Online Education On Campus: A Technological Frames Perspective on the Process of Technology Appropriation

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To My Parents

Abstract

The advent of computer-mediated communication (CMC) and the Internet has created significant opportunity for online education. Research on this topic has addressed its effectiveness, but as yet little attention has been given to the technology appropriation process in this context.

This thesis adopts a social constructivist perspective. To enhance the understanding of online education, the study argues for abandoning the notion of technology as a passive tool and, instead, for considering the contextual issues which surround it. In order to understand how learning and technology appropriation takes place, the organisational and cultural setting needs to be considered. From this underlying conceptual position, the thesis constructs a theoretical framework using theories of collaborative and situated learning in combination with technological frames analysis. Applying this framework, an empirical study is performed on the implementation of an online education system at a traditional U.K. university.

Research findings suggest that student perception and interpretation of technology and of online education are strongly influenced by their understanding of the institution, and these perceptions alter students' subsequent behaviour towards technology during the learning process. Furthermore, the study reveals that student appropriation of technology changes in accordance with the surrounding context and their realisation of the educational value which emerges from their interaction with the system over time.

The theoretical contribution arises from applying to the study of online education the social constructivist approach to information systems. The methodological contribution lies in demonstrating the value of the interpretive approach for understanding online education on campus. Empirically, the thesis has significant value for educationalists by highlighting the contextual issues that affect student appropriation of technology and the consequent learning outcomes.

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1.1 Introduction

The introduction of information communication technology (ICT) ranging from electronic mail to groupware has benefited numerous organisations in enhancing productivity, achieving better workflow management and obtaining competitive advantage. In particular, the development of computer-mediated communication (CMC) releases geographical and temporal constraints of communication and enables different parties to exchange ideas or messages asynchronously or synchronously across organisational boundaries. Apart from its value for organisational performance and efficiency, the potential of CMC to improve the teaching and learning process has, in the past few years, begun to generate strong interest from researchers and practitioners in the field of both education and information systems. Furthermore, with the growth and widespread popularity of the Internet, we see the birth and mushrooming phenomenon of online education, a name nowadays given to mainly describe the delivery of the CMC-enabled or Web-based education. This is exactly the area in which this thesis puts