all formal or informal professionals outside the university such as formal educational professionals (e.g., other national and international universities), formal government advisers and inspectors (e.g., MOE assessment committee) and external informal associations (e.g., governmental fund association, professional e-learning development organizations). The private factor included the influences from all commercial resource providers outside the university such as textbook and e-learning curriculum publishers, commercial educational websites or TV channels, commercial discipline company or in-service training courses, e-learning platforms and courseware providers or regular support mechanisms. The public factor included the views and concerns of non-government sources beyond the university such as the perceptions of the community people, parents, media and public opinions. Both instructors and students noted they had been affected by the external professionals and private commercial resources providers

in their use of e-learning (see Sections 5.2.3, 5.4.5, 6.2.3 and 6.4.5). These findings have parallels with the studies by Covington, Petherbridge, and Warren, 2005 and Osman, 2005). Some instructors commented they have been influenced by the social demands of flexible learning and services. The public opinions and needs within the society and among the public have affected some instructors in their e-learning development and teaching (see Sections 4.2.4, 5.2.3 and 5.4.1). These instructors saw this e-learning trend and demand so they were motivated and enthusiastic in their engagement in e-learning. In sum, the findings indicate participants not only perceive e-learning as a network of technology-based and collaborative learning but also perceive whole e-learning practice as a situated social-cultural learning activity within and beyond the university.

This study has examined relations between government and institutional policy making and e-learning teaching in the university community. It has also considered the interplay of instructor and student will and capacity with the provision of incentives and opportunities to teach and learn as these were mobilized by the university system and wider community context.

### **7.3 Participant suggested enhancement strategies for university e-learning**

The third research question, which is the focus of this section, was:

What do administrators, technical support people, instructors, and students see as possible enhancement strategies for the practice of the e-learning in general, and for science e-learning in particular?

This section synthesizes suggested strategies for enhancing e-learning practice. Three categories were identified: suggested changes for the university, instructors, and students. The first set of suggested changes for the university relate to effective leadership, well-defined e-learning goals and policy, better university support services and policy changes, and more incentives for instructors and students. The second category includes the changes of instructors' attitude to e-learning, the provision of well-designed e-learning courses, and actual involvement in e-learning. The third suggested change for the students is the change of students' learning attitude in e-learning. The required good cooperation

among all participant groups and the suggested changes for science education are also described.

Effective leadership is crucial for successful e-learning practice. All administrators, technical support staff and a majority of instructors suggest the university needs to assign a high-level prestigious person or recruit a knowledgeable and supportive e-learning specialist in a high-level dedicated e-learning practice position to conduct detailed and well-defined goals and policy for e-learning practice. This dedicated person needs to manage the integration of university resources for well-designed e-learning development and to coordinate and conduct all matters pertaining to e-learning practice. This suggestion of organization change for effective leadership parallels a number of research studies (see also Abel, 2005; Branigan, 2004).

A well-defined e-learning goal and development policy is required for e-learning practice. The data in Sections 4.2.5, 4.3.5 and 5.5.2 showed the view for university e-learning development goals was different amongst different groups. However, whether the university goal for e-learning practice was to improve the academic quality of teaching and learning or to make money from e-content sales or both, a documented university vision or a well-defined e-learning goal and development policy considered important (see also McGraw, 2001; Moloney & Tello, 2003). A well-defined e-learning policy and goals that set out the university vision and goals for e-learning practice; support policy for instructors and students; cooperation policy within university departments/ colleges and or with other universities; and the assessment system for evaluating e-learning were said to be needed. The suggestion was that if the university had a well defined e-learning policy then instructors would follow it. All administrators and some instructors suggested the university needed to inspect and learn how to apply the business enterprise e-learning practice model on campus. However, some instructors and support staff indicated it would affect instructor e-learning course development because the business model and educational model are different.

University support services and policy changes are important to instructor and student adoption of e-learning (see Section 5.5 and Section 6.5). These included

continuously providing student assistant support and high-quality manpower support to help instructors to develop their e-learning courses; providing more funding to buy more adequate, up-to-date and high quality e-learning related facilities and software; reducing instructor teaching load; providing the student feedback to the instructors and also taking feedback or suggestions from instructors and students to enhance e-learning practice; providing extra technical supports (e.g., training and seminars for technology use and course design) and resources (e.g., e-books, CDs, online e-learning courses or database) whether from internal or from external professional or private commercial publishers for their e-learning instructional design and development. Furthermore, despite technical staff and student assistant support being the main support for the use of e-learning, the peer coaching or peer support were encouraged as strategies to overcome instructor and student psychological barriers and help them to try e-learning.

Many incentives for instructors and students were described and suggested in Sections 4.5, 5.5 and 6.5 as ways of motivating instructor and student use of e-learning. As mentioned above, university support services (e.g., student assistant support) are also thought to be one kind of incentive. However, different colleges/ departments or instructors had different organization cultures and personal needs so different incentives might apply. For instructors, they preferred to be respected and encouraged rather than forced. Thus, the extra hour-pay, monetary awards, best teaching awards were provided as incentives and also expected to be continued as encouragements. The respect and recognition of instructor contributions to e-learning from the university in tenure promotion policy as incentives were necessary and important (see also McLean, 2006; Clark, 1993; Wolcott, 1997). For students, personal extra grading marks from the instructors and the increase of e-learning total-credits for graduation from the MOE were seen as encouragement incentives.

The second set of suggested changes was for instructors. All participants, especially instructors, noted they all needed to change their perception and attitude to accept the e-learning trend. Instructors were the key people in e-learning practice so their personal perception and attitude towards e-learning

development were of the most concern. Many support forms and incentives mentioned above can be used for overcoming challenges (e.g., lack of time, personal willingness and capacity) and changing instructor attitude to e-learning. Help to improve instructor capability of technical skills and pedagogical approach was seen to be an effective strategy for a well-designed e-learning course and it could improve student learning. Instructors were recommended to design more advanced applications of e-learning courses which would include well-organized course materials and provide more opportunities for student-instructor interaction. The instructor presence, peer discussion and social interaction in online discussion are significantly important and need to be taken account in the course design. The aim of well-designed e-courses and actual involvement in e-learning is to help or motivate students to learn actively and diligently.

The third set of suggested changes was for students. All participants indicated a majority of students were passive and lazy learners so they suggested the students change their perception and learning attitude to e-learning and adapt to the current information age. Students were recommended to become active, diligent and self-managed learners and to improve their personal capabilities in time management and technical skills along with organizational ability.

Furthermore, good communication and cooperation amongst all participants within the university is crucial for successful e-learning practice. As mentioned earlier in Section 7.2, e-learning requires the involvement of diverse participant groups so mutual respect and recognition are important for their relationship and communication. The collaborative e-learning teaching approach among instructors within or beyond department/college is not only to reduce instructor teaching load but also to save some money for the university and improve their cooperation in teaching and research.

Possible enhancement strategies for science education in e-learning were the same as those for other colleges and included providing more seminars, demonstrations, and workshops to motivate science instructors to use e-learning. The College of Science also needed to have a well-detailed development plan, to audit their courses, and based on the course attributes, to design their own e-learning courses.

The administrators and some instructors suggested that science instructors might need to meet together and discuss how to divide into certain groups to cooperate to develop the science e-learning courses.

Overall, the findings in Chapters 4 and 5 have shown all administrators, technical support people and instructors agree that an effective e-learning practice requires good communication and cooperation amongst all participant groups (see Sections 4.3.5, 4.4.5 and 5.6.2). Each participant group recognized they had their own responsibilities and should help each other. Current e-learning practice at NRU is not satisfactory to the university administrators, technical support people, and a majority of instructors and students. Some possible enhancement strategies were suggested. Suggested changes for the university included effective leadership, a well-defined e-learning goal and policy, support services, and incentives as encouragements. However, the suggested changes for instructors and students were only to change their personal perception and attitude to e-learning because their personal time, will and capacity were most of concern for a successful e-learning practice. A well-designed course organization was also suggested to be developed by instructors to help students learn actively, diligently, and in a self-managed fashion. However, the most important suggested strategies for enhancing e-learning practice to be successful are good communication and cooperation amongst all participants within the university.

## **7.4 Summary of the findings**

E-learning as discussed in this study refers to the online component of a blended learning course and is a comparatively new initiative in universities worldwide. Thus the participants in this study were relatively inexperienced with it; most had taught or learnt only two or three courses. The findings of this study suggest that university e-learning practice as perceived and experienced by administrators, technical support people, instructors and students is a socio-cultural practice (Wertsch, 1991). Seven factors that influenced instructor and student uptake and use of e-learning were identified. These were policy factors, personal will and capacity, available technology, pedagogical and learning approaches, private, public, and external professional factors. Policy played an important role in

providing resources and incentives for e-learning practice and effective leadership was considered crucial for its development and management. The participants saw e-learning as an important trend and perceived both benefits and challenges for themselves, the university, and even for the community. Personal will and capacity were considered as the crucial factors in the use of e-learning. The engagement of instructors and students in e-learning is mediated and affected by the technology and so e-learning pedagogies and learning approaches are needed. These were said to require instructor and student good personal technical knowledge and skills for technology use and course design, and self-management capacity. Furthermore, public opinion and access to the e-resources produced by private and external groups influenced instructor and student use of e-learning. Suggestions provided by the participants for improving e-learning related to these seven factors. They noted the further development of e-learning would be enhanced by instructor and student personal active involvement and national, institutional and wider community leadership and support where this included e-learning professional development and learning resources, and good cooperation among all participant groups in the e-learning practice.

This chapter has outlined the findings pertaining to how e-learning courses are currently conducted and the key factors associated with effective teaching and learning in this context from administrator, technical support people, instructor and student perspectives. It has also set out suggestions for how e-learning practice might be enhanced, particularly that in science education. The model that accommodates these factors to understand the reality of e-learning practice in a Taiwan university context, first proposed in Chapter 2 will be refined and further developed in the next Chapter. The limitations, implications and suggestions for further research also will be discussed next.

# **Chapter 8 Towards a model for e-learning**

## **8.1 Introduction**

This chapter outlines a model for conceptualizing the implementation of e-learning as a component of blended learning at a university where research is accorded high status. Section 8.2 sets out an explanatory model of the factors that influence e-learning practice. Section 8.3 discusses the limitations of the study and Section 8.4 discusses the implications. Finally, Section 8.5 provides suggestions for further research and Section 8.6 provides a final comment.

## **8.2 A proposed model for e-learning practice in Taiwan university context**

E-learning as discussed in this study refers to the online component of blended learning courses. This, it is argued (Seng & Mohamad, 2002), is the fastest growing area of technology-based learning. The findings of the study indicate that, at least in the research-focused university in Taiwan involved in this study, administrators, technical support people, instructors and students share a similar understanding of how e-learning might be developed and implemented in a university setting. Their perceptions of benefits and challenges and influences on the use of e-learning were similar. More than this, individuals from each of the different groups identified the same broad range of factors as influential. This section presents an explanatory model that takes into account the wide range of factors that this group of stakeholders identified.

The model for the factors that influence e-learning as part of blended learning proposed on the basis of the findings of this study has four layers: a central enactment zone that encompasses the interactions and relations between instructors, students and technologies; a zone that recognizes the role of collaborative activity amongst support providers including university technical support people, instructor colleagues, and student peers, and those who enact

e-learning as an educational reform; a zone that accounts for the influences from the university situation; and a zone that accounts for the influences from the wider socio-cultural context. Section 8.2.1 describes the central enactment zone which is the heart of the teaching and learning process. Section 8.2.2 details the role of collaborative and productive relationships amongst those within the university. Section 8.2.3 overviews the influences that arise from the organizational university context. Section 8.2.4 explicates the influences from the broader community context. The nature of e-learning practice within blended learning is described in Section 8.2.5. Section 8.2.6 provides an overview of the model.

### **8.2.1 The central enactment zone: Interactions and relations between instructors, students and technology**

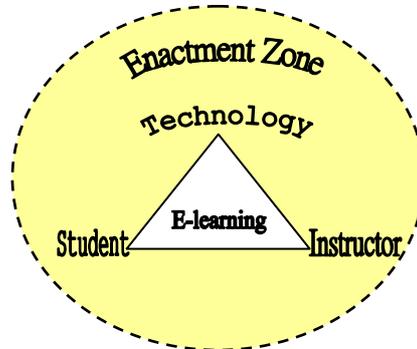
The first central layer of model proposed in this study is shown in Figure 8.1. It represents the central enactment zone for e-learning practice as the interactions between instructors, students and the e-learning technology along with the three-way relationship between them. E-learning practice as an educational reform is accomplished via instructor and student engagement in day to day teaching and learning. Both instructors and students need to decide to use e-learning so they both are at the center of the model. Instructor and student use of e-learning cannot be separated from their access to and use of available ICT technologies and so these are also included in the enactment zone (Section 7.2.4).

The findings from the questionnaires and interviews indicate instructor and student personal will and capacity to do with the benefits of e-learning and to do with the e-learning technologies influence their participation. Instructor and student personal will refers to their personal characteristics such as personal beliefs and preferences, and their attitudes to technology use, education, learning and e-learning. Instructor and student personal capacity refers to their personal technical knowledge and skills to utilize technologies in e-learning and self-management and organization ability. Instructor and student interactions and relations are an important component of enactment zone. Students can serve as powerful incentives for instructor instructional change (Section 7.2.1). On the other hand, students can inhibit instructor use of e-learning due to instructor

perceptions that students have passive learning attitudes and lack personal access to the required technology (Sections 5.4.1 and 7.2.4).

Figure 8.1

*Interactions and relationships among instructors, students and technology*



University instructors have academic freedom. They can choose to provide for e-learning opportunities within their courses meaning that their personal views and preferences need to be taken account in a model for e-learning practice (Sections 7.2.1 and 7.2.2). Instructor personal motivations to adopt e-learning teaching include the flexibility of teaching and learning in time and place for them and their students, easy to manage course materials and student academic records, the potential to reuse course materials, and improved opportunities to interact with their students (Section 5.3.1). Although these benefits were thought to improve instructor teaching efficiency and quality, instructors also face challenges that undermine their motivation (Section 5.3.2). The time and effort needed to prepare e-learning lessons, the challenge of instructional design with new media and the demands of online interaction can decrease instructor motivation to use e-learning (Section 5.4.1). When instructors consider e-learning can improve the wider public's knowledge and skills they are motivated to teach in e-learning (Sections 5.3.1 and 7.2.4). However, if instructors consider e-learning is not a good tool for instruction, they will not use it (Sections 5.3.2 and 5.4.1). Instructor personal capacity associated with the use of technology can inhibit, or motivate, their use of e-learning. In addition, some instructors may be anxious about their capability to use multimedia facilities and with being videoed when lecturing (Sections 5.2.3 and 7.2.2). Instructor preference for face-to-face instruction is another factor which can influence the use of e-learning (Section 5.3.2). This complex set of

factors which influence instructor use of e-learning means it is important they are included in the central enactment zone.

Successful e-learning practice relies on student participation, all the more so in the case of e-learning as a complement to face-to-face teaching as part of blended learning courses. In this case student participation is optional and so student personal motivation and capacity are crucial. The central role of student active participation is reflected in their inclusion in central enactment zone of the proposed model. Student personal perceptions of the benefits and challenges of e-learning, preferred learning approaches, sense of learning community and personal technical knowledge and skills influence student use of e-learning (Sections 6.3.1.and 6.3.2). A majority of the students in this study appreciated the convenience and flexibility of e-learning in supporting them to achieve their academic goals (see also Lao & Gonzales, 2005). Students considered they had been able to expand their learning and knowledge beyond the limitations of knowledge found in the textbook and presented in lectures, and to enhance their interactions with their instructors and peers (Section 7.2.1). However, students realized the flexibility of learning required them to be active, diligent learners with a high degree of self-management and motivation. Student preferences for face-to-face instruction and reading the textbook can undermine student willingness to use of e-learning. Individual student technical skills for online access and interaction, a lack of easy access to quality e-learning technologies along with a reduced sense of being in a learning community are also influential in student use of e-learning and so contribute to the nature of the enactment zone that emerges through student interaction with classmates, lectures and the technology.

E-learning is different from face-to-face instruction because the technologies are essential in mediating the process. Easy access to high quality technologies such as functional and reliable network technologies and e-learning systems is essential for a successful e-learning practice. For this reason technology is included in the central enactment zone with instructors and students. Instructor and student possibilities for teaching and learning are enhanced, and can be limited, by the

intersection of the available e-learning facilities and functionality and their own expertise.

Interactions between technology and instructors and students in the central enactment zone in the proposed model include two aspects: access to and quality of technology and the capacity of using technology. Access to and the quality of technology is an issue for instructors and students even though the nature and quality challenges they face can vary considerably (Sections 5.3.2, 6.3.2 and 7.2.4). Instructor and student lack of easy and high quality access to infrastructure and e-learning platforms can hinder their use of e-learning. At the university in this study, as is likely to be the case in most universities, instructors and students did not have much flexibility in what multimedia facilities and e-learning platforms they could use. These were provided by the university and enabled and constrained course development and the provision of online course materials through the limits of time use and system function (Sections 5.4.1 and 6.4.1).

More than this, e-learning requires a network of technologies. The technologies for e-learning include delivery systems for online videotape, audio/video, CD-ROMs, DVDs, video-conferencing, VOD, e-mail, live chat, the use of the Web, and satellite television programs. Different technologies support different teaching methods including student viewing of videos of previous lessons online, online assessment tasks and online synchronous and asynchronous discussions (Section 5.2.3). The need to consider issues around instructor and student use of multiple interrelated technologies to deliver instruction across time and place constraints and to provide access to information resources about learning content and or to assist in the management of such information and the perceived benefits arising from this were highlighted in this study in a manner consistent with studies elsewhere (see for example Lim, 2003, OCED, 2005). An easy to use and high quality interface and functionality of the technologies and the e-learning system was said to be required for graphs, figures, and even voice online and also to address the challenge of typing Chinese characters and science formulae and symbols online, particularly for science courses (Section 7.2.2).

Both instructors and students can struggle with a lack of personal technical knowledge and skill to use advanced technologies (Section 7.2.2). Instructors may feel they lack time but some also experience challenges from their personal expertise and beliefs to the incorporation of technology into course design. Actually most instructors have had little or no formal training in the effective use of technological resources in e-learning (Section 5.3.2). Similarly, some students lack the technical knowledge and skills to access e-content and online interactions for e-learning (Section 6.3.2). Thus, the nature of effective and useful e-content in e-learning relies on their personal capacity and the nature of participant access to multiple interrelated technologies.

The central enactment zone is not static but dynamic and variable over time and depending on the interactions between instructors, students and the e-learning technology along with the three-way relationship between them. In the early stages of e-learning practice, instructors and students may have limited ICT knowledge and skills. They may not have clear perception of the pedagogical and learning value of e-learning and so may not consider it is worthwhile to engage in e-learning practice. E-learning is mediated by the technologies and new technologies are always on the horizon. Both instructors and students need to continue learn how to use available technologies. They need to learn to manage the challenges and benefits of more flexibility, more interactions and a different from of workload. The rapid advances in ICT technologies mean that the issues around instructor and student personal will and capacity with technology is an ongoing issue. E-learning is mediated by the technologies and as this evolves so too do the possibilities for e-learning. To sum up, the model for e-learning practice in a Taiwan university context that arises from this study construes the central enactment zone as encompassing the interactions and relationships amongst instructors, students and e-learning technologies.

Although the notion of a central enactment zone draws heavily on the work of Spillane (1999) and Millett and Bibby (2004), the models they proposed focused on the enactment zone as associated with an individual teacher in a traditional classroom. Their models focused largely on instructional change based on teacher personal resources such as teacher prior knowledge of subject matter, beliefs and

dispositions. In their models, the teachers were the key people in classroom instructional reform. Students in the context of their models do not have the freedom to choose to attend class and so they are positioned as just one of the influences on individual teacher instructional decisions. However, in e-learning practice as part of blended learning, student engagement is as important as instructor involvement because students can decide to use e-learning, or not. Both instructors and students can choose to participate in face-to-face instruction alone and not engage in blended learning. Neither Spillane (1999) nor Millett and Bibby (2004) placed much emphasis on the role of artifacts or other tools, including computer technologies, in the teaching and learning process. However, in e-learning teaching and learning possibilities are shaped by the available technologies. The proposed model takes this into account by placing technology in the central enactment zone. The expansion of enactment zone to include students and technology is a key contribution of this study. It is not sufficient to leave students as an influence when seeking a model to explain instructor and student engagement in e-learning as part of blended learning.

Technology is expensive and requires both a technological and organisational infrastructure to support its use and so any model that seeks to explain the use of e-learning as part of blended learning university courses needs to consider the wider 'situation' (Millett and Bibby, 2004). The relationships and collaborations between those who provide support and instructors and students, as the implementers of e-learning as an educational reform within an institution, will be described next.

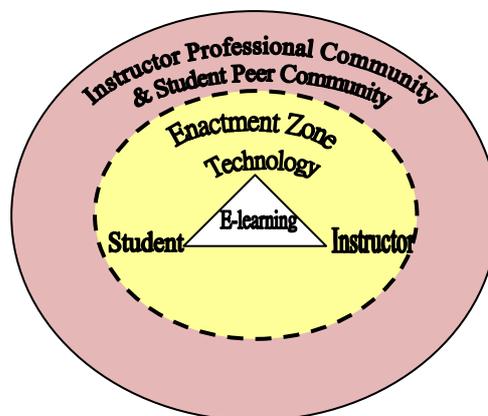
### **8.2.2 E-learning practice as a collaborative activity**

E-learning practice involves the use of multiple technologies and if these are to be available for use in teaching and learning they need to be purchased, configured and maintained. More than this, instructors and students need help to learn how to use them. These activities require the engagement and collaboration of diverse groups of people. Technical support people, instructor and student communities each play a role in e-learning practice. They each have their own contribution to make and need to help each other. The second layer of the proposed model is institutional instructor professional community and student peer community

which have immediate contact with instructors and students (Figure 8.2). The instructor professional community includes people who teach or work as support staff for e-learning practice including instructor colleagues and technical support people (technical staff and student assistants). This layer acknowledges the e-learning practice relies on good relationships and collaboration amongst instructors, help from technical support staff and student peer communities. For day-to-day teaching and learning, the support and pressure from instructor professional colleagues, in the case of instructors, and student peers in the case of students is influential because it can directly affect participation in and development of e-learning (Sections 5.2.3, 5.4.1, and 6.4.1). This support can influence student accessing e-content and online interactions and can address some of the concerns they face their psychological barriers in the adoption of e-learning. This layer of the proposed model represents the dynamic relationships between the individual instructor and student enactment zone and their respective communities within the institution.

Figure 8.2

*Relationships and collaborations amongst support providers and implementers*



Instructor colleague influences can be on the development of e-content, e-learning teaching approaches and the use of e-learning technologies through the forum of easily accessible models of practice (Section 5.4.2). Instructor colleague perceptions and experiences in e-learning can influence on instructor adoption and use of e-learning because they are part of the immediate context (Section 5.4.2). Instructor colleagues can share their e-learning experiences with each other (both cognitive and affective issues). The individual instructor can work with colleagues at different levels of intensity and in different power relationships within varied e-learning contexts and cultures. Instructors can work together to create e-content,

establish an e-learning website, and teach each other how to use multimedia facilities, to name but a few possibilities (Sections 5.2.3 and 5.3.1). Pressure and support, including emotional support and friendship, from colleagues are all important influences from the professional community. The more instructor colleagues are enthusiastic about and skillful in e-learning, the more likely others will be encouraged to become active and collaborative in e-learning teaching. Interaction and collaboration between instructors and their colleagues can be seen to create a culture for the use of e-learning, or not, within a department or even the university. In this way, the culture of a department and the university are critical influences on e-learning practice and hence are included in the model.

University support people such as technical support staff and student assistants are included in the second layer of the model because they play an important role in supporting instructors and students to use e-learning (Sections 5.2.3 and 6.2.3). Technical support people impact on e-learning through the provision of high quality technology and a reliable and fully-functional e-learning system, and efficient technical support. Technical support staff design and maintain university e-learning systems and provide technical support services for instructor development of e-content and student access to e-content and online interaction. Student assistants also play an important role in the instructor development of e-courses and student use of e-learning (Section 4.4.2). They can help instructors to set up e-learning related facilities for video-recording, video file transfer online and or maintenance of e-learning website. They also can help instructor to manage student academic records and online (group) discussion. They also can help students to solve e-learning related technological problems such as student access to e-content and ongoing online interactions. Without prompt student assistant help, instructors and students may not use e-learning. With their help, instructors can concentrate on e-learning teaching, and not worry about e-learning related technical problems (Section 5.4.2).

The inclusion of the student peer community in the model acknowledges that students learn and work together within the university. Student peers can influence each other in the adoption of e-learning because students take into account how easily they can get support when they face challenges. Student peer

views and attitudes to e-learning also act as an influence on student adoption of e-learning. Peers can help each other to access e-content and to sustain their involvement in online discussion. They can help each other to solve e-learning related technical problems (Section 6.2.3) and share feeling of frustration and satisfaction. Just as importantly, when a student interacts with their instructors and peers online, he/she benefits from a sense of learning community and respect and trust from peers. When student peers are active, diligent and skillful e-learning users they can influence others to become active and collaborative learners (Section 6.4.1). The interaction and collaboration between students and their peers is crucial for successful e-learning practice because peer support is usually timely and targeted at specific problems. It is also crucial in ameliorating student psychological barriers in the adoption of e-learning because they can get immediate support from these groups.

Technical support people (i.e., technical support staff and student assistants) provide their support services to instructors and students based on the university policy for e-learning. Their support is beneficial for instructors in their development of e-learning. Technical support staff and student assistants can deal with technical and administrative issues and so technical support services can influence instructors and their ongoing involvement in e-learning (Sections 4.3.2 and 4.4.2).

To sum up, support people, instructor colleagues and student peers play active but different roles in e-learning. These roles are interrelated and their productive interaction is influential in facilitating and enhancing e-learning participation by instructors and students thereby indicating e-learning can be modeled as a collaborative practice to which instructors, students and support people need to contribute for its mutual construction. E-learning is mediated by, and contributes to, the relationships that develop among participants as individuals and groups via the use of technologies. Mutual trust and respect among these three groups are important (Sections 4.2.5, 4.3.3, 5.3.2, and 5.4.1). While effective e-learning practice requires instructors and students to be active and self-managed it is accomplished with the support and cooperation of instructor professional community and student peer community within the university.

The relations between instructors and their professional community of colleagues, and student peers in the case of students, were not clearly identified as important in Spillane's model. Millet and Bibby (2004) introduced consideration of the professional community within the school 'situation' when they sought to use Spillane's model in their study of primary mathematics instructional reform but they did not consider the technical support colleagues and student peer community. The professional community in Millet and Bibby's (2004) model focuses more on subject leaders or coordinators and head-teachers for general leadership and management of in-school mathematics instructional reform. The quality of leadership in their model is important because the reform needed to follow the national curriculum. They do not focus on support issues and include students only as part of the 'situation' (Millet and Bibby, 2004, p.7). In this study student peers are included as part of the social dimension following on from their inclusion in the central enactment zone. In the model developed here professional colleagues, student peers and technical support people are positioned as an immediate influence on e-learning practice and thus the enactment zone is surrounded by these groups rather than being subject to their more distant influence. The model in this study therefore portrays e-learning as much more a situated and social practice than do the models proposed by Spillane and Millet and Bibby.

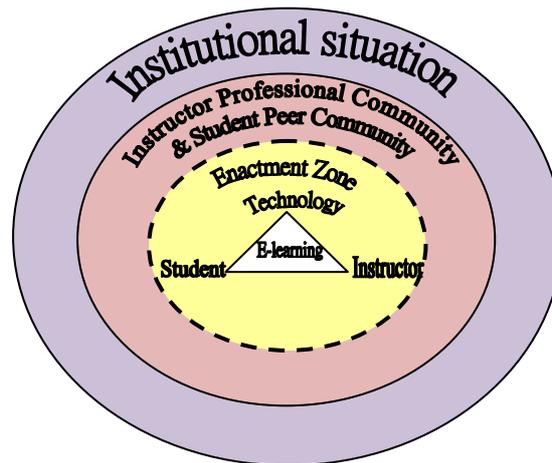
To sum up, the model proposed here identifies an immediate influence and support on instructor teaching and student learning in e-learning comes from instructor professional colleagues, student peers and technical support people. The next section will describe the institutional situation—the university-wide policy and practice environment for e-learning.

### **8.2.3 E-learning practice as situated in the institutional situation**

University e-learning practice does not just involve instructors and students and e-learning technologies (Section 8.2.1), or even technical support people, instructor professional and student peer communities (Section 8.2.2). The university-wide environment, especially when the university has chosen to promote e-learning, also needs to be considered in a model that seeks to describe and explain e-learning. The university in this study faced many challenges in responding to

the introduction of e-learning (Section 7.2.4) and these challenges influenced the implementation of e-learning including instructor teaching and student learning. Hence, the third layer of the proposed model (shown in Figure 8.3) considers the influence of university-level leadership policies and goals, financial matters, and other influences from the university institutional situation.

Figure 8.3  
*Influences within the university e-learning context*



In the model for e-learning as part of blended learning being developed in this study, the institutional situation refers to the spectrum of influences from across the university. When building an e-learning infrastructure it is important to consider how university existing culture and development policies (e.g., governing principles, processes, structures and goals) might contribute to e-learning success or failure (Section 7.2.4). University administrators are the key people in shaping these aspects. Their role and status means that their perceptions of e-learning influences the initiation and development of university e-learning policy, including policies to do with the provision of the technology and the administrative and technical support that are crucial to the implementation of e-learning. University administrators play the role of university policy-maker. They impact on e-learning practice through the initiation of e-learning development goals and policies that include the provision of high quality technology and efficient administrative and technical support services (Section 7.2.4). Effective leadership by university level administrators is crucial for successful e-learning practice because it is required to support the development of detailed and well-defined goals, policies and practices for e-learning practice.

Administrators' considerations include the potential impact of e-learning on a university's reputation, and finances. In the university in this study the university administrators saw e-learning as a tool that could help the university increase its competitiveness and reputation and also could make, or at least save, money by way of selling e-learning content and lowering educational costs. High university reputation can benefit a university when they come to sell their e-content and also to attract students and the public to take their e-courses. On the other hand, a high university reputation can exert pressure on a university and instructors to develop e-learning particularly well-designed e-content for other universities, enterprises, and the public. University administrators need to manage the financial implications of providing e-learning infrastructures, related technologies and technical support for e-learning practice. Thus, university administrators as leaders need a vision and need to be skilled in coordinating people and integrating university wide resources to support e-learning practice. This range of responsibilities and tasks led to the inclusion of administrators in the model developed in this study.

A budget to provide the requisite technologies and provide manpower support is an influential issue that can only be addressed at the university-wide level. The provision of support as an indication that e-learning is valued within the university and therefore worth pursuing would seem to be crucial for instructor and student adoption of e-learning (Section 5.4.2). The complex nature of e-content requires instructors and students to have access to a range of hardware and software but a majority of participants noted the university struggled with a budget shortfall to keep their technology up-to-date (Section 7.2.4). In addition, e-learning practice requires a support and staff to provide administrative and technical support services. This has cost and university organizational structure implications (Section 8.2.2). The provision of financial and support incentives is a university wide strategy that can be used to motivate the use of e-learning. In this study money rewards and student assistant support for instructors and graduation credits for students were provided to encourage and motivate instructors and students to engage in e-learning teaching and learning (Section 7.2.4).

Policy also needs to include a mechanism for professional development in e-learning and a professional leader to support e-learning implementation. What a university defines as a priority influences what instructors pay attention to and value. Universities in the current Taiwan research-focused context, tend to define their development goals as research-oriented. As the findings of this study indicate, instructors in this context are likely to concentrate on research, rather than teaching, because this is linked with promotion and progress (Sections 1.2.2 and 7.2.2). All the more so, when university development goals also emphasize instructors obtaining research funding and publication. In this context, university recognition of, and respect for, instructor contribution to e-learning is an important aspect of the institutional setting. When instructor contributions to e-learning are neglected or doubted, they are not as likely to use of e-learning (Sections 5.3.2 and 5.4.1). On the other hand it may be that if policy values research and publication it is possible that personal respect and regard from university or administrators and colleagues may provide an incentive for instructors to develop e-courses. Thus, successful e-learning practice requires a well-documented e-learning strategy that sets out the overall direction and objectives for e-learning and recognizes instructor contributions.

At the moment, e-learning policy does not have a clear support policy and guidelines for e-pedagogy; e-content is assessed for rewards. The promoting e-learning initiatives through emails, newsletters, and acknowledging instructors who complete significant e-courses and rewarding them publicly has changed the university culture and motivate instructors to use e-learning. All these cultural changes have the potential to affect the atmosphere of using e-learning and improve the effectiveness of e-learning practice. Current national and university policy in Taiwan e-learning context does not give the clear curricular guidance and procedures for e-learning practice so the university and instructors do not know how to implement and design the good e-content for e-learning teaching. The policy also lacks good assessment system to evaluate the quality of e-content (Section 7.2.2). Thus university administrators, as university policy makers or leaders, need to consider the influences and expectations of instructor and student adoption of e-learning and then include all these in their decisions around e-learning goals and policy.

Ambiguous e-learning policies and polices that lack consistency and authority facilitate local inattention. Ambiguous e-learning policies and goals and a lack of a knowledgeable and supportive e-learning leadership can lead to mutual distrust and misunderstanding between university administrators and instructors (Section 7.2.2). A clear vision of the university development goals and e-learning policy along with effective communication of this vision are important to the implementation of e-learning. When instructors and students are not familiar with university e-learning policy, they may do not know where or how to apply the administrative and technical support from the university to help them develop or uptake e-learning courses. If instructors and students are not satisfied with university e-learning policy, they may not like to get the administrative and technical support from the university. On the other hand, insufficient or poor e-learning supports and resources also hinder instructor and student adoption of e-learning.

Although Millet and Bibby (2004) introduced consideration of the school 'situation' when they sought to use Spillane's model in their study of primary mathematics instructional reform, their model focused on the context as 'that which surrounds' (Cole, 1996) an individual teacher making decisions about teaching mathematics. E-learning practice is affected by university development goals and e-learning polices including the support policy for e-learning. This more distant, but still immediate, influence on university e-learning has been described in this section. This influence is presented in the model for this study as surrounding the instructor-student-technology triad as this is nested within and supported by the local community of colleagues, student peers and support people further emphasizing the situated and social nature of the e-learning practice.

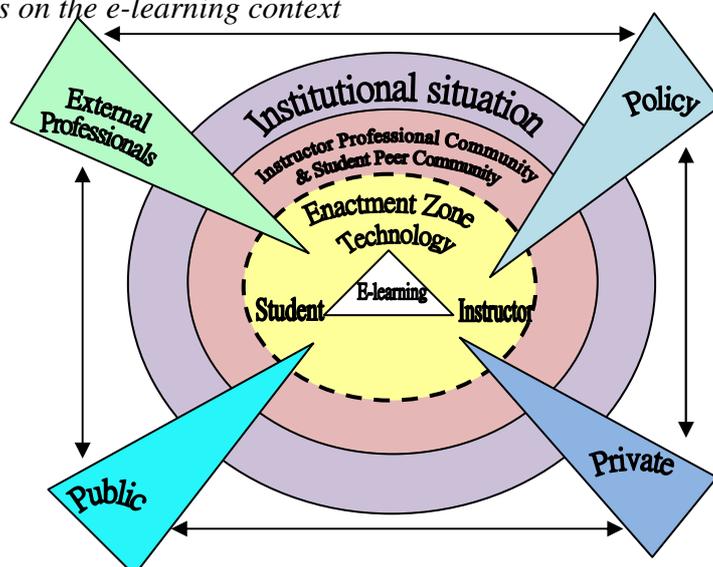
E-learning is a global trend which is fast growing in education worldwide so the more distant wider community outside the university also impacts university e-learning practice. The next section will describe the e-learning practice as situated in the wider socio-cultural context.

## 8.2.4 E-learning practice as situated in the wider socio-cultural context

The social demand for flexibility of learning and educational services has influenced the innovation of education worldwide. It also affects university e-learning practice. In the current Taiwan e-learning context, there are many factors affecting development. Not only are instructors and students influenced by their personal will and capacity to use e-learning (as shown by the enactment zone) and by their respective communities (as in the second layer) and the institutional e-learning environment (as in the third layer) they are also affected by factors from outside the university. These factors can be grouped into the national policy context, external professionals, public, and private enterprise. These are shown in Figure 8.4. These external factors are not mutually exclusive and interact with one another in a variety of ways. For example, the external professionals and the private sectors are peopled by the public. In order not to complicate the diagram the researcher does not use circles to represent each one of the external influences and does not use many arrows to indicate all links between all the external factors. These influences can directly and indirectly influence the institution, the instructor and student community, and the central enactment zone. These factors can impinge directly on the individual instructor or student without being mediated through the institutional situation and their communities. The two-way arrows in the model represent the two-way dynamic relationships between four external factors and two previous factors. All the two-way arrows in the model present a circle of influences that can directly or indirectly affect each other and the central enactment zone.

Figure 8.4

*Influences on the e-learning context*



The national government policy factor here refers to national development goals and policies for education and e-learning. Taiwan has not been alone in initiating e-learning reform efforts (Sections 1.1 and 2.3) and the Taiwan government has been active in and endeavored to promote e-learning to cultivate e-generation talents (Section 1.2.2). For example, universities are expected to collaborate online with other universities and to build new relationships with their community via e-learning (Section 7.2.4). The expectation to obtain collaborative instruction online from the university has impacted on university development policy and university culture. Hence, university instructors are expected to change their perception and attitude to collaborate their instruction online with their colleagues within the university or with other professionals outside the university (Sections 5.2.3 and 5.3.1). Instructors are also expected to become good public agent because the government and university think e-learning practice was a good way to foster good relationships with the community and enterprises through well-designed e-learning courses (Section 4.2.3). E-learning courses are thought not only for the campus students but also for the community or for the enterprises' staff training. Based on national policy, universities and instructors have pressure to undertake self-review or internal evaluation and develop their own plans for future improvement. National policies can influence university development goal and policy for implementation of e-learning and instructor teaching and student learning. Thus, the influences on university e-learning practice from the wider national policy context are needed to be considered in the e-learning model.

The influence from the national policy on e-learning practice includes two aspects: visions (or directions) and practical supports for e-learning practice. National policy supports e-learning to cultivate the whole population to become an e-generation and life-long learners via the broadcast of e-courses to the community, and even through staff training. The Taiwan government considers e-learning can improve their people's ICT literacy and skills to adapt to the current information and knowledge economy era and so the national policy provides practical support for university e-learning practice. These practice supports include budgets for building e-learning infrastructures, the purchase of technologies, recruiting technical manpower support, and rewards for e-learning instructors (Sections 1.2.2 and 4.2.1). In this way, the national policy can directly and or indirectly

influence the university implementation of e-learning and instructor teaching and student learning in e-learning.

The external professional factor refers to all those professionals outside the university with whom the university as a whole, and instructors as individuals, have contact. These professionals include people from other national or international universities, formal government advisers and inspectors (e.g., the MOE assessment committee), and external informal associations (e.g., government funded association) (Sections 7.2.1 and 7.2.4). Professionals from national-wide and/or international universities contribute to the effectiveness of the university implementation of e-learning and the instructor development of e-courses as a source of ideas and through the creation of high expectation of well-designed courses. It is possible for the universities and instructors to collaborate with the external professionals in online instruction, and even to work collaboratively on the e-learning research projects (Section 5.2.3). Formal government advisers and inspectors are included in this group because they can directly influence the university reputation and budget through their evaluation on the performance of university e-learning practice and what is seen as ‘good’ e-content (Sections 4.2.4 and 4.3.4). As noted above, inspection reports are published placing universities in competition with one another for good reports. External informal associations provide up-to-date information on e-learning trends and conferences, and discussion forums for exchanging e-learning experiences. Together these professionals external to a university can influence directly, and indirectly, university e-learning practice and instructor practice and so they were included in the model.

The public factor in the model takes into account the views and concerns of non-government sources beyond the university gates but with a keen interest in education. This includes general public, student parents, and the media. E-learning can provide the public people more opportunities to be educated and become life-long learners. People can take e-learning courses in community colleges through the TV and newspapers (Sections 5.3.1 and 5.4.1). Reports in the media (e.g., TV channels, newspapers) about the benefits of e-learning can motivate people to use e-learning and improve their ICT literacy. Parent’s views of

e-learning can influence student adoption of e-learning (Section 4.2.4). When parents consider e-content as an effective supplementary resource to improve their children's knowledge and skills they will encourage their children to take e-learning courses and view e-content online. The opinions of these groups can directly, and indirectly, influence university e-learning practice and instructor and student adoption of e-learning hence their inclusion in the model.

The private factor influence attends to the influence of commercial resource providers outside the national government or university such as textbook and e-learning curriculum publishers, commercial educational websites, audio/video providers, commercial discipline companies or in-service training courses, and e-learning platform and courseware providers. Resources for e-learning provided by the private sector can be, and the instructors in this study indicated they are, beneficial in reducing instructor workload and increase student access to a variety of course materials and content (Sections 5.2.3, 5.4.5 and 6.4.5). Sometimes instructors can directly adopt CD, videos, VOD or e-book resources into their e-learning teaching. Students also can view these e-resources as supplementary sources. Providers also influence e-learning through training courses or demonstrations of system functionality from commercial discipline companies, e-learning platform and courseware.

The interactions amongst national policy, external professionals, the public and private sectors also needs to be considered. These groups as external influences or constraints will move in and out of focus for all of the participants involved in e-learning practice across the university. For instance, the influence of the public may be a focus at the time of an inspection and then back away again. National policy in Taiwan has not only encouraged instructor and student use of e-learning within the universities but also promoted businesses and other enterprises to develop and use of e-learning as an efficient and cost effective way to improve staff work capability and the public as long-life learners (Sections 1.2.2 and 7.2.4). Nation-wide or international-wide, formal or informal, linkages with professionals outside the university have an influence with national policy. The products of external professionals in e-learning development can influence national policy decisions but they are also influenced by the national policy context and

worldwide external professional development. The perception of external professionals is crucial especially when the evaluators assess the performance of university e-learning practice (Section 7.2.4). Similarly, the private and public sectors also have mutual influences with national policy and external professionals. The introduction of e-learning can influence the private sector to respond this innovation by providing new or adapted commercial schemes that fit e-learning structures and requirements based on the goals of national policy and external professional development (Sections 5.4.5 and 6.4.5). Some instructors and students, directly or indirectly, adopted the e-content provided by the private book publisher and the commercial resources providers (Sections 5.2.3 and 6.2.3). The public opinions and needs of flexible learning and educational services have impacted the national policy and worldwide external professional development in e-learning and also influenced the university and instructors in their e-learning development and teaching (Sections 4.2.2 and 5.4.1). Thus, this study supports that e-learning practice is socially and culturally situated.

In considering the model presented here it is important to note that it differs from Spillane's model in that that the wider socio-cultural external influences detailed above are considered to impact directly on the central enactment zone of instructors-students-technology. This influence is in addition to the way they shape the instructor professional and student peer community within the university situation. While the external influences are similar to those proposed in the Millet and Bibby's model their influence is considered to penetrate through the other layers of context grounded in the university setting to shape instructor and student action: they impact on individual instructor professional development and on the whole e-learning context and all those who are participants.

To sum up, the factors that motivate and inhibit instructors and students have been shown to relate to instructor and student personal will and capacity. Instructor and student personal resources and technology as a mediating tool are at the center of the model because other influences are mediated in and through instructor and student personal resources and the technology in the central enactment zone for teaching and learning. Instructors and students experience pressures and daily influences from technical support people, instructor colleagues, and student peers

in the case of students, to do with their adoption of e-learning. University administrator decisions around university e-learning development goals and policies along with support policies and university organizational and cultural aspects also influence instructor and student use of e-learning. The national policy context, external professionals, public and private sectors can directly or indirectly determine instructor and student adoption of e-learning because these influences can change their knowledge, dispositions, and attitudes to e-learning in their personal enactment zone. Thus, e-learning practice is affected by, and situated in, the broader community socially and culturally. Taken together with the previous parts in the model, e-learning practice in this study is conceptualized as a dynamic situated socio-cultural practice.

### **8.2.5 The nature of e-learning practice within blended learning**

E-learning pedagogy, as part of blended learning, is a consequence of the e-learning system which has been described and discussed in the previous section. That is, e-learning pedagogy is derived from instructor and student personal factors associated with their ideas about education and their will and capacity for technology use along with the particular attributes of the subject of the study and of the technology itself in an enactment zone. As described by the model above e-learning pedagogy is also shaped by the instructor professional community and student peer community (Section 8.2.2), the institutional situation (Section 8.2.3) and national policy, external professionals, private, and public factors (Section 8.2.4). E-learning pedagogy is initiated by and derives from the whole of the context for instructor teaching and student learning. This section talks about the nature of e-learning practice within blended learning as it emerged within the context of research-oriented university in Taiwan.

Research has indicated technology can change pedagogy (see for example Fisher, Higgins, & Loveless, 2006). Computers, multimedia and the Internet or text-based resources such as online books or articles used interactively in an e-learning environment can act in the role of a scaffold (Salomon & Perkins, 1998; Fisher, Higgins & Loveless, 2006). As mentioned earlier in Section 7.2.4, most of the instructors and students in this study considered the use of online course materials, and audios/videos, assessment tools, along with asynchronous and synchronous

interactions could help students reflect and construct their own knowledge and share experiences pointing to three aspects of e-learning pedagogy: content delivery, assessment tools, and interaction.

The content delivery aspect of e-learning practice that emerges from this study refers to the provision of course and other materials online. The importance attributed to this aspect by participants in the study is consistent with the emphasis on the replication of course learning content by the Taiwan government and the university. The provision of e-content is evaluated as an aspect of effective e-learning courses and performance of e-learning practice. E-learning content delivery is thought to provide students with the flexibility to preview or review course ideas at their own convenience of time and place, and at their own pace. Online course materials can include course lecture notes, audios/videos of lessons, and lists of supplementary references (Section 7.2.4). Online lecture notes provide students with an electronic rather than a paper copy of materials they can access by attending class. Audios/videos of face-to-face lessons essentially provide a copy or duplicate student face-to-face instruction. The viewing of video (or audio) of lessons online provides an opportunity for students who have attended face-to-face instruction to review the material presented to develop more complete lecture notes and understandings. It provides an opportunity for those who did not go to class to access this material. Viewing and reviewing lecture notes and video of lessons has the potential to help students better understand course materials but only if students actively engage with these materials to construct knowledge and skills themselves. The provision of lecture notes and audios/videos before class allows students to preview course materials. This has the advantage that students can concentrate in class sessions because they do not need to take comprehensive notes in class. They are in a better position to discuss course content with their instructors and student peers. Further, a review of video of lessons and video of student presentation also can provide instructors and students a chance to reflect on their own practice and co-construct their ideas, knowledge, and interactions. Hence, the provision of lecture notes and audios/videos of lessons online is an important aspect of e-learning pedagogy for instructor and student use of e-learning.

Supplementary online references, websites, audios/videos and other e-resources provide students with access to additional sources of content (Section 7.2.4). This material is often more visual and up-to-date than that in textbooks. This material has the potential to enrich student knowledge and learning because it provides access to different ways of presenting the same ideas which students may understand more readily. The provision of course related references and other supplementary materials online can be useful when instructors do not have time to teach or explain all the course content in detail in class. Students also can gain benefit from viewing these resources online when they are allowed to interact with external people and get external professional ideas or help to improve their learning. Again, the provision of resources such as this relies on student active engagement with ideas.

Instructor and student support for the duplication of class lectures online and the online provision of course materials and supplementary resources could be seen to fit with students being passive in a manner more consistent with behaviorism or as supporting the active personal discovery of knowledge in a manner more consistent with personal constructivism. The provision of the same or similar course materials online and face-to-face can be considered as fitting with a behaviorist view of learning (Case *et al.*, 1996). When instructors perceive they can directly transmit their knowledge to their students in didactic forms of instruction, they tend to assimilate technology to replicate face-to-face didactic forms into their e-learning teaching to provide more opportunities for this to happen. Instructor perception of “what is taught” and “what is learnt” (Elton, 1997) encourages instructors to develop complete course notes and videos of lessons because these are thought to help students understand and memorize the course content. The provision of online supplementary resources fits more closely with a personal constructivist view of learning because this gives students the opportunity to construct their own understandings. Student learning from supplementary resources necessarily involves more than rote memorizing of information that has been transmitted in class because, almost invariably, discrepancies and different ways of presenting ideas will require students to make active sense of this material if they are to gain from it. From a constructivist view, the instructor role is to provide students with opportunities, incentives, and

guidance to construct their own knowledge (see also Sunal, Sunal, Sundberg, & Staples, 2002; Shulman and Shulman, 2004). However, instructors cannot “force” students to construct ideas (von Glasersfeld, 1993, p.32). Moreover, students do not always develop the understandings their instructors intend (Churach & Fisher, 2001). Furthermore, it cannot be assumed that students will automatically take up the flexibility and autonomy provided by e-learning course materials. Learner autonomy only can be seen as a social process (see also Lim & Chai, 2003).

The second aspect of e-learning pedagogy refers to assessment tools for assessing student learning. Online assignments, quizzes/tests can be effective in enhancing student motivation and effort and support student monitoring of their own learning. They also can improve instructor teaching in e-learning through the provision of more detailed information on what students know and can do. Online assignments, quizzes/tests as an e-learning pedagogical tool can motivate students to preview or review course materials before or after class. Instructors providing online quizzes immediately after in-class discussion can prompt students to attend and concentrate on class lectures (Sections 5.2.3 and 6.2.3). These tools can encourage students to do more practice so they can learn more and better from this. Students also can learn from all, or those good, student assignments along with instructor and student interactions and feedback online and share the information with peers. When the answers to online assignments, quizzes and tests are available immediately after students submit their work this can support student learning by maintaining student interest and help them focus their study effort. Timely information on student learning can enhance instructor understanding of their students’ progress and allow them to adjust their teaching approach. Moreover, the provision of online assignments, quizzes/tests can save instructor time and cost in printing and/or distributing paper-based materials. In sum, these tools can support student learning and instructor teaching efficiency and quality.

In line with a behaviorist view of learning this approach meets the perceived need to provide students with external stimuli and exercises as reinforcement for learning. Online assignments, quizzes/test can provide for extra student drill and practice along with extrinsic motivation rewards although they may fail to identify student individual difficulties. Student prior knowledge and motivations are often

ignored in the behaviorist view of learning so this approach can, but does not necessarily; fail to actively engage with individual student understandings. Thus, these assessment tools could be seen to fit with students being passive in a manner more consistent with behaviorism.

The third aspect of e-learning pedagogy refers to the interaction between instructors and students. E-learning provides instructors and students more, and different, opportunities to interact with each other. This is important because, at least for the instructors and students in this study, interaction is seen as beneficial because it allows for the sharing of experiences and for students to ask questions of peers and instructors (Section 7.2.1). Compared with face-to-face teaching instructors and students reported more opportunities for interaction through instructional activities including synchronous and asynchronous interaction in online discussions, emails, bulletin boards, and collaborative projects (Some external professionals and e-resource providers provide discussion forums). These communication tools can assist instructors to reflect on or co-construct their ideas and knowledge (Shulman & Shulman, 2004). The possibility of synchronous and asynchronous interactions provides students with the flexibility to seek help from instructors and student peers anytime, and from any place. Synchronous and asynchronous interactions allow for more and different collaboration between students and their peers and even with their instructors. However, online interaction requires students to be active and self-managed (Loader, 1991) because participation is voluntary. Interaction-based e-learning pedagogy requires instructors to change from being a 'sage on the stage' to 'guide on the side' if e-learning is to involve the full variety of resources and interactions that are currently possible (Sections 5.4.3 and 7.2.4). Instructor and student support for interaction and collaborative learning is consistent with a social view of learning. Social interaction between instructors and students and student sense of learning community are features of social constructivism whereby students construct knowledge via talk (Hodson & Hodson, 1998). They featured as important in student and instructor communication in this study.

In the current Taiwan e-learning context, the government and university describe e-learning as 'electronic/online assisted instruction', that is as instruction that

assists face-to-face instruction (National Science Council, 2000). The national policy suggests that the provision of online course notes and video of lessons is important so universities and instructors pay less attention to the online interactions (Section 4.3.5). The potential of the policy will encourage universities and instructors to concentrate on providing course lecture notes and video of lessons as an effective pedagogical approach in the development of e-learning, particularly when government and university evaluators assess these in their evaluation of the performance of university e-learning practice. Hence, the strategies for enhancing e-learning practice also need to take e-learning pedagogy into account to improve instructor teaching and student learning in e-learning.

To sum up, the pedagogical approaches and learning opportunities experienced by students and instructors in this study could be considered to draw on behaviorist, constructivist and social views of learning. Instructors provided e-content (video of lessons, course notes and supplementary references) that students could use to reinforce and memorize lecture material and/or help them construct their own understandings. Instructors also assessed their teaching and student learning quality and efficiency by using online assessment tools. Instructors and students also valued the sharing of ideas and experiences. This complexity is an important consideration in any planning to enhance university e-learning practice in the current Taiwan e-learning context.

### **8.2.6 Concluding comments**

The literature review in Chapter 2 indicates research and development in general e-learning practice has focused mainly on the provision of technological resources and the definition of standards for sharing and reusing learning objects. Educational reform models to do with ICT integration in schools have focused more on the individual teacher and their professional development with ICT (Fisher, Higgins and Loveless, 2006; Zhao, Pugh, Sheldon & Byers, 2002) or on students learning with ICT (Lim, 2002; Lim & Hang, 2003). Only a few studies have considered the broad scope of possible influences on e-learning practice. E-learning practice does not only require a good technology infrastructure but also need many human active and collaborative involvements (see also Alonso, Lopez,

Manrique & Vines, 2005; Zhao & Frank, 2003; Zhao, Pugh, Sheldon & Byers, 2002). This study proposes an e-learning model which represents all the factors influencing e-learning practice within and outside the university institutional situation as these are perceived and experienced by administrators, technical support people, instructors and students. The breadth of participants has allowed for the development of a comprehensive model to describe and explain the influences.

The model derived from this study supports a view that e-learning practice as a whole is a socio-cultural system. Participants in the study described the influences, benefits and challenges to their use of e-learning in a manner that indicated that they experienced e-learning as shaped by the social, cultural and technological context. The model proposed in this study takes into account the importance of interactions between instructors, students and the technology where these interactions are shaped by the instructor professional community and the student peer community, the wider university situation and by national policy, external professionals, and private enterprise and the public at large. In this way, the model portrays the complexity of change as including personal factors, a redefined zone of enactment, and interpersonal factors: instructor colleagues, technical support people and student peer communities, and more distant but still immediate factors arising from the university situation, along with external factors arising from the context outside the university. Those involved in this study portrayed effective e-learning pedagogy arising from this context as incorporating aspects consistent with behaviorism, constructivist (both personal and social) views of learning. This suggests e-learning pedagogy can draw from and utilize ideas and opportunities from each of these theories although participants expressed preference was for interaction to support learning.

Although the model that emerged from this study drew heavily on the work of Spillane (1999) and Millett and Bibby (2004) there are some key differences. It also can be distinguished from the previous models for ICT integration and e-learning such as those proposed by (Lim & Hang, 2003; Shulman & Shulman, 2004; Zhao & Frank, 2003; Zhao, Pugh, Sheldon & Byers, 2002). The distinguishing features of the model are:

- Instructors and students and technology in a central enactment zone for change. Instructor and student voluntary participation is essential in the e-learning component of blended courses so student must be included. Technology is an indispensable mediating tool in e-learning and must be included in the zone of enactment.
- A focus on the broad scope of possible influences on e-learning practice not just on individual instructor decision making or individual student participation.
- E-learning practice as involving a technological infrastructure and a human infrastructure. The model points to the importance of the active involvement of people at all levels of university. E-learning practice requires the active engagement and collaboration among administrators, technical support people, instructors and students to provide the technical infrastructure and the personal support for engagement.
- Recognition that the external influences from private enterprise, the public, external professionals and the national policy context can directly impact on the central enactment zone of instructor-student-technology interaction. This impact can occur by mediation from university policies and practices but it also can be direct.
- An e-learning pedagogy that emerges from the interaction of instructors, students, and the technology as this is shaped by instructor professional community and student peer community and the university situation and even the wider community context.

To conclude, the model developed in this study provides an understanding of existing e-learning practice as part of blended courses at the university level.

Another contribution of the study is the analysis of e-learning practice in terms of the three main view of learning that are currently influential to show that each of them may be useful in describing what is considering helpful by student and instructor participants in e-learning and hence for improving e-learning practice in Taiwan at this time. Consideration of this analysis of valued teaching and learning practices has the potential to inform enhancement strategies for teaching and learning, and to lead to better decision-making regarding institutional support and investment.

### **8.3 Limitations of the study**

Any educational inquiries have some constraints and limitations (Cohen, Manion, & Morrison, 2000). This was also the case for the use of questionnaires and interviews in this study.

The questionnaires are able to gather data from a large sample that could be analyzed quantitatively, providing opportunities for the statistical interrogation of the data. Each participant had the opportunity to respond to each question, and to spend time considering their response. However, data from the open questions is often difficult to interpret due to the use of multiple terminologies. In this study, the use of postal questionnaires prevented any opportunity to clarify unclear responses. On the other hand, semi-structured interviews allow for in-depth exploration of issues raised by participants and immediate opportunities for clarification of responses. In this process, the researcher makes every effort to minimize any concerns on the participant's part about her role as an instructor at NRU. However, it is possible that some participants are not as open as they may have been due to this concern. This said, the researcher being intimately associated with the context being researched helped with the posing of questions and the interpretation of responses.

In terms of access to participants this study faced three constraints. Firstly, not all college e-learning instructors and students were sent questionnaires and interviewed because they were volunteers. Secondly, the participating instructors and students were only on-campus at one university and so did not include the community people and other instructors and students whose universities cooperate with NRU in video-conferencing or distance teaching. Thirdly, the researcher did not actually see how and what instructors had designed for the e-learning component of their courses or how students responded to this. Thus, this thesis is limited to self-reported data based on the responses to questionnaires and interviews. On the other hand, a broad spectrum of perspectives was elicited: opinions and experiences were elicited from all those involved in e-learning from administrators to support people to instructors and students.

## **8.4 Implications of the study**

The findings of this study raise several implications for consideration by those involved in university e-learning practice. These implications are stated here as suggestions for the university administrators, instructors and students.

### **Implications for university administrators**

E-learning practice seen as whole is a technology-mediated collaborative practice which is socially and culturally situated. It requires the engagement of a broad range of participants and many factors influence its practice within the university situation and the wider context. University administrators would be wise to recognize the benefits and challenges to instructor and student use of e-learning identified in this study and to provide the policy changes and necessary practical support to maximize the factors that enhance and minimize factors that inhibit instructor and student use of e-learning practice.

Deciding the most effective blend of instructional strategies for a particular purpose is crucial. Various factors such as scalability of the delivery method, the learning culture of the students, content type, costs and learning effectiveness need to be considered. Consideration of the appropriateness of a delivery system needs to be based on the relative benefits of each aspect in relation to the course content and the needs of learners and not simply on convenience for the designer or instructors. This is important because this places the focus on learning and the learner, rather than on instruction or teaching. This said adequate funding is required to ensure that e-learning teaching is sustainable from both financial and human resource perspectives. The need to provide high quality and accessible ICT and organizational infrastructures and facilities is an important implication arising from the study. Universities need to maintain update multimedia facilities for e-learning and, if possible, provide flexible system functions and that can connect internationally. Technical staff who can design and maintain an effective e-learning platform and provide timely and efficient support services for a large number of instructors and students are also needed. In addition, instructor and student pedagogical concerns such as course development needs, course attributes, class sizes, and role changes also affect their design and use of e-learning. It is

suggested that all these factors need to be taken into consideration in the e-learning development plan and practice. Given the complexity of administrator decisions around e-learning goals and policy recruiting a knowledgeable and supportive leader who is also able to develop a team approach for e-learning practice would seem to be crucial.

This study indicates the inhibiting factors of a successful e-learning practice are strongly related to instructor and student personal will and capacity. Instructors who take great enjoyment in teaching and are comfortable working with technology are well-suited to this endeavor, but not all the instructors like to teach using technology. Many instructors resist e-learning. Universities that wish to promote e-learning need to provide incentives and support to encourage instructor participation. Universities need to value for e-learning instructor evaluation and promotion. Participants in this study indicated instructors face pressure on doing research and this is why many resist using e-learning. University policy and support services, including credits toward instructor tenure promotion and institutional administrative and technical support for instructors, and students, could address this issue and influence decisions to adopt e-learning. Consequently providing technical and individual support for e-learning practice could motivate instructors and students to endeavor to use e-learning, particularly given the time involved. When instructors are able to spend less time and effort on e-course development they can do more research leading to a good cycle for university and individual development of teaching and learning and research. An added benefit of high quality support is that such provision leads to mutual respect and recognition between university and instructors. Participants in this study commented that mutual trust and understanding amongst participant groups (administrators, technical support people, instructors and students) helps to eliminate some of the challenge in using e-learning. Student commentary also suggested that they might be persuaded to make more use of the e-learning component of blended courses if well-designed e-courses and extra resources are available. This has implications for professional development in e-learning pedagogy and for the government and university in evaluating effective e-learning courses and the performance of e-learning practice.

### **Implications for instructors**

University instructors have academic freedom, meaning their will and capacity in the use of e-learning teaching is important. Moreover, instructors need to share their time between teaching, service and scholarship so those who use e-learning instructors need to be intrinsically self-motivated. When instructors have strong personal will to use e-learning, they are prepared and able to overcome the challenges in e-learning. This is not the case for all instructors. Although teaching via e-learning as part of blended courses is not required for all instructors at this stage how to entice instructors into e-learning is still a challenge facing university administrators. As pointed out above, if universities want instructors to engage in e-learning they need to provide support services, incentives, and resources to encourage and support e-learning use. Although instructors putting course materials online does not necessarily help students to take responsibility for their own learning and motivate them to learn actively it can still serve as a first step in instructor, and student, involvement in the e-learning.

Concerning changing instructor attitude towards e-learning, the research found that while online work takes time there are benefits. Instructors enjoy and appreciate their teaching in e-learning because it can increase instructor-student interactions. Online interactions provide time flexibility and increase opportunities for communication. Added to this, e-learning course materials can be reused and some materials can be included in publications such as books or papers. A suggestion from this study is that instructors be made aware of the benefits of e-learning to help motivate them to use it.

E-learning design is not a simple matter. There is no one simple solution or best way to provide for e-learning in a blended learning course. When designing and preparing online course material, instructors need to balance the benefits students could gain from reviewing previous materials and considering supplementary ideas with the time this will take students, not only to read and view the material but also find their way around it. Instructors would be advised to include guidance for students on how to use and navigate the online component of their course in order to reduce students' learning load. In addition, instructors would also be

advised to include online discussions, both synchronously and asynchronously, and collaborative projects in their course design to motivate student engagement.

### **Implications for students**

University students have freedom to decide whether or not to attend the class and engage in e-learning, meaning their will and capacity in the use of e-learning is important. The findings indicate e-learning can benefit students through flexibility in time and place of learning; improved learning quality and efficiency, and an increase in student capacity to adapt to the information age. E-learning can also provide opportunities for online interaction among students and between instructors and students. Instructors and students involved in this study thought these benefits only arose when students were active and diligent in e-learning. The implication of this for students is that they need to be self-managed and take responsibility for their e-learning. This also suggests that instructors would be advised to provide support to assist students to develop the skills of self-management and participate in online activities. Again, there implications for instructor professional development, and for student active engagement if e-learning is to realize its potential to improve student learning quality and outcomes.

## **8.5 Recommendations for further research**

This study has highlighted some of the emerging issues regarding the impacts/challenges of e-learning practice on institutional administrators, technical support people, instructors and students. In order to be able to provide some possible enhancement strategies for e-learning practice in university science education in Taiwan, this study has explored the factors that influence e-learning practice at a political, institutional, instructor, and student level. The findings could be used as a basis for future policy to enhance tertiary e-learning practice at the universities in Taiwan, especially for university science education, and to improve the educational quality for instructors and students.

This study only investigated one national research-oriented university in Taiwan so future work could be extended in various combinations of national and private

universities and the area of science and non-science education, and even extends to the wider context internationally. For example, it could compare non-science e-learning at NRU with other national or international research-oriented universities or explore science e-learning at both national and private non-research-oriented universities. This study has mainly investigated the factors and strategies from institutional administrator, support person, instructor and student perspectives for enhancing e-learning practice as a whole rather than for the specific e-learning course content. Thus, it may try using some incentives as encouragement to motivate instructor or student use of e-learning and examined their effectiveness and the research methods could change, perhaps by using observation and or intervention. Furthermore, although this study is focused on the university level, it still can apply to the primary and secondary school or technology colleges. The main differences between NRU and these levels of schools are the teachers do not have academic freedom and are often most affected by the national or school policy and curriculum development.

## **8.6 Final comments**

As a lecturer at the Computer and Network Center in a national research-oriented university in Taiwan, the researcher is particular interested in e-learning and so she was eager to explore why only a few instructors like to use e-learning while many do not. She also knew and understood the context for e-learning well and realised the need to engage high-level administrators in the reserch to better understand existing e-learning practice. She also realised that the research would more likely have a practical impact if its findings and implications could be synthesised to produce an explanation of the current situation that might also provide a means to discuss possible action.

E-learning as part of blended learning was thought by instructors and students in this study to provide benefits but challenges were also identified. The model developed in this study indicates instructor and student use of e-learning depends on the interaction of instructors, students and the technology within an enactment zone which is nested within instructor professional and student peer communities and the institutional situation all of which in turn are influenced by national policy,

external professional, private and public factors. The model provides a framework that encompasses and links the factors that influence e-learning use as perceived by administrators, technical support people, instructors and students. Given the trend towards blended learning courses that include a component of e-learning university administrators, technical support staff, instructors and even students themselves need to consider how to enhance the current implementation of e-learning in order to protect and enhance the academic quality of courses for both students and instructors. It is anticipated that the findings, suggestions and model presented in this study will contribute to better instructor teaching and student learning and better administrator decision-making regarding institutional policy, investment in learning technologies, and support services for e-learning, and ultimately in the enhancement of e-learning practice as part of undergraduate education in the research universities.

## **Appendix A: Informed Consent Form for Vice Principal**

### **The University of Waikato Centre for Science and Technology Education Research (CSTER) Enhancing the Existing E-learning for University Science Education in Taiwan**

#### **Information for Vice Principal**

Researcher: Su-Chen Wang (PhD student), Centre for Science and Technology Education Research (CSTER), University of Waikato, Hamilton, New Zealand (Tel: 64-7-8384466~8923, Room: KP G.20, e-mail: sw110@waikato.ac.nz)  
Supervisor: Prof. Alister, Jones, (CSTER), University of Waikato, Hamilton, New Zealand (Tel: 64-7-8383366~4245, Fax: 64-7-8384272, Room: KP G.25, e-mail: a.jones@waikato.ac.nz)

#### **The Study**

Hello. This study is part of my PhD research. The goal of the research is to develop a better understanding of existing e-learning practice at NRU<sup>1</sup> and to explore what are the challenges, benefits and related success factors of e-learning practice. The overall aim is to be able to suggest some strategies to enhance the practice of e-learning in science education at NRU.

- 1) As first step toward this goal, a semi-systematic investigation will be undertaken of the existing situation specifically from the perspective of administrators and experienced online educators and their students regarding the benefits of teaching and learning in the e-learning context. This will better inform the researcher of key aspects, prospects and challenges to teaching and learning in the e-learning context.
- 2) Next, an in-depth investigation will be conducted with the instructors and students from the Departments of Physics and Life Science to ask why they do, and do not, use e-learning and what they see as the benefits and challenges.
- 3) From these some suggestions will be developed to enhance e-learning in science education.

The main research question is: What is effective practice of e-learning for university science education in Taiwan? Some of the questions relating to this research are:

1. What is the context of e-learning practice in tertiary education in Taiwan?
2. What do university administrators and technical support people in Taiwan see as the benefits and challenges of e-learning?
3. What are instructors' perceptions of what makes effective e-learning in Taiwan?
4. What are students' perceptions of what makes effective e-learning in Taiwan?
5. What are instructors' and students' perceptions of what would enhance the practice of the e-learning science education in Taiwan?

This research is devised from the desire to improve e-learning practice for instructors and students at NRU in Taiwan. This study will adopt an interpretive paradigm as the basis for its research methodology to capture the richness of participants' experience in a natural context. The information for the research will be collected through interviews and questionnaires. The sample for this qualitative case study will include administrators, technical support people, professional faculty members who design and implement e-learning courses, and Physics and Life Science department faculty members. The researcher will interview 4~6 groups of students whose instructors have and have not received the student assistant support to use e-learning system. A questionnaire will be sent to instructors and students who involved in e-learning teaching and learning in the university.

#### **Your Contribution**

Firstly, thank you very much for your support of my advanced study in New Zealand.

Secondly, I hope to gain your consent to interview the Dean of Academic Affairs and the Director of the Computer and Network Center and their people, eight instructors involved in e-learning courses and their students, and 6~8 instructors in the Physics and the Life Science Departments. I would also like to send the questionnaires to the online instructors and their students to find out their perceptions of challenges faced, benefits gained, expectations and related experiences of the effective e-learning practice at NRU.<sup>1</sup>

The following are the ethical guidelines for the study.

#### **Ethical Guidelines**

The research will follow the University of Waikato Human Research Ethics Regulations 2000 and the ethical guidelines of the New Zealand Association of Research in Education (NZARE). If the participants take part in this study, they will have the following rights:

#### **Confidentiality and Anonymity**

I am committed to respecting the participants' privacy and maintaining confidentiality. The information collected from the interviews will be treated as strictly confidential. All quotes and transcripts will be coded and a pseudonym will be used in the report in order that the participants' identity is not revealed.

#### **Right to withdraw**

Participants have the right to withdraw from the research at any stage or choose not to answer any question. Participants can ask questions regarding the research. If they have any concerns regarding their participation in the project, they approach me Su-Chen Wang (see first page for my contact details). For any unresolved concerns please contact my supervisor, Professor Alister Jones (ph: 002-64-7-8384466~4245, or Fax: 002-64-7-8384272 or on the following e-mail: a.jones@waikato.ac.nz).

#### **Ownership**

The participants have copyright on any data produced by them. I will have the copyright on any analyses and materials I produce. The participants will have the right to access the data collected from them and transcripts of the interview will be made available to them to check the accuracy as well as to approve usage in the research. All information collected in the form of audiotapes, transcripts, notes, and computer printouts will be kept in secure storage at Centre for Science and Technology Education Research, University of Waikato, Hamilton, New Zealand and destroyed at the conclusion of the research.

#### **Use of information**

The information obtained will be used for a PhD thesis and may be used for other publications and presentations.

Thank you in advance for your consent.

Yours sincerely,

Su-Chen Wang

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<sup>1</sup> NRU is a pseudonym. The real name of the university is not used in this thesis due to protecting the privacy of the respondents.

**Appendix A: Informed Consent Form for Vice Principal**

**Informed Consent**

I have read the Information for the Vice Principal and agree to the university and the named administrators, technical support people and instructors being interviewed, and other online instructors and their students being approached to be involved in the research under the conditions set out above.

Name: \_\_\_\_\_

Signed: \_\_\_\_\_

Date: \_\_\_\_\_

## **Appendix B: Informed Consent Form for Deans, Director, and Heads of Departments**

懷 卡 托 大 學  
科學與技職教育研究中心  
台灣目前大學科學教育應用數位學習改善之策略

敬愛之教務長、計網中心主任、相關學院院長及物理和生命科學系系主任：

首先本人非常誠摯地邀請您參與本研究，此為紐西蘭 漢彌頓 懷卡托大學 科學與技職教育研究中心的博士論文研究。

本研究將藉由描述式的質性研究方法來了解目前在台灣國立研究大學<sup>2</sup>已實施之數位學習(網路教學)現況，進而從政策面、學校、教師、學生等之觀點，來探討數位學習所引起之衝擊、所帶來之教學利益和影響成功實施之因素等等，最後將提出一套針對大學科學教育應用數位學習可行之改善策略，以落實提升大學學生在科學教育之基本學識能力。為達成此目標，首先本研究將藉由詳細了解目前研究大學實施網路教學之概況—研究者將從行政管理、實際使用網路教學有經驗之教師和選修這些課程的學生們等之觀點，來探討在數位學習環境下所帶來之教學利益、衝擊和種種影響因素及他們對數位學習之期望等等。接著，將更深入了解物理系和生命科學系教師和學生的使用狀況，詢問他們為何使用或不使用數位學習(網路教學)系統、有何衝擊及優缺點，以利了解應用數位學習對科學教育之影響，最後經由歸納分析將發展出一套應用數位學習改善大學科學教育之可行策略。

本研究主要問題是『何謂大學科學教育有效地應用數位學習？(What is effective practice of e-learning for university science education?)』本研究將嘗試對下列研究問題尋求答案，期望能得到本研究的初始方向及概括性觀點。

1. 台灣高等教育應用數位學習之環境為何？
2. 台灣各大學行政管理如何看待數位學習所引起的挑戰與利益？
3. 從台灣教師的觀點來看，什麼是有效應用數位學習及其影響因素？
4. 從台灣學生的觀點來看，什麼是有效應用數位學習及其影響因素？
5. 什麼是應用數位學習之可行改善策略，尤其是應用在大學科學教育實施方面？

第二，本人非常希望得到您的同意可以讓本人去訪談貴單位/院/系的同仁及師生。同時，本人也將分送問卷給有使用網路教學系統授課之教師和其學生填寫，以了解他們對數位學習的概括性觀點，包括他們所面臨的挑戰、所得利益、期待和相關影響因素等等。本研究將遵守懷卡托大學和紐西蘭教育研究協會的研究倫理大綱，它主要包括下列事項：

- 參與本研究者乃出於自願，將保持個人的匿名狀態。
- 所有的個人資料將被安全且保密地保存。所有的個人資料將在論文結束三年後被銷毀。
- 在本研究過程中所獲得的資料，將只被用於本研究和可能的相關研討會及刊物。

若您願意參與本研究，我們將尋求您的正式同意(參與研究同意函另附)以便進行研究。有關進一步的諮詢或您有任何疑問，不論是目前或是未來，請您與本人聯絡(請看下方的聯絡方式)。若是有無法解決的相關事宜，請聯絡懷卡托大學科學與技職教育研究中心的主任(也是本人的指導教授)，艾里斯特·瓊斯教授 (Prof Alister Jones)。他的聯絡方式為(a.jones@waikato.ac.nz, Tel: 64-7-838 4245, Fax:64-7-838 4272)。謝謝您並順頌 鈞安

您誠摯的

王素貞敬上

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<sup>2</sup> 台灣國立研究大學 is a pseudonym. The real name of the university is not used in this thesis due to protecting the privacy of the respondents.

**Appendix B: Informed Consent Form for Deans,  
Director, and Heads of Departments**

同意函

我在參閱『致敬愛的教務長、計網中心主任、相關學院院長及物理系和生命科學系系主任』一文後，並了解本論文研究所遵循之相關法則與事項，我同意讓研究者至本單位/院/系進行相關研究活動。

職稱： \_\_\_\_\_

姓名： \_\_\_\_\_

簽名： \_\_\_\_\_

日期： \_\_\_\_\_

**Appendix C: Informed Consent Form for Dean of Academic Affairs and  
the Director of the Computer and Network Centre**

懷 卡 托 大 學

科學與技職教育研究中心

台灣目前大學科學教育應用數位學習改善之策略

**參與研究同意函**

**致敬愛的教務長、計網中心主任：**

首先，本人非常誠摯地邀請您參與本研究，此為紐西蘭 漢彌頓 懷卡托大學 科學與技職教育研究中心的博士論文研究。

本研究將藉由描述式的質性研究方法來了解目前在台灣國立研究大學已實施之數位學習(網路教學)現況，進而從政策面、學校、教師、學生等之觀點，來探討數位學習所引起之衝擊、所帶來之教學利益和影響成功實施之因素等等，最後將提出一套針對大學科學教育應用數位學習可行之改善策略，以落實提升大學學生在科學教育之基本學識能力。為達成此目標，首先本研究將藉由詳細了解目前研究大學實施網路教學之概況—研究者將從行政管理者、實際使用網路教學有經驗之教師和選修這些課程的學生們等之觀點，來探討在數位學習環境下所帶來之教學利益、衝擊和種種影響因素及他們對數位學習之期望等等。接著，將更深入了解物理系和生物系教師和學生的使用狀況，詢問他們為何使用或不使用數位學習(網路教學)系統、有何衝擊及優缺點，以利了解應用數位學習對科學教育之影響，最後經由歸納分析將發展出一套應用數位學習改善大學科學教育之可行策略。

本研究主要問題是『何謂大學科學教育有效地應用數位學習？(What is effective practice of e-learning for university science education?)』，本研究將嘗試對下列研究問題尋求答案，期望能得到本研究的初始方向及概括性觀點。

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2. 台灣各大學行政管理者如何看待數位學習所引起的挑戰與利益？
3. 從台灣教師的觀點來看，什麼是有效應用數位學習及其影響因素？
4. 從台灣學生的觀點來看，什麼是有效應用數位學習及其影響因素？
5. 什麼是應用數位學習之可行改善策略，尤其是應用在大學科學教育實施方面？

您將被邀請參與此研究接受一次訪談，訪談時間不超過一小時，而且經由你的同意，訪談時將被錄音且轉譯寫出後，再交由您的確認。下列問題將是訪談之主要內容：

1. What do you see as the benefits of the national policy for e-learning?  
從利益觀點出發，你如何看待國家數位學習政策？
2. In your view, what are the benefits of e-learning for the university?  
以您的觀點，對大學而言數位學習將帶來什麼利益？
3. How are e-learning courses developed/ supported?  
數位學習課程是如何被推展或支援的？
4. What are your views of the effectiveness of the teaching and learning in the e-learning courses?  
以您的觀點，在數位學習課程中有效的教學品質(內容)是什麼？
5. What changes would you like to see from an institutional perspective?  
從學校觀點來看，你最願意看到什麼樣的改變？
6. How do you think administrators would best improve support the e-learning practice?  
您認為行政管理者應提供什麼樣的支援才能提升數位學習實施的成效？
7. What strategies do you think could be used to enhance e-learning practice for science education?  
您認為什麼樣的策略將最能改善大學科學教育應用數位學習的成效？

本研究將遵守懷卡托大學和紐西蘭教育研究協會的研究倫理大綱，它主要包括下列事項：

- 參與本研究者乃出於自願。參與本研究將不會影響受訪者的正常工作。將保持個人的匿名狀態，所有的個人資料將被安全且保密地保存。本研究所收集的有關資料數據，將不被任何第三者所使用。
- 受訪者將在雙方同意的狀況下接受晤談，這些晤談隨後將被轉錄。受訪者有權利看這些被轉錄後的書面資料，若受訪者認為有需要亦可要求做適當的更改。所有的個人資料將在論文結束三年後被銷毀。
- 在資料記錄或論文撰寫中，除了數字代號或假名外，受訪者本人將不會被辨識出來。在本研究過程中所獲得的資料，將只被用於本研究和可能的相關研討會及刊物。

若是有無法解決的問題，受訪者可聯絡懷卡托大學 科學與技職教育研究中心的主任，艾利斯特·瓊斯教授 (Prof Alister Jones, a.jones@waikato.ac.nz, Tel: 64-7-838 4245, Fax:64-7-838 4272)。

您誠摯的

王素貞敬上

**Appendix C: Informed Consent Form for Dean of Academic Affairs and  
the Director of the Computer and Network Centre**

同意函

我在參閱『參與研究同意函---致敬愛的教務長、計網中心主任』一文後，並了解本論文研究所遵循之相關法則與事項，我同意參與此研究，接受訪問。

職稱：\_\_\_\_\_

姓名：\_\_\_\_\_

簽名：\_\_\_\_\_

日期：\_\_\_\_\_

**Appendix D: Informed Consent Form for Group leader of the Teaching  
Information in the Office of Academic Affairs**

懷 卡 托 大 學  
科學與技職教育研究中心  
台灣目前大學科學教育應用數位學習改善之策略

**參與研究同意函**

致親愛的 \_\_\_\_\_ 主任：

首先，本人非常誠摯地邀請您參與本研究，此為紐西蘭 漢彌頓 懷卡托大學 科學與技職教育研究中心的博士論文研究。

本研究將藉由描述式的質性研究方法來了解目前在台灣國立研究大學已實施之數位學習(網路教學)現況，進而從政策面、學校、教師、學生等之觀點，來探討數位學習所引起之衝擊、所帶來之教學利益和影響研究實施之因素等等，最後將提出一套針對大學科學教育應用數位學習可行之改善策略，以落實提升大學學生在科學教育之基本學識能力。為達成此目標，首先本研究將藉由詳細了解目前研究大學實施網路教學之概況—研究者將從行政管理、實際使用網路教學有經驗之教師和選修這些課程的學生們等之觀點，來探討在數位學習環境下所帶來之教學利益、衝擊和種種影響因素及他們對數位學習之期望等等。接著，將更深入了解物理系和生物系教師和學生的使用狀況，詢問他們為何使用或不使用數位學習(網路教學)系統、有何衝擊及優缺點，以了解應用數位學習對科學教育之影響，最後經由歸納分析將發展出一套應用數位學習改善大學科學教育之可行策略。

本研究主要問題是『何謂大學科學教育有效地應用數位學習？(What is effective practice of e-learning for university science education?)』，本研究將嘗試對下列研究問題尋求答案，期望能得到本研究的初始方向及概括性觀點。

1. 台灣高等教育應用數位學習之環境為何？
2. 台灣各大學行政管理如何看待數位學習所引起的挑戰與利益？
3. 從台灣教師的觀點來看，什麼是有效應用數位學習及其影響因素？
4. 從台灣學生的觀點來看，什麼是有效應用數位學習及其影響因素？
5. 什麼是應用數位學習之可行改善策略，尤其是應用在大學科學教育實施方面？

您將被邀請參與此研究，接受一次訪談，訪談時間不超過一小時，而且經由你的同意，訪談時將被錄音且轉譯寫出後，再交由您的確認。下列問題將是訪談之主要內容：

2. 對數位學習而言，您的單位在學校裡扮演何種角色？
3. 為什麼引用數位學習的環境？開發網路教學系統的目標、功能和希望得到的效果為何？如何鼓勵教師與學生的使用？
4. 目前校園內提供哪些應用數位學習的課程？提供何種支援給老師和學生們？
5. 以您的觀點，什麼樣的內容才是有效教學的數位學習課程？它們是如何被開發和支援的？
6. 在數位學習環境中，對提升教學品質，您有什麼改善建議？

本研究將遵守懷卡托大學和紐西蘭教育研究協會的研究倫理大綱，它主要包括下列事項：

若有無法解決的問題，受訪者可聯絡懷卡托大學 科學與技職教育研究中心的主任，艾里斯特·瓊斯教授 (Prof. Alister Jones, a.jones@waikato.ac.nz, Tel: 64-7-838 4245, Fax:64-7-838 4272)。

您誠摯的

王素貞敬上

**Appendix D: Informed Consent Form for Group leader of the Teaching  
Information in the Office of Academic Affairs**

同意函

我在參閱『參與研究同意函---致敬愛的 \_\_\_\_\_主任』一文後，並了解本論文研究所遵循之相關法則與事項，我同意參與此研究，接受訪問。

姓名：\_\_\_\_\_

簽名：\_\_\_\_\_

日期：\_\_\_\_\_

## **Appendix E: Informed Consent Form for Technical Support Staff**

Su-Chen Wang  
KP G.20, Centre for Science and Technology  
Education Research (CSTER)  
University of Waikato, Hamilton, NZ  
Tel: (O) 64-7-8384466~8923  
Tel: (O) 64-7-8582988  
Fax: 002-64-7-8384272  
e-mail: [sw110@waikato.ac.nz](mailto:sw110@waikato.ac.nz) or  
[suchen1@gmail.com](mailto:suchen1@gmail.com)

Centre for Science and Technology  
Education Research  
The University of Waikato  
Private Bag 3105  
Hamilton, New Zealand  
Ph: 64-7-838 4035  
(Centre direct line)  
Fax: 64-7-838 4272



### **Invitation to be interviewed for the research: “Enhancing existing e-learning for university education in Taiwan”**

#### **Dear technical support staff:**

Hello. My name is Su-Chen Wang. I am a senior lecturer at NRU and am currently undertaking advanced study for a PhD with the support of the University. I am a PhD student at the Centre for Science and Technology Education Research (CSTER), University of Waikato, Hamilton, New Zealand. The goal of my PhD research is to develop a better understanding of existing e-learning practice at NRU. The overall aim is to be able to suggest some strategies to enhance the practice of e-learning. I think it is important that your ideas and suggestions as a technical support staff involved in e-learning are incorporated into the development of e-learning. I invite you to take part in an interview for this study. Your participation is important in suggesting ideas for how to enhance the quality of e-learning now and in the future. Your cooperation will be greatly appreciated.

You are invited to be interviewed in this research. Interviews will allow me to explore your experiences of e-learning in more depth. The interview normally will be up to 30 minutes. With your permission the interviews will be audio taped and transcribed. The information you provide will be kept confidential and you will not be identified in any reports.

All the information obtained will be destroyed at the conclusion of the research. The information obtained will be used for a PhD thesis and may be used for other publications and presentations.

You can ask questions regarding the research. If you have any concerns regarding your participation in the research, you can approach me Su-Chen Wang (see top of this page for my contact details). For any unresolved concerns please contact my supervisor, Prof Alister Jones (KP G.25, CSTER, University of Waikato, Hamilton, New Zealand; Tel: 002-64-7-8384245, or Fax: 002-64-7-8384272 or on the following e-mail: [a.jones@waikato.ac.nz](mailto:a.jones@waikato.ac.nz)).

Thank you very much in advance for your time and helpful participation.

Yours sincerely,

Su-Chen Wang

**Appendix E: Informed Consent Form for Technical Support Staff**

**Informed Consent for:** Centre for Science and Technology  
**Enhancing existing e-** Education Research  
**learning in university** The University of Waikato  
**education in Taiwan** Private Bag 3105  
Hamilton, New Zealand  
Ph: 64-7-838 4035 (Centre direct line)  
Fax: 64-7-838 4272



**Please hand in this consent form to me.  
Or send to my office at 5F of the Computer and Network Centre.**

I have read the Invitation to be interviewed for the research: “Enhancing existing e-learning in university education in Taiwan” and agree to participate in the study under the conditions set out.

Name: \_\_\_\_\_ Signed: \_\_\_\_\_

Date: \_\_\_\_\_ E-mail: \_\_\_\_\_

Contact phone: \_\_\_\_\_

Please tick one or two of the following time would suit you to take part in a group-interview.

- Feb 17 (Friday)
- Feb 21 (Monday)
- Feb 22 (Tuesday)
- Feb 24 (Thursday)
- Feb 25 (Friday)
- Other (Please specify): \_\_\_\_\_

I will email or ring you to confirm a time and place for our interview discussion.

***Thank you very much for your participation and interest!***

## **Appendix E: Informed Consent Form for Technical Support Staff (Chinese)**

懷 卡 托 大 學  
科學與技職教育研究中心  
台灣目前大學科學教育應用數位學習改善之策略

### **參與研究同意函**

致親愛的 \_\_\_\_\_ 先生/小姐：

首先本人非常誠摯地邀請您參與本研究，此為紐西蘭 漢彌頓 懷卡托大學 科學與技職教育研究中心的博士論文研究。

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本研究主要問題是『何謂大學科學教育有效地應用數位學習？(What is effective practice of e-learning for university science education?)』，本研究將嘗試對下列研究問題尋求答案，期望能得到本研究的初始方向及概括性觀點。

1. 台灣高等教育應用數位學習之環境為何？
2. 台灣各大學行政管理如何看待數位學習所引起的挑戰與利益？
3. 從台灣教師的觀點來看，什麼是有效應用數位學習及其影響因素？
4. 從台灣學生的觀點來看，什麼是有效應用數位學習及其影響因素？
5. 什麼是應用數位學習之可行改善策略，尤其是應用在大學科學教育實施方面？

您將被邀請參與此研究，訪談時間不超過一小時，而且經由您的同意，訪談時將被錄音且轉譯寫出後，再交由您的確認。下列問題將是訪談之主要內容：

1. 對數位學習而言，您和您的單位在學校裡扮演何種角色？
2. 為什麼引用數位學習的環境？開發網路教學系統的目標、功能和希望得到的效果為何？如何鼓勵教師與學生的使用？
3. 目前校園內提供哪些應用數位學習的課程？提供何種支援給老師和學生們？
4. 以您的觀點，什麼樣的內容才是有效教學的數位學習課程？它們是如何被開發和支援的？
5. 在數位學習環境中，對提升教學品質，您有什麼改善建議？

本研究將遵守懷卡托大學和紐西蘭教育研究協會的研究倫理大綱，它主要包括下列事項：

- 參與本研究者乃出於自願。參與本研究將不會影響受訪者的正常工作。將保持個人的匿名狀態，所有的個人資料將被安全且保密地保存。本研究所收集的有關資料數據，將不被任何第三者所使用。
- 受訪者將在雙方同意的狀況下接受晤談，這些晤談隨後將被轉錄。受訪者有權利看這些被轉錄後的書面資料，若受訪者認為有需要亦可要求做適當的更改。所有的個人資料將在論文結束三年後被銷毀。
- 在資料記錄或論文撰寫中，除了數字代號或假名外，受訪者本人將不會被辨識出來。在本研究過程中所獲得的資料，將只被用於本研究和可能的相關研討會及刊物。

若有無法解決的問題，受訪者可聯絡懷卡托大學 科學與技職教育研究中心的主任，艾利斯特·瓊斯教授 (Prof. Alister Jones, a.jones@waikato.ac.nz, Tel: 64-7-838 4245, Fax:64-7-838 4272)。

您誠摯的  
王素貞敬上

**Appendix E: Informed Consent Form for Technical Support Staff (Chinese)**

同意函

我在參閱『參與研究同意函---致敬愛的\_\_\_\_\_先生/小姐』一文後，並了解本論文研究所遵循之相關法則與事項，我同意參與此研究，接受訪問。

姓名：\_\_\_\_\_

簽名：\_\_\_\_\_

日期：\_\_\_\_\_

## **Appendix F: Informed Consent Form for Student Assistant**

Su-Chen Wang  
KP G.20, Centre for Science and Technology Education  
Research (CSTER)  
University of Waikato, Hamilton, New Zealand  
Tel: (O) 64-7-8384466~8923  
Tel: (O) 64-7-8582988  
Fax: 64-7-8384272 Ph: 64-7-8384466~8923  
e-mail: [sw110@waikato.ac.nz](mailto:sw110@waikato.ac.nz) or  
[suchen1@gmail.com](mailto:suchen1@gmail.com)

Centre for Science and  
Technology Education  
Research

The University of Waikato  
Private Bag 3105  
Hamilton, New Zealand

Ph: 64-7-838 4035  
Fax: 64-7-838 4272



### **Invitation to be interviewed for the research: “Enhancing existing e-learning for university education in Taiwan”**

**Dear student assistant:**

Hello. My name is Su-Chen Wang. I am a senior lecturer at NRU and am currently undertaking advanced study for a PhD with the support of the University. I am a PhD student at the Centre for Science and Technology Education Research (CSTER), University of Waikato, Hamilton, New Zealand. The goal of my PhD research is to develop a better understanding of existing e-learning practice at NRU. The overall aim is to be able to suggest some strategies to enhance the practice of e-learning. I think it is important that your ideas and suggestions as a student assistant involved in e-learning are incorporated into the development of e-learning. I invite you to take part in an interview for this study. Your participation is important in suggesting ideas for how to enhance the quality of e-learning now and in the future. Your cooperation will be greatly appreciated.

You are invited to be interviewed in this research. Interviews will allow me to explore your experiences of e-learning in more depth. Each interview normally will be up to 30 minutes. With your permission the interviews will be audio taped and transcribed. The information you provide will be kept confidential and you will not be identified in any reports.

All the information obtained will be destroyed at the conclusion of the research. The information obtained will be used for a PhD thesis and may be used for other publications and presentations.

You can ask questions regarding the research. If you have any concerns regarding your participation in the research, you can approach me Su-Chen Wang (see top of this page for my contact details). For any unresolved concerns please contact my supervisor, Professor Alister Jones (KP G.25, CSTER, University of Waikato, Hamilton, New Zealand; Tel: 002-64-7-8384245, or Fax: 002-64-7-8384272 or on the following e-mail: [a.jones@waikato.ac.nz](mailto:a.jones@waikato.ac.nz)).

Thank you very much in advance for your time and helpful participation.

Yours sincerely,

Su-Chen Wang

**Appendix F: Informed Consent Form for Student Assistant**

**Informed Consent for:  
Enhancing existing e-  
learning in university  
education in Taiwan**

Centre for Science and Technology  
Education Research  
  
The University of Waikato  
Private Bag 3105  
Hamilton, New Zealand  
Ph: 64-7-838 4035 (Centre direct line)  
Fax: 64-7-838 4272



**Please hand in this consent form to me.**

I have read the <u>Invitation to be interviewed for the research: “Enhancing existing e-learning in university education in Taiwan”</u> and agree to participate in the study under the conditions set out.	
Name: _____	Signed: _____
Date: _____	E-mail: _____
Contact phone: _____	

Please tick one or two of the following time would suit you to be interviewed.

- Feb 17 (Friday) 4:30 pm~5:30 pm
- Feb 21 (Monday) 1:30 pm~2:30 pm
- Feb 22 (Tuesday) 9:00 am~10:00 am
- Feb 24 (Thursday) 10:00 am~11:00 am
- Feb 25 (Friday) 1:30 pm~2:30 pm
- Other (Please specify): \_\_\_\_\_

I will email or ring you to confirm a time and place for our interview discussion.

***Thank you very much for your participation and interest!***

## **Appendix G: Informed Consent Form for E-learning Instructors**

Su-Chen Wang  
KP G.20, Centre for Science and Technology  
Education Research (CSTER)  
University of Waikato, Hamilton, New Zealand  
Tel: (O) 64-7-8384466~8923  
Tel: (H) 64-7-8582988  
Fax: 002-64-7-8384272  
e-mail: [sw110@waikato.ac.nz](mailto:sw110@waikato.ac.nz) or  
[suchen1@gmail.com](mailto:suchen1@gmail.com)

Centre for Science and Technology  
Education Research  
The University of Waikato  
Private Bag 3105  
Hamilton, New Zealand  
Ph: 64-7-838 4035 (Centre direct line)  
Fax: 64-7-838 4272



### **Invitation to be interviewed for the research: “Enhancing existing e-learning for university Science education in Taiwan”**

You are invited to be interviewed in the research. Interviews will allow me to explore your experiences of e-learning in more depth. Each interview normally will be up to 30 minutes. With your permission the interviews will be audio taped and transcribed. The following issues will be explored:

1. How e-learning courses are currently conducted?
2. What are some of the key factors associated with effective teaching and learning in this context?
3. What are instructors' perspectives of what makes the effectiveness of e-learning?
4. What are the challenges faced by instructors and students?
5. Why do instructors use e-learning with/without the student assistant support from university?
6. What are the benefits of assistance support?
7. What changes do instructors think would help them teach e-learning courses more effectively/efficiently?

I am committed to respecting your privacy and maintaining confidentiality. The information collected from your interviews will be treated as strictly confidential. All quotes and transcripts will be coded and a pseudonym will be used in the report in order that your identity is not revealed.

All the information obtained will be destroyed at the conclusion of the research. The information obtained will be used for a PhD thesis and may be used for other publications and presentations.

You can ask questions regarding the research. If you have any concerns regarding your participation in the research, you can approach me Su-Chen Wang (see top of this page for my contact details). For any unresolved concerns please contact my supervisor, Prof Alister Jones (KP G.25, CSTER, University of Waikato, Hamilton, New Zealand; Tel: 002-64-7-8384245, or Fax: 002-64-7-8384272 or on the following e-mail: [a.jones@waikato.ac.nz](mailto:a.jones@waikato.ac.nz)).

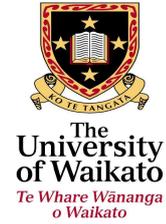
Please indicate whether you'll be interested in being interviewed. Please write down your contact details (e.g. e-mail, phone number or mobile number) at the end of this letter if you would like to be contacted. Thank you very much in advance for your participation and help.

Yours sincerely,

Su-Chen Wang

**Appendix G: Informed Consent Form for E-learning Instructors**

**Informed Consent for:** Centre for Science and Technology  
**Enhancing existing e-** Education Research  
**learning in university** The University of Waikato  
**education in Taiwan** Private Bag 3105  
Hamilton, New Zealand  
Ph: 64-7-838 4035  
(Centre direct line)  
Fax: 64-7-838 4272



**Please fax this reply to:**

Ms Su-Chen Wang  
CSTER, University of Waikato  
Private Bag 3105  
Hamilton  
New Zealand  
Fax No: 002 64 7 838 4272

**Or mail with the questionnaire using the stamped addressed envelope provided.**

I have read the Invitation to be interviewed for the research: “Enhancing existing e-learning for university education in Taiwan” and agree to participate in the study under the conditions set out above.

Name: \_\_\_\_\_ Department: \_\_\_\_\_

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

E-mail: \_\_\_\_\_

Contact phone: \_\_\_\_\_

I will email or ring you to confirm a time and place for our interview discussion.

***Thank you very much for your participation and interest!***

**Appendix H: Informed Consent Form for Non-e-learning Science Instructors**  
**(Chinese)**

敬愛的 教授:

您好! 我是學校計網中心講師王素貞，很感謝學校支持本人至國外進修攻讀博士學位，目前本人已是紐西蘭 漢彌敦 懷卡托大學 科學及技職教育研究中心 (Center for Science and Technology Education Research, University of Waikato, Hamilton, New Zealand) 博士研究生。我的博士論文研究主要目的是檢視及了解台灣目前大學教育應用數位學習之實施現況，進而探討發展出一套可改善大學應用數位學習之實施策略，以提升教師及學生教學及學習品質。為達此目的，本人預定以更深入實際了解目前學校應用計網中心自行開發之網路教學系統實施數位學習之現況，來探討目前國家教育政策、現行制度，對學校、教師、學生等之衝擊及影響因素。因此，本人在此誠摯地邀請您參與本研究。由於您的參與，可提供有關您為何不應用數位學習系統來教學的經驗和一些如何在未來提高應用數位學習教學品質的寶貴意見，這些資訊尤其在台灣目前國家政策正積極推展數位學習的情況下，更彰顯其重要性，所以您的參與是非常重要的，令人讚賞的，感恩您！

您所提供的個人資料將被保密，且將不會在任何報告裡被認出。訪談時間預定在明年一、二月，訪談一般將不會超過半小時。同封信會附上一封有關訪談事項大綱的邀請函和同意函，請卓參! 我希望您很樂意接受我的訪談。謝謝您的撥冗協助! 順頌

教安

未學

王素貞 敬上 November 1, 2004

## **Appendix H: Informed Consent Form for Non-e-learning Science Instructors**

### **(English)**

Su-Chen Wang  
KP G.20, Centre for Science and  
Technology Education Research (CSTER),  
University of Waikato, Hamilton, New  
Zealand  
Tel: (O) 64-7-8384466~8923  
Tel: (H) 64-7-8582988  
Fax: 002-64-7-8384272  
e-mail: [sw110@waikato.ac.nz](mailto:sw110@waikato.ac.nz) or  
[suchen1@gmail.com](mailto:suchen1@gmail.com)

Centre for Science and Technology  
Education Research

The University of Waikato  
Private Bag 3105  
Hamilton, New Zealand  
Ph: 64-7-838 4035  
(Centre direct line)  
Fax: 64-7-838 4272



## **Invitation for the research: “Enhancing existing e-learning for university education in Taiwan”**

Dear Professor \_\_\_\_\_:

Hello. My name is Su-Chen Wang. I am a senior lecturer at NRU and am currently undertaking advanced study for a PhD with the support of the University. I am a PhD student at the Centre for Science and Technology Education Research (CSTER), University of Waikato, Hamilton, New Zealand. The goal of my PhD research is to develop a better understanding of existing e-learning practice at NRU. The overall aim is to be able to suggest some strategies to enhance the practice of e-learning. I invite you to take part in this study by being interviewed. Your participation is important in providing information about the reasons why you do not use e-learning teaching, identifying issues that are important in e-learning in Taiwan and suggesting ideas for how to enhance the implementation of e-learning in the future. Your cooperation will be greatly appreciated. Please mail by using the attached stamped addressed envelope, or fax the completed consent form back to me as soon as possible.

The information you provide will be kept confidential and you will not be identifiable in any reports. Each interview normally will take less than half an hour. A letter outlining what the interviews will involve and inviting you to take part is included with this invitation letter (please see attachment). I hope you will agree to talk with me about your experiences.

Thank you very much in advance for your time and helpful participation.

Yours sincerely,

Su-Chen Wang

## **Appendix H: Informed Consent Form for Non-e-learning Science Instructors (Attachment)**

Su-Chen Wang

KP G.20, Centre for Science and Technology  
Education Research (CSTER)  
University of Waikato, Hamilton, New Zealand  
Tel: (O) 64-7-8384466~8923  
Tel: (H) 64-7-8582988  
Fax: 002-64-7-8384272  
e-mail: [sw110@waikato.ac.nz](mailto:sw110@waikato.ac.nz) or  
[suchen1@gmail.com](mailto:suchen1@gmail.com)

Centre for Science and Technology  
Education Research

The University of Waikato  
Private Bag 3105  
Hamilton, New Zealand

Ph: 64-7-838 4035 (Centre direct line)  
Fax: 64-7-838 4272



### **Invitation to be interviewed for the research: “Enhancing existing e-learning for university education in Taiwan”**

You are invited to be interviewed in the research. Interviews will allow me to explore your experiences of e-learning in more depth. Each interview normally will be up to 30 minutes. With your permission the interviews will be audio taped and transcribed. The following issues will be explored:

1. Why do you not use e-learning? What would influence you to use e-learning in your courses?
2. What are the challenges faced by instructors and students?
3. In your view, what strategies might be used to enhance e-learning practice for science education?
4. What changes are necessary for university and/or for instructors from your perspective?

I am committed to respecting your privacy and maintaining confidentiality. The information collected from your interviews will be treated as strictly confidential. All quotes and transcripts will be coded and a pseudonym will be used in the report in order that your identity is not revealed.

All the information obtained will be destroyed at the conclusion of the research. The information obtained will be used for a PhD thesis and may be used for other publications and presentations.

You can ask questions regarding the research. If you have any concerns regarding your participation in the research, you can approach me Su-Chen Wang (see top of this page for my contact details). For any unresolved concerns please contact my supervisor, Prof Alister Jones (KP G.25, CSTER, University of Waikato, Hamilton, New Zealand; Tel: 002-64-7-8384245, or Fax: 002-64-7-8384272 or on the following e-mail: [a.jones@waikato.ac.nz](mailto:a.jones@waikato.ac.nz)).

Please indicate whether you'll be interested in being interviewed. Please write down your contact details (e.g. e-mail, phone number or mobile number) at the end of this letter if you would like to be contacted.

Thank you very much in advance for your participation and help.

Yours sincerely,

Su-Chen Wang

**Appendix H: Informed Consent Form for Non-e-learning Science Instructors  
(Attachment)**

**Informed Consent for:  
Enhancing existing e-  
learning in university  
education in Taiwan**

Centre for Science and Technology Education  
Research

The University of Waikato  
Private Bag 3105  
Hamilton, New Zealand  
Ph: 64-7-838 4035  
(Centre direct line)  
Fax: 64-7-838 4272



**Please fax this reply to:**

Ms Su-Chen Wang  
CSTER, University of Waikato  
Private Bag 3105  
Hamilton  
New Zealand  
Fax No: 002 64 7 838 4272

**Or mail with the questionnaire using the stamped addressed envelope provided.**

I have read the Invitation to be interviewed for the research: “Enhancing existing e-learning for university education in Taiwan” and agree to participate in the study under the conditions set out above.

Name: \_\_\_\_\_ Department: \_\_\_\_\_

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

E-mail: \_\_\_\_\_

Contact phone: \_\_\_\_\_

I will email or ring you to confirm a time and place for our interview discussion.

***Thank you very much for your participation and interest!***

## **Appendix I: Informed Consent Form for E-learning Students (English)**

Su-Chen Wang  
KP G.20, Centre for Science and Technology  
Education Research (CSTER)  
University of Waikato, Hamilton, New Zealand  
Tel: (O) 64-7-8384466~8923  
Tel: (H) 64-7-8582988  
Fax: 002-64-7-8384272  
e-mail: [sw110@waikato.ac.nz](mailto:sw110@waikato.ac.nz) or  
[suchen1@gmail.com](mailto:suchen1@gmail.com)

Centre for Science and  
Technology Education  
Research

The University of Waikato  
Private Bag 3105  
Hamilton, NZ  
Ph: 64-7-838 4035  
(Centre direct line)  
Fax: 64-7-838 4272



## **Invitation to be interviewed for the research: “Enhancing existing e-learning for university education in Taiwan”**

### **Dear student:**

Hello. My name is Su-Chen Wang. I am a senior lecturer at NRU and am currently undertaking advanced study for a PhD with the support of the University. I am a PhD student at the Centre for Science and Technology Education Research (CSTER), University of Waikato, Hamilton, New Zealand. The goal of my PhD research is to develop a better understanding of existing e-learning practice at NRU. The overall aim is to be able to suggest some strategies to enhance the practice of e-learning. I think it is important that student ideas and suggestions are incorporated into the development of e-learning. I invite you to take part in a group-interview for this study. Your participation is important in suggesting ideas for how to enhance the quality of e-learning now and in the future. Your cooperation will be greatly appreciated.

You will be involved in a group-interview with about 3~5 other students. Each group-interview should take about 30 minutes. The interview seeks to identify the factors, challenges, benefits and disadvantages of current e-learning practice. With your permission the interviews will be audio taped and transcribed. The information you provide will be kept confidential and you will not be identified in any reports. All the information obtained will be destroyed at the conclusion of the research. The information obtained will be used for a PhD thesis and may be used for other publications and presentations.

You can ask questions regarding the research. If you have any concerns regarding your participation in the research, you can approach me Su-Chen Wang (see top of this page for my contact details). For any unresolved concerns please contact my supervisor, Prof Alister Jones (KP G.25, CSTER, University of Waikato, Hamilton, New Zealand; Tel: 002-64-7-8384245, Fax: 002-64-7-8384272 or on the following e-mail: [a.jones@waikato.ac.nz](mailto:a.jones@waikato.ac.nz)). Thank you very much in advance for your time and helpful participation.

Yours sincerely,

Su-Chen Wang

**Appendix I: Informed Consent Form for E-learning Students**

**Informed Consent for:  
Enhancing existing e-  
learning in university  
education in Taiwan**

Centre for Science and  
Technology Education Research  
The University of Waikato  
Private Bag 3105  
Hamilton, New Zealand  
Ph: 64-7-838 4035  
Fax: 64-7-838 4272



**Please hand in this consent form to me.**

**Or send to my office at 5F of the Computer and Network Centre.**

I have read the Invitation to be interviewed for the research: “Enhancing existing e-learning for university education in Taiwan” and agree to participate in the study under the conditions set out.

Name: \_\_\_\_\_ Signed: \_\_\_\_\_

Date: \_\_\_\_\_ E-mail: \_\_\_\_\_

Contact phone: \_\_\_\_\_

Please tick one or two of the following time would suit you to take part in a group-interview.

- Feb 18 (Friday) afternoon 3:30~4:30
- Feb 21 (Monday) afternoon 4:30~5:30
- Feb 22 (Tuesday) afternoon 4:30~5:30
- Feb 24 (Thursday) afternoon 4:30~5:30
- Feb 25 (Friday) afternoon 3:30~4:30
- Other (Please specify): \_\_\_\_\_

I will email you to confirm a time and place for our interview discussion.

*Thank you very much for your participation and interest!*

## **Appendix J: Invitation Letter with Questionnaire for E-learning Instructors**

Su-Chen Wang  
KP G.20, Centre for Science and Technology  
Education Research (CSTER), University of  
Waikato, Hamilton, New Zealand  
Tel: (O) 64-7-8384466~8923  
Tel: (H) 64-7-8582988  
Fax: 002-64-7-8384272  
e-mail: [sw110@waikato.ac.nz](mailto:sw110@waikato.ac.nz) or  
[suchen1@gmail.com](mailto:suchen1@gmail.com)

Centre for Science and Technology  
Education Research

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Private Bag 3105  
Hamilton, New Zealand  
Ph: 64-7-838 4035 (Centre direct line)  
Fax: 64-7-838 4272



### **Invitation for the research: “Enhancing existing e-learning for university education in Taiwan”**

Dear Professor \_\_\_\_\_ :

Hello. My name is Su-Chen Wang. I am a senior lecturer at NRU and am currently undertaking advanced study for a PhD with the support of the University. I am a PhD student at the Centre for Science and Technology Education Research (CSTER), University of Waikato, Hamilton, New Zealand. The goal of my PhD research is to develop a better understanding of existing e-learning practice at NRU. The overall aim is to be able to suggest some strategies to enhance the practice of e-learning. I invite you to take part in this study by completing the attached questionnaire. Your participation is important in providing information about e-learning teaching experiences, identifying issues that are important in e-learning in Taiwan and suggesting ideas for how to enhance the quality of e-learning in the future. Your cooperation will be greatly appreciated.

The questionnaire will take 15 – 20 minutes to complete, although you may choose to take longer to write more detailed responses. Please mail the completed questionnaire back to me, using the attached stamped-addressed envelope, by November 30, 2004 or as soon as possible.

The information you provide will be kept confidential and you will not be identifiable in any reports. Completion of this questionnaire will be taken as consent to use the data in the research.

To gain more in-depth information I would also like to conduct interviews with some staff. Each interview normally will take less than half an hour. A letter outlining what the interviews will involve and inviting you to take part is included with this questionnaire (please see attachment). I hope you will agree to talk with me about your e-learning teaching experiences.

Thank you very much in advance for your time and helpful participation.

Yours sincerely,

Su-Chen Wang

**Appendix J: Invitation letter with Questionnaire for the E-learning Instructors**  
**(Chinese)**

敬愛的\_\_\_\_\_教授:

您好! 我是計網中心講師王素貞, 很感謝學校支持本人至國外進修攻讀博士學位, 目前本人已是紐西蘭 漢彌敦 懷卡托大學 科學及技職教育研究中心 (Center for Science and Technology Education Research, University of Waikato, Hamilton, New Zealand) 博士研究生。我的博士論文研究主要目的是檢視及了解台灣目前大學教育應用數位學習之實施現況, 進而探討發展出一套可改善大學應用數位學習之實施策略, 以提升教師及學生教學及學習品質。為達此目的, 本人預定以更深入實際了解目前學校應用計網中心自行開發之網路教學系統實施數位學習之現況, 來探討目前國家教育政策、現行制度, 對學校、教師、學生等之衝擊及影響因素。因此, 本人在此誠摯地邀請您參與本研究協助填答問卷, 您將會收到本人所寄出之問卷及接受訪談之邀請函 (請見附件)。由於您的參與, 可提供有關您在應用數位學習系統方面豐富的教學經驗和一些如何在未來提高應用數位學習教學品質的寶貴意見, 這些資訊尤其在台灣目前國家政策正積極推展數位學習的情況下, 更彰顯其重要性, 所以您的參與是非常重要的, 令人讚賞的, 感恩您!

問卷調查將花費您 15 至 20 分鐘去填寫, 雖然有可能您會選擇花更長時間去詳填您寶貴的意見。懇請您在填完問卷後, 利用所附之回郵信封在 11 月 30 日前或儘快寄回, 謝謝您!

您所提供的個人資料將被保密, 且將不會在任何報告裡被認出。完成此問卷之填寫即視同得到您的允許可使用其中之資料在此研究中。

為了能得到更詳細深入之資訊, 我也想訪談一些教授們。訪談時間預定在明年一、二月, 訪談一般將不會超過一小時。同封信會附上一封有關訪談事項大綱的邀請函和同意函, 請卓參! 我希望您很樂意接受我的訪談有關您數位學習教學的寶貴經驗。謝謝您的撥冗協助! 順頌

教安

末學

王素貞 敬上 November 1, 2004

## **Appendix J: Invitation letter with Questionnaire for the E-learning Instructors (Attachment)**

### **Section 1: Your details**

This section hopes to obtain information on your background. **(Please tick the appropriate box)**

<b>1. Your name</b>	
<b>2. Your email address</b>	
<b>3. Department</b>	
<b>4. Gender</b>	<input type="checkbox"/> male <input type="checkbox"/> female
<b>5. Your current position</b>	<input type="checkbox"/> full professor <input type="checkbox"/> associate professor <input type="checkbox"/> assistant professor <input type="checkbox"/> lecturer
<b>6. Age</b>	<input type="checkbox"/> <30 <input type="checkbox"/> 30~40 <input type="checkbox"/> 41~50 <input type="checkbox"/> 51~55 <input type="checkbox"/> 56+
<b>7. How many years teaching experience do you have?</b>	<input type="checkbox"/> 0~5 years <input type="checkbox"/> 6~10 years <input type="checkbox"/> 11~15 years <input type="checkbox"/> 16~20 years <input type="checkbox"/> 21~25 years <input type="checkbox"/> 26+ years
<b>8. Please indicate the year levels you usually teach?</b>	<input type="checkbox"/> Freshman <input type="checkbox"/> Sophomore <input type="checkbox"/> Junior <input type="checkbox"/> Senior <input type="checkbox"/> Master <input type="checkbox"/> PhD (You may select more than one)
<b>9. Are you familiar with the following?</b>	National policy on e-learning? <input type="checkbox"/> yes <input type="checkbox"/> no University policy on e-learning? <input type="checkbox"/> yes <input type="checkbox"/> no

### **Section 2: Your e-learning experiences with the university e-learning system**

This section hopes to obtain information regarding your experiences with the Network Teaching System at NRU and your general perceptions of e-learning practice. 這章節是爲了取得您使用學校網路教學系統(即數位學習應用系統)的經驗和您對數位學習應用的觀點。

<b>10. How many years teaching experience in e-learning do you have?</b>	Please tick <b>ONE</b> box: <input type="checkbox"/> 0~1 year <input type="checkbox"/> 2 years <input type="checkbox"/> 3 years <input type="checkbox"/> 4 years <input type="checkbox"/> 5+ years
<b>11. How many e-learning courses have you taught?</b>	Please tick <b>ONE</b> box: <input type="checkbox"/> This is my first e-learning course <input type="checkbox"/> 2 courses <input type="checkbox"/> 3 courses <input type="checkbox"/> 4 courses <input type="checkbox"/> 5 courses <input type="checkbox"/> 6+ courses
<b>12. How would you rate your ability to use e-learning?</b>	Please tick <b>ONE</b> box: <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> beginner intermediate expert
<b>13. What kind of auxiliary equipment have you used in your e-learning course(s)? Please tick as many as apply.</b> 下列何種教學輔助設備您會應用在您的數位學習課程上? (請打勾, 可複選)	
<input type="checkbox"/> <input type="checkbox"/> CD-ROM <input type="checkbox"/> <input type="checkbox"/> Video <input type="checkbox"/> <input type="checkbox"/> VOD (Video on Demand online) <input type="checkbox"/> <input type="checkbox"/> Audiocassettes <input type="checkbox"/> <input type="checkbox"/> Digital camera <input type="checkbox"/> <input type="checkbox"/> Video camera <input type="checkbox"/> <input type="checkbox"/> Scanner <input type="checkbox"/> <input type="checkbox"/> Other: _____	
13b. Please go back and put another tick beside those you found helpful.	

<p><b>14. Which of the following teaching methods have you used in your e-learning course(s)?</b>  <b>(Please tick as many as apply)</b> 下列何種教學方法您會應用在您的數位學習課程上?          (請打勾, 可複選)</p>
<p><input type="checkbox"/> Course notes on the e-learning system (將上課資料筆記放在教學系統上)</p> <p><input type="checkbox"/> References (book/website/hints, etc.) on the e-learning system (將參考資料放在教學系統上)</p> <p><input type="checkbox"/> Video of my lesson(s) on the e-learning system (將您上課實況錄成影帶放在教學系統上)</p> <p><input type="checkbox"/> Student projects/reports online (將學生的專案設計/報告放在教學系統上)</p> <p><input type="checkbox"/> Video of students presenting their projects online (將學生上課專案報告實況錄成影帶放在教學系統上)</p> <p><input type="checkbox"/> Online discussion (including discussion board, chat room, etc.) (線上討論, 包括討論區、聊天室等)</p> <p><input type="checkbox"/> Online group discussion (線上群組討論)</p> <p><input type="checkbox"/> Collaborative projects or assignments (指定合作專案或作業)</p> <p><input type="checkbox"/> Online quiz or test or assignment (線上小考或考試或指定作業)</p> <p><input type="checkbox"/> Other: _____</p>
<p><b>15. Which of the following personal factors influence your use of the university e-learning system?</b>  <b>(Please tick at left column as many as apply)</b>          下列何種個人因素會影響您使用學校數位學習系統? (請在左方欄打勾, 可複選)</p>
<p><input type="checkbox"/> <input type="checkbox"/> I am comfortable with the system (我喜歡使用此系統, 感覺很好)</p> <p><input type="checkbox"/> <input type="checkbox"/> Pressure from students (來自學生的壓力)</p> <p><input type="checkbox"/> <input type="checkbox"/> It improves the efficiency of my teaching (它能提高我教學的效率)</p> <p><input type="checkbox"/> <input type="checkbox"/> Promotion issues (for tenure system) (爲了能增加升等機會)</p> <p><input type="checkbox"/> <input type="checkbox"/> Requirement from department or university (來自系上或學校的要求)</p> <p><input type="checkbox"/> <input type="checkbox"/> Incentive pay (鼓勵的酬勞, 如鐘點費的加計)</p> <p><input type="checkbox"/> <input type="checkbox"/> Source of income (make money from e-learning content, etc.) (收入的來源例如販賣課程內容等)</p> <p><input type="checkbox"/> <input type="checkbox"/> It improves the quality of my teaching (它能提高我教學的品質)</p> <p><input type="checkbox"/> <input type="checkbox"/> Other: _____</p> <p>15b. Please go back and put another tick beside those you found important.</p>
<p><b>16. Which of the following support factors influence your use of the university e-learning system?</b>  <b>(Please tick at left column as many as apply)</b>          下列何種支援服務因素會影響您使用學校數位學習系統? (請在左方欄打勾, 可複選)</p>
<p><input type="checkbox"/> <input type="checkbox"/> Help from colleagues (來自同事的幫忙)</p> <p><input type="checkbox"/> <input type="checkbox"/> Help from external professional sectors (來自校外專家或公司的幫忙)</p> <p><input type="checkbox"/> <input type="checkbox"/> Technical support services from the Teaching and Research Group of the Computer Centre          (來自計網中心多媒體製作使用小組 技術同仁的協助服務)</p> <p><input type="checkbox"/> <input type="checkbox"/> Student assistant support from the Office of Academic Affairs of the university          (來自教務處補助研究生的協助)</p> <p><input type="checkbox"/> <input type="checkbox"/> Training from the university (來自校內使用說明訓練)</p> <p><input type="checkbox"/> <input type="checkbox"/> Administrative support from department / university (來自校內行政支援)</p> <p><input type="checkbox"/> <input type="checkbox"/> Other: _____</p> <p>16b. Please go back and put another tick beside those you found important.</p>

<p><b>17. Which of the following policy and leadership factors will influence your use of the university e-learning system? (Please tick as many as apply)</b> 下列何種政策或領導因素會影響您使用學校數位學習系統? (請打勾, 可複選)</p> <p><input type="checkbox"/> National policy on e-learning (國家數位學習的政策)</p> <p><input type="checkbox"/> University policy on e-learning (學校數位學習的政策)</p> <p><input type="checkbox"/> University/Department requirement (來自系上或學校的要求)</p> <p><input type="checkbox"/> University/Department culture (e.g., pressure from colleague) (校內或系上文化形勢, 如來自同事的壓力)</p> <p><input type="checkbox"/> University/Department source of external income (校內或系上校外經費來源之一)</p> <p><input type="checkbox"/> Other: _____</p>
<p><b>18. In your view, what are the key influences that affect the instructors teaching e-learning course(s)?</b> 在您的觀點裡, 哪些是影響老師應用數位學習系統教學的主要因素?</p> <p>_____</p>
<p><b>19. In your view, why do other teachers not use e-learning?</b> 在您的觀點裡, 為什麼其他老師不應用數位學習系統教學呢?</p> <p>_____</p>
<p><b>20. Do you think will it be <u>helpful</u> to enhance e-learning practice if the university makes the following changes? Please indicate the appropriate degree to each statement below.</b> 假如大學作了下列改變, 您是否認為它將會對提高使用數位學習系統有所助益? 請在下列表達您的意見。1= Strongly Disagree (非常不同意) 2= Disagree (不同意) 3= Neither Agree nor Disagree (尚可) 4= Agree (同意) 5= Strongly Agree (非常同意)</p> <ul style="list-style-type: none"> <li>• Increases the evaluation ratio of teaching e-learning course in tenure-promotion policy (提高升等計分的評比)    <input type="checkbox"/>1   <input type="checkbox"/>2   <input type="checkbox"/>3   <input type="checkbox"/>4   <input type="checkbox"/>5</li> <li>• Increases the incentive pay (e.g., Teach 1 hour can get 1.5 ~ 2 hour pay, etc.) (增加鼓勵的酬勞, 如鐘點費的加計, 教 1 小時可領 1.5 至 2 小時鐘點費等)    <input type="checkbox"/>1   <input type="checkbox"/>2   <input type="checkbox"/>3   <input type="checkbox"/>4   <input type="checkbox"/>5</li> <li>Any comments: _____</li> <li>• Requires all instructors use e-learning system (要求所有教師必須使用數位學習系統)    <input type="checkbox"/>1   <input type="checkbox"/>2   <input type="checkbox"/>3   <input type="checkbox"/>4   <input type="checkbox"/>5</li> <li>• Provides more student/staff technical support (提供更多的學生或職員的技術支援)    <input type="checkbox"/>1   <input type="checkbox"/>2   <input type="checkbox"/>3   <input type="checkbox"/>4   <input type="checkbox"/>5</li> <li>• Provides more functionality (e.g., automatically computing student grades, etc.) (提供更多的系統功能, 如自動計算學生成績等)    <input type="checkbox"/>1   <input type="checkbox"/>2   <input type="checkbox"/>3   <input type="checkbox"/>4   <input type="checkbox"/>5</li> <li>• Provides more demonstrations to show good e-learning courses (提供更多的好課程展示說明會)    <input type="checkbox"/>1   <input type="checkbox"/>2   <input type="checkbox"/>3   <input type="checkbox"/>4   <input type="checkbox"/>5</li> <li>• Provides more seminars to share experiences (提供更多的研討會以利分享經驗)    <input type="checkbox"/>1   <input type="checkbox"/>2   <input type="checkbox"/>3   <input type="checkbox"/>4   <input type="checkbox"/>5</li> <li>• Provides incentives such as a “teaching award” or “faculty fellows”, etc. (提供更多的鼓勵誘因, 如教學優良獎或特別研究獎等)    <input type="checkbox"/>1   <input type="checkbox"/>2   <input type="checkbox"/>3   <input type="checkbox"/>4   <input type="checkbox"/>5</li> </ul> <p>Any comments: _____</p>

### Section 3: Your own e-learning experiences

This section hopes to obtain information regarding your own experiences of e-learning practice.

<p><b>21. In your experience, what have been some of the most effective strategies you have used in your e-learning course(s)? Please describe one or two examples.</b> (請舉例說明，您曾經使用過哪些最有效的教學策略在您的數位學習課程上?)</p>

### Section 4: The support services in e-learning course(s)

This section hopes to obtain feedback regarding the e-learning support services from the university, departments, and peers. By "support services" we mean services the institution provides to teachers to help them complete their teaching. Support services include but are not limited to technical assistance, library facilities (including extension library resources), counselling services, and computer labs. 這章節是爲了取得您使用學校網路教學系統時，從學校或系上或同事所得支援服務的經驗。所謂支援服務並不侷限於技術協助，圖書館設備資源的提供，諮詢服務和電腦實驗室等。

<p><b>22. What kind of support services do you use? (Please tick at left column as many as apply for current use)</b></p>	
<p><input type="checkbox"/> <input type="checkbox"/> Technical support staff to teach me how to use the technologies</p> <p><input type="checkbox"/> <input type="checkbox"/> A student assistant to help me operate the technology and handle online issues</p> <p><input type="checkbox"/> <input type="checkbox"/> Training courses</p> <p><input type="checkbox"/> <input type="checkbox"/> Seminars to share experiences</p> <p><input type="checkbox"/> <input type="checkbox"/> A demonstration to show good e-learning courses</p> <p><input type="checkbox"/> <input type="checkbox"/> Provision of additional technology</p> <p><input type="checkbox"/> <input type="checkbox"/> Other: _____</p>	
<p><b>22b. Please go back and put another tick beside those you found helpful.</b></p>	
<p><b>23. What other support services should be available? Please specify why.</b> 您認爲應該還有哪些支援服務是必備的？請說明其原因。</p>	
<p><b>24. For how many e-learning courses have you received student assistant support from the university?</b> (有多少數位學習課程您曾經接受過學校補助研究生的協助?)</p>	<p>Please tick <b>ONE</b> box:</p> <p><input type="checkbox"/> None    <input type="checkbox"/> 1 course    <input type="checkbox"/> 2 courses</p> <p><input type="checkbox"/> 3 courses    <input type="checkbox"/> 4 courses    <input type="checkbox"/> 5+ courses</p>

<b>25. What advantages did you experience when you had student assistant support from university?</b>
<b>26. What disadvantages have you experienced when you did not have student assistant support from university?</b>

### Section 5: Benefits and challenges of e-learning practice

This section hopes to obtain feedback regarding the benefits and challenges which you experienced and your perceptions about e-learning. 這章節是爲了取得您使用學校網路教學系統時，數位學習系統所帶來之利益和您所面臨之挑戰的經驗和您對數位學習應用的觀點。

<b>27. What do you think are the benefits of e-learning practice for the university? Please tick as many as apply.</b> 對大學而言，您認爲數位學習系統會給大學帶來何種利益？(請打勾，可複選)
<input type="checkbox"/> Increases university competitiveness and reputation (提高學校競爭力 and 知名度) <input type="checkbox"/> Improves the quality of interaction among students and instructors (提高師生間交流品質) <input type="checkbox"/> Improves the quality of teaching and learning (提高教學品質) <input type="checkbox"/> Increases between institutional cooperation or partnership (增加機構或組織間合作或合夥) <input type="checkbox"/> Lowers average costs per course per student (降低每個學生每個課程教學資源的平均成本) <input type="checkbox"/> Source of income (校內或系上經費的來源之一) <input type="checkbox"/> Other: _____
<b>28. What do you think are the benefits of e-learning practice for you as an instructor? Please tick at left column as many as apply.</b> 對教師而言，您認爲數位學習系統會給教師帶來何種利益？(請在左方欄打勾，可複選)
<input type="checkbox"/> <input type="checkbox"/> Flexibility of time and place of teaching (教學時間和地點的彈性) <input type="checkbox"/> <input type="checkbox"/> Increases my teaching efficiency (提高我教學的效率) <input type="checkbox"/> <input type="checkbox"/> Increases personal reputation (提高個人知名度) <input type="checkbox"/> <input type="checkbox"/> Improves interaction with students (改善師生間交流品質) <input type="checkbox"/> <input type="checkbox"/> Easier to manage my academic work (e.g., keep student records or assignments, etc.) (更容易管理教學相關行政工作，如：保存學生成績紀錄或作業等) <input type="checkbox"/> <input type="checkbox"/> Easier to create and manage my course materials (更容易開發設計與管理教學相關教材) <input type="checkbox"/> <input type="checkbox"/> Improves the quality of my teaching (提高我教學的品質) <input type="checkbox"/> <input type="checkbox"/> Easier to share views and experiences with others (更容易與他人分享想法與經驗) <input type="checkbox"/> <input type="checkbox"/> Other: _____
<b>28b. Please go back and put another tick beside those you found important.</b>

**29. What do you think are the benefits of e-learning practice for the students? Please tick at left column as many as apply.** 對學生而言，您認為數位學習系統會給學生帶來何種利益？(請在左方欄打勾，可複選)

- Flexibility of time, place and pace of learning (學生學習時間、地點和進度的彈性)
- Improves students' interaction with peers (改善學生間彼此交流品質)
- Improves students' interaction with instructors (改善師生間彼此交流品質)
- Easier to manage homework, reports, etc. (學生更容易管理其作業、報告等)
- Improves student motivation (提高學生學習的動機)
- Improves student participation (提高學生學習的參與)
- Improves students' quality of learning (提高學生學習的品質)
- Improves the students' ability to use technologies adaptable to this "information age"  
(提高學生使用科技的能力，以利適應「資訊時代」的來臨)
- Other: \_\_\_\_\_

**29b. Please go back and put another tick beside those you found important.**

**30. What are the challenges faced by you as an instructor teaching an e-learning course? (e.g. a role change, teaching methods, curriculum design, assignments, tests, the ways you and students talk, etc.)** 當一個教師應用數位學習系統教學時，會面臨哪些挑戰？(例如：教師角色的改變、教學方法、課程設計、指定作業或考試方式的改變等)

### Section 6: Suggested changes:

This section hopes to obtain any additional suggested changes for e-learning practice from your perspective.

**31. In your experience, what would be some useful strategies to enhance e-learning practice?**  
(對於改善應用數位學習的策略，您有哪些建議?)

### Section 7: Any other comments

This section hopes to obtain any additional comments or suggestions from your perspective in e-learning course.

**Thank you very much for taking the time to complete this questionnaire, I appreciate your contribution to this research study which is supported by the university. Please return your completed questionnaire by using the attached stamped addressed envelope. The return mail address is 3F, 322 Yu-Nong Road, Tainan, Taiwan, R.O.C.**

非常謝謝您的撥冗填答此問卷，這個研究活動是經過校方同意且支持的，我非常感恩您對此研究的貢獻。請將您填好之問卷放入所附之回郵信封寄回王素貞收，謝謝!

**If you would like to be interviewed about your ideas and experiences, please refer to the attached invitation letter.**

若您願意接受我的訪談，來分享您寶貴的卓見與經驗，請繼續卓參所附之訪談邀請函。

**Finally, please feel free to make any additional comments or suggestions for me at anytime. You can email me at [suchen1@gmail.com](mailto:suchen1@gmail.com) or [sw110@waikato.ac.nz](mailto:sw110@waikato.ac.nz)**

最後請您隨時不吝指教，您可 email 至 [suchen1@gmail.com](mailto:suchen1@gmail.com) or [sw110@waikato.ac.nz](mailto:sw110@waikato.ac.nz)

## **Appendix K: Invitation Letter with Questionnaire for E-learning Student**

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### **Centre for Science and Technology Education Research**

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Hamilton, New Zealand  
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## **Enhancing existing e-learning in university education in Taiwan**

Dear student,

Hello. My name is Su-Chen Wang. I am a senior lecturer at NRU and am currently undertaking advanced study for a PhD with the support of the University. I am a PhD student at the Centre for Science and Technology Education Research (CSTER), University of Waikato, Hamilton, New Zealand. The goal of my PhD research is to develop a better understanding of existing e-learning practice at NRU. The overall aim is to be able to suggest some strategies to enhance the practice of e-learning. I think it is important that student ideas and suggestions are incorporated into the development of e-learning. I invite you to take part in this study by completing the attached questionnaire. Your participation is important in suggesting ideas for how to enhance the quality of e-learning now and in the future. Your cooperation will be greatly appreciated.

The questionnaire should take between 15 to 20 minutes to complete, although you may choose to take longer to write more detailed responses. Please return your completed questionnaire to me, using the attached stamped-addressed envelope, by **January 10, 2005** or as soon as possible.

The information you provide will be kept confidential and you will not be identified in any reports. Completion of this questionnaire will be taken as consent to use the data in the research.

Thank you very much in advance for your time and helpful participation.

Yours sincerely,

Su-Chen Wang

**Appendix K: Invitation Letter with Questionnaire for E-learning Students**  
**(Attachment)**

For the purposes of this research, the term **e-learning** will be defined as a teaching approach that combines online and/or web-based supported course materials and face-to-face instruction (For example, face-to-face instruction with NRU Network Teaching System) .

**Section 1: Your details**

This section is about your background. **(Please tick the appropriate box)**

<b>1. Your department</b>	
<b>2. Your email address (optional)</b>	
<b>3. Gender</b>	<input type="checkbox"/> Male <input type="checkbox"/> Female
<b>4. Your level of study</b>	<input type="checkbox"/> Freshman <input type="checkbox"/> Sophomore <input type="checkbox"/> Junior <input type="checkbox"/> Senior <input type="checkbox"/> Master <input type="checkbox"/> PhD
<b>5. Are you familiar with the following ...</b>	National policy on e-learning? <input type="checkbox"/> yes <input type="checkbox"/> no University policy on e-learning? <input type="checkbox"/> yes <input type="checkbox"/> no
<b>6. In general, I prefer to learn:</b>	<input type="checkbox"/> Alone <input type="checkbox"/> With a partner <input type="checkbox"/> In a group
<b>7. In general, I prefer to learn:</b>	<input type="checkbox"/> Face-to-face only <input type="checkbox"/> Face-to-face and e-learning/online <input type="checkbox"/> Only e-learning/online (i.e. no face-to-face)

**Section 2: Your e-learning experiences and general perceptions**

This section is about your experiences and your general perceptions of e-learning practice. That is, using online or web-based materials as part of your university courses.

<b>8. Which of the following teaching methods have you experienced in your course(s)? Please tick in the left column as many as apply.</b>	
<input type="checkbox"/> <input type="checkbox"/> Course notes on the e-learning system <input type="checkbox"/> <input type="checkbox"/> References (book/website/hints, etc.) on the e-learning system <input type="checkbox"/> <input type="checkbox"/> Video of the lesson(s) on the e-learning system <input type="checkbox"/> <input type="checkbox"/> Student projects/reports online <input type="checkbox"/> <input type="checkbox"/> Video of students presenting their projects online <input type="checkbox"/> <input type="checkbox"/> Online discussion (including discussion board, chat room, etc.) <input type="checkbox"/> <input type="checkbox"/> Online discussion in organized groups <input type="checkbox"/> <input type="checkbox"/> Collaborative projects or assignments <input type="checkbox"/> <input type="checkbox"/> Online quiz or test or assignment <input type="checkbox"/> <input type="checkbox"/> Other: _____	
<b>8b. Please go back and put another tick beside those you found helpful.</b>	
<b>9. How many e-learning courses have you taken previously?</b>	Please tick <b>ONE</b> box: <input type="checkbox"/> first e-learning course <input type="checkbox"/> 2 courses <input type="checkbox"/> 3 courses <input type="checkbox"/> 4 courses <input type="checkbox"/> 5 courses <input type="checkbox"/> 6+ courses
<b>10. How many years experience in e-learning do you have?</b>	Please tick <b>ONE</b> box: <input type="checkbox"/> 0~1 year <input type="checkbox"/> 2 years <input type="checkbox"/> 3 years <input type="checkbox"/> 4 years <input type="checkbox"/> 5+ years
<b>11. How would you rate your ability to use e-learning?</b>	Please tick <b>ONE</b> box: <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> beginner intermediate expert
<b>12. In your experience, what have been some of the most effective strategies your instructors have used in the online component of the course(s)? Please describe one or two examples.</b>	

### Section 3: Personal factors and course organizational factors

This section is about personal and course organizational factors which influence your use of the e-learning system.

<b>13. Which of the following personal factors <u>encourage</u> you to use the e-learning system? Please tick in the left column as many as apply.</b>
<input type="checkbox"/> I am comfortable with the system <input type="checkbox"/> I can learn at my own time, place and pace <input type="checkbox"/> I can take more personal responsibility for my learning <input type="checkbox"/> It is a requirement from instructors <input type="checkbox"/> Pressure from peers <input type="checkbox"/> It improves the efficiency of my learning <input type="checkbox"/> It improves the quality of my learning <input type="checkbox"/> It improves my grades <input type="checkbox"/> The technology increases my motivation to work on the course  <input type="checkbox"/> Other: _____
<b>13b. Please go back and put another tick beside those factors which influenced you most.</b>
<b>14. In your view, which of the following personal factors <u>hinder</u> you to use the e-learning system? Please tick as many as apply.</b>
<input type="checkbox"/> Preference for learning through direct social interaction with instructors (i.e. face-to-face) <input type="checkbox"/> Fear of others having access to personal information <input type="checkbox"/> Discomfort with e-learning/online methods and tools <input type="checkbox"/> Lack of easy access to necessary equipment <input type="checkbox"/> Lack of computing skills <input type="checkbox"/> Online component is not assessed <input type="checkbox"/> Online component is not required to complete the course <input type="checkbox"/> Participating e-learning/online component requires good time management <input type="checkbox"/> Participating e-learning/online component requires good personal organization ability <input type="checkbox"/> Participating in online group discussion involves expressing an opinion in public  <input type="checkbox"/> Other: _____
<b>15. Which of the following course organization factors <u>encourage</u> you to use the e-learning system? Please tick in the left column as many as apply.</b>
<input type="checkbox"/> Clear links between face-to-face and online supported materials <input type="checkbox"/> Instructor responds rapidly online to student questions  <input type="checkbox"/> Course notes offered online before the class <input type="checkbox"/> Prompt online comments on assignments from the instructor <input type="checkbox"/> Course materials and notes are well-organized online <input type="checkbox"/> Online syllabus is detailed <input type="checkbox"/> Online discussion <input type="checkbox"/> Online quizzes <input type="checkbox"/> Other: _____
<b>15b. Please go back and put another tick beside those factors which influenced you most.</b>

### Section 4: Support influences and the support services in e-learning course(s)

This section is about the support that is available for students along online courses. By "support services" we mean services the university provides to students to help them with their learning. Support services include but are not limited to: technical assistance, library facilities (including extension library resources), counselling services, and computer labs.

<p><b>16. Which of the following support factors influence your use of the university e-learning system? Please tick in the left column as many as apply.</b></p> <p> <input type="checkbox"/> <input type="checkbox"/> Help from peers  <input type="checkbox"/> <input type="checkbox"/> Help from instructors  <input type="checkbox"/> <input type="checkbox"/> Help from teaching assistants  <input type="checkbox"/> <input type="checkbox"/> Help from technical support services at the Teaching and Research Group of the Computer Centre  <input type="checkbox"/> <input type="checkbox"/> Student assistant support from the Office of Academic Affairs at the university  <input type="checkbox"/> <input type="checkbox"/> Training from the university  <input type="checkbox"/> <input type="checkbox"/> One-page user's guide  <input type="checkbox"/> <input type="checkbox"/> Counselling Services at the Computer and Network Centre  <input type="checkbox"/> <input type="checkbox"/> Other: _____ </p> <p><b>16b. Please go back and put another tick beside those factors you found important</b></p>
<p><b>17. What other support services should be available? Please specify why.</b></p>    

**Section 5: Benefits and challenges of e-learning practice**

This section is about the benefits and challenges of e-learning.

<p><b>18. What do <u>you</u> see as the main differences between e-learning and face-to-face instruction?</b></p>       
<p><b>19. What do you think are the benefits of e-learning practice <u>for you as a student</u>? Please tick in the left column as many as apply.</b></p> <p> <input type="checkbox"/> <input type="checkbox"/> Flexibility of time, place and pace of learning  <input type="checkbox"/> <input type="checkbox"/> Improves my interaction with peers  <input type="checkbox"/> <input type="checkbox"/> Improves my interaction with instructors  <input type="checkbox"/> <input type="checkbox"/> Easier to manage homework, reports, etc.  <input type="checkbox"/> <input type="checkbox"/> Online quizzes and the self assessments help me identify areas I understand less and provide more relevant practice  <input type="checkbox"/> <input type="checkbox"/> Improves my motivation  <input type="checkbox"/> <input type="checkbox"/> Improves my participation and cooperation  <input type="checkbox"/> <input type="checkbox"/> Improves my quality of learning  <input type="checkbox"/> <input type="checkbox"/> Improves my ability to use information technologies adaptable/relevant to this "information age"  <input type="checkbox"/> <input type="checkbox"/> Other: _____ </p> <p>19b. Please go back and put another tick beside those benefits you consider contributed most to your learning.</p>

<b>20. What are the challenges faced by you as a student learning an e-learning course? (e.g., a role change, learning methods, curriculum design, assignments, tests, the ways you and your instructor talk, etc.)</b>

**Section 7: Any other comments**

Do you have any additional comments or suggestions from your perspective in e-learning course(s)?

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Thank you very much for taking the time to complete this questionnaire. I appreciate your contribution to this research study, which is supported by the university. Please return your completed questionnaire by using the enclosed envelope. The return-mail address is 3F, 322 Yu-Nong Road, Tainan, Taiwan, R.O.C.

Finally, please feel free to make any additional comments or suggestions for me at anytime. You can email me at [suchen1@gmail.com](mailto:suchen1@gmail.com) or [sw110@waikato.ac.nz](mailto:sw110@waikato.ac.nz)

## **Appendix K: Invitation Letter with Questionnaire for E-learning Students** **(Attachment)**

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### **Centre for Science and Technology Education Research**

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Fax: 64-7-838 4272



### **目前台灣各大學教育應用數位學習之改善策略**

親愛的各位同學:

您好! 我是計網中心講師王素貞, 很感謝學校支持本人至國外進修攻讀博士學位, 目前本人已是紐西蘭 漢彌敦 懷卡托大學 (University of Waikato, Hamilton, New Zealand) 科學及技職教育研究中心博士研究生。我的博士論文研究主要目的是要更深入實際了解目前學校應用網路教學系統實施數位學習之現況, 進而探討發展出一套可改善大學應用數位學習之實施策略, 以提升教師及學生教學及學習品質。我認為學生的想法和建議, 對數位學習的應用與推展是非常重要的, 因此本人在此誠摯地邀請您參與本研究協助填答問卷。由於您的參與, 可提供有關您如何在現在與未來提高應用數位學習教與學品質的寶貴意見, 所以您的參與是非常重要的且令人讚賞的, 感恩您!

問卷調查將花費您 10 至 15 分鐘去填寫, 雖然有可能您會選擇花更長時間去詳填您寶貴的意見。懇請您在填完問卷後, 利用所附之回郵信封在民國 94 年 1 月 10 日前 或 儘快寄回本人台南住處: 台南市東區裕農路 322 號 3 樓 王素貞收, 謝謝您!

您所提供的個人資料將被保密, 且將不會在任何報告裡被認出。完成此問卷之填寫即視同得到您的允許可使用其中之資料在此研究中。

謝謝您的撥冗協助! 順祝

學業進步、考試順利!  
新年吉祥如意!

王素貞 敬上 December 24, 2004

[suchen1@gmail.com](mailto:suchen1@gmail.com)  
[sw110@waikato.ac.nz](mailto:sw110@waikato.ac.nz)

**Appendix K: Invitation Letter with Questionnaire for E-learning Students  
(Chinese)**

**目前台灣各大學教育應用數位學習之改善策略**

為了這個研究的目的，數位學習這個名詞將被定義為一種包含有線上或網頁數位學習教材和實際面對面上課的教學方法。(例如：實際面對面教學和利用學校網路教學系統混合教學)。

**第一部分：您的基本資料**

這部分主要是有關您的背景資料。(請勾選適合您的項目)

1. 您的系所	
2. 您的電子郵件位址	
3. 性別	<input type="checkbox"/> 男 <input type="checkbox"/> 女
4. 您的級別	<input type="checkbox"/> 大一 <input type="checkbox"/> 大二 <input type="checkbox"/> 大三 <input type="checkbox"/> 大四 <input type="checkbox"/> 碩士生 <input type="checkbox"/> 博士生
5. 您熟悉右列 . . .	國家數位學習政策? <input type="checkbox"/> 是 <input type="checkbox"/> 否 學校數位學習政策? <input type="checkbox"/> 是 <input type="checkbox"/> 否
6. 一般而言，我學習時比較喜歡	<input type="checkbox"/> 獨自 <input type="checkbox"/> 與一個同伴 <input type="checkbox"/> 群組
7. 一般而言，我學習時比較喜歡	<input type="checkbox"/> 只有面授 <input type="checkbox"/> 面授和線上數位學習 <input type="checkbox"/> 只有線上數位學習 (即沒有面授)

**第二部分：您的數位學習經驗和您對數位學習應用的觀點**

這部分是有關您應用數位學習的經驗和一般概念，亦即如同您使用學校網路教學系統的線上或網頁教材為您大學課程的一部分的學習經驗。

<p><b>8. 下列何種教學方法，您的教師曾使用過在您的數位學習課程上? (請在左方欄裡打勾，可複選)</b></p> <p><input type="checkbox"/> <input type="checkbox"/> 教師將上課資料筆記放在教學系統上</p> <p><input type="checkbox"/> <input type="checkbox"/> 教師將參考資料放在教學系統上</p> <p><input type="checkbox"/> <input type="checkbox"/> 教師將上課實況錄成影帶放在教學系統上</p> <p><input type="checkbox"/> <input type="checkbox"/> 將學生的專案設計/報告放在教學系統上</p> <p><input type="checkbox"/> <input type="checkbox"/> 將學生上課專案報告實況錄成影帶放在教學系統上</p> <p><input type="checkbox"/> <input type="checkbox"/> 線上討論，包括討論區、聊天室等</p> <p><input type="checkbox"/> <input type="checkbox"/> 線上群組討論</p> <p><input type="checkbox"/> <input type="checkbox"/> 指定合作專案或作業</p> <p><input type="checkbox"/> <input type="checkbox"/> 線上小考或考試或指定作業</p> <p><input type="checkbox"/> <input type="checkbox"/> 其他: _____</p> <p><b>8b. 請回去在右方欄內，勾選您認為最有幫助的教學方法</b></p>
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<p><b>15. 下列何種課程組織因素會鼓勵您去使用數位學習系統? (請在左方欄裡打勾, 可複選)</b></p> <p><input type="checkbox"/> <input type="checkbox"/> 面對面教學與線上輔助教材有清楚且一致的連結</p> <p><input type="checkbox"/> <input type="checkbox"/> 教師會很快在線上回應學生的問題</p> <p><input type="checkbox"/> <input type="checkbox"/> 教師會在上課前 先將上課資料筆記放在教學系統上</p> <p><input type="checkbox"/> <input type="checkbox"/> 教師會很快在線上回應學生的作業</p> <p><input type="checkbox"/> <input type="checkbox"/> 提供線上組織好的上課資料筆記</p> <p><input type="checkbox"/> <input type="checkbox"/> 提供線上詳細的課程大綱與進度</p> <p><input type="checkbox"/> <input type="checkbox"/> 提供線上討論, 包括討論區、聊天室等</p> <p><input type="checkbox"/> <input type="checkbox"/> 提供線上小考</p> <p><input type="checkbox"/> <input type="checkbox"/> 其他: _____</p> <p><b>15b. 請回去另外在右方欄內, 勾選您認為最會影響您的課程組織因素</b></p>
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#### 第四部份：數位學習課程的支援因素和支援服務

這部分是有關線上課程學生可得之支援服務。所謂**支援服務**亦即大學提供給學生，幫助他們學習的支援。支援服務並不侷限於技術協助, 圖書館設備資源的提供、諮詢服務和電腦實驗室等支援均是。

<p><b>16. 下列何種支援因素會影響您去使用數位學習系統? (請在左方欄裡打勾, 可複選)</b></p> <p><input type="checkbox"/> <input type="checkbox"/> 來自同學的幫忙</p> <p><input type="checkbox"/> <input type="checkbox"/> 來自老師的幫忙</p> <p><input type="checkbox"/> <input type="checkbox"/> 來自老師研究生(助教)的協助</p> <p><input type="checkbox"/> <input type="checkbox"/> 來自計網中心 教學研究組 多媒體製作技術同仁的協助服務</p> <p><input type="checkbox"/> <input type="checkbox"/> 來自教務處補助學生助理的協助</p> <p><input type="checkbox"/> <input type="checkbox"/> 來自校內使用說明訓練</p> <p><input type="checkbox"/> <input type="checkbox"/> 一頁簡易使用說明</p> <p><input type="checkbox"/> <input type="checkbox"/> 計網中心諮詢室的協助</p> <p><input type="checkbox"/> <input type="checkbox"/> 其他: _____</p> <p><b>16b. 請回去另外在右方欄內, 勾選您認為最重要影響您的支援因素</b></p>
<p><b>17. 您認為應該還有哪些支援服務是必備的? 請說明其原因。</b></p>



**第七部份：任何其他建議**

這部分是從您對數位學習課程的觀點來看，您有任何其他的意見和建議嗎？

非常謝謝您的撥冗填答此問卷，這個研究活動是經過校方同意且支持的，我非常感恩您對此研究的貢獻。請將您填好之問卷放入所附之回郵信封寄回台南市東區裕農路 322 號 3 樓 王素貞收，謝謝！

最後，歡迎您隨時來信給我您寶貴的意見，您可 email [至 suchen1@gmail.com](mailto:suchen1@gmail.com) or [sw110@waikato.ac.nz](mailto:sw110@waikato.ac.nz)

**Appendix L: Interview Questions for Administrators**

<b>Participants</b>	<b>Questions for interviews</b>
<p><u>Administrators</u> (Dean of Academic Affairs and the Director of the Computer and Network Centre)</p>	<ol style="list-style-type: none"> <li>1. What do you see as the benefits of the national policy for e-learning?</li> <li>2. What do you see as the key aspects of the university e-learning policy?</li> <li>3. In your view, what are the challenges and benefits of e-learning for the university?</li> <li>4. How did you develop or support e-learning courses?</li> <li>5. What, in your view, are the benefits for teaching and learning in the e-learning courses?</li> <li>6. In your experience, do different colleges and/or subjects appear to have different needs to use e-learning? ***Any thoughts about science education?</li> <li>7. What do you think could be used to enhance e-learning practice for university? *** Any thoughts about science education?</li> <li>8. What changes would you like to see from an institutional perspective? Why would you like to see these changes?</li> </ol>
<p><u>Administrators</u> (Group leader of the Teaching Information in the Office of Academic Affairs)</p>	<p><u>Part A:</u></p> <ol style="list-style-type: none"> <li>1. What is involved in your official role on campus for e-learning practice?</li> <li>2. To your knowledge, why the e-learning environment was introduced (e.g. intended outcomes/ functions)?</li> <li>3. What are the current practices of e-learning course(s) on campus?</li> <li>4. What, in your view, are the benefits for teaching and learning of e-learning courses?</li> <li>5. How do you support? for * instructors * students</li> <li>6. What suggestions for improvements do you have to improve teaching and learning in the e-learning environment? * in science education</li> </ol> <p><u>Part B:</u></p> <ol style="list-style-type: none"> <li>1. In your role as a national evaluator of e-learning practice, (a) what do you see as the main benefits of e-learning? (b) What do you see as the current trends in e-learning? (c)What are key characteristics of e-learning nationally? (d) What do you suggest to enhance it?</li> <li>2. Would you please tell me more ...?</li> </ol>

**Appendix M: Interview Questions for Technical Support People**

<b>Participants</b>	<b>Questions for interviews</b>
<p><u>Technical Support people</u> (Technical support staff in the Computer Center)</p>	<ol style="list-style-type: none"> <li>1. What is your official role on campus?</li> <li>2. In your view, why did the university introduce an e-learning environment?</li> <li>3. In your opinion, what are the Network Teaching system's goals/ intended outcomes/ functions?</li> <li>4. What are the current practices of e-learning course(s) on campus? Please could you describe a particularly effective example?</li> <li>5. How do you encourage the instructors and students to use e-learning?</li> <li>6. How do you support? for * instructors *students</li> <li>7. In your view, what is the effectiveness of the teaching and learning in the e-learning courses? How are they developed / supported?</li> <li>8. What suggestions for improvements would you make to improve teaching and learning in the e-learning environment?</li> </ol>
<p><u>Technical Support people</u> (Student-assistants)</p>	<ol style="list-style-type: none"> <li>1. In how many courses have you assisted instructors who teach, including e-learning?</li> <li>2. Can you tell me what sort of things you have done as part of e-learning assistance support?</li> <li>3. What challenges did you face?</li> <li>4. What kind of support (technical or financial, etc.) do you get from the university? Where and how do you get it? Would you please tell me more about it?</li> <li>5. How many hours per week on average do you spend assisting instructors with e-learning courses?</li> <li>6. In your opinion, how does this assistance help teachers and students?</li> <li>7. In your opinion, what are the key factors associated with effective e-learning?</li> <li>8. What changes are necessary for e-learning to become more effective from your perspective?</li> <li>9. What changes are necessary for e-learning courses to become more effective from your perspective?</li> </ol>

**Appendix N: Interview Questions for Instructors**

<b>Participants</b>	<b>Questions for interviews</b>
<p><u>Instructors</u> (Instructors including science instructors who used e-learning)</p>	<ol style="list-style-type: none"> <li>1. Why have you used e-learning? What factors have influenced you to use e-learning in science education? How are your e-learning courses conducted?</li> <li>2. In your view, what are the key factors associated with effective teaching and learning? *policy *personal *support (financial and technology, etc.) *pedagogy *external professionals, *private *public</li> <li>3. In your view, what makes for effective e-learning?</li> <li>4. What challenges have you and your students faced in e-learning?</li> <li>5. Do you think any of these challenges are specific to science education?</li> <li>6. In your experience, what are the benefits with student assistant support and disadvantages without student assistant support in e-learning?</li> <li>7. Do you still use e-learning now? If no, why do you not use e-learning now? What factors influenced your decision?</li> <li>8. In your view, what strategies might be used to enhance e-learning practice for science education?</li> <li>9. What changes are necessary for university and/or for instructors from your perspective?</li> </ol>
<p><u>Instructors</u> (Science instructors who did not use e-learning)</p>	<ol style="list-style-type: none"> <li>1. Why do you not use e-learning? What would influence you to use e-learning in your courses?</li> <li>2. What are the challenges faced by instructors and students?</li> <li>3. In your view, what strategies might be used to enhance e-learning practice for science education?</li> <li>4. What changes are necessary for university and/or for instructors from your perspective?</li> </ol>

**Appendix O: Interview Questions for Students**

<b>Participants</b>	<b>Questions for interviews</b>
<p><u>Students</u> (Students whose instructors used e-learning with or without student assistant support)</p>	<ol style="list-style-type: none"> <li>1. How many e-learning courses have you taken or taking? In what subjects?</li> <li>2. Can you tell me what sort of things you have done as part of e-learning?</li> <li>3. What do you see as the main differences between e-learning and face-to-face instruction?</li> <li>4. What are the challenges faced by you as a student learning an e-learning course? (e.g., a role change, learning methods, curriculum design, assignments, tests, and the ways you and your instructor talk, etc.)</li> <li>5. In your experience, what have been some of the most effective strategies your instructors have used in the online component of the course(s)? Please describe one or two examples.</li> <li>6. In your opinion, what are the key issues associated with effective e-learning? What are the key influences that affect your learning e-learning course(s)?</li> <li>7. What are the advantages, if any, that you have experienced when your instructor has had or has not had student-assistant support?</li> <li>8. What are the disadvantages, if any, that you have experienced when your instructor has had or has not had student-assistant support?</li> <li>9. In your view, why do other students not use e-learning?</li> <li>10. What are your expectations of the effective e-learning practice?</li> <li>11. What changes are necessary to enhance e-learning from your perspective? Or what other support services should be available? Please specify why.</li> </ol>

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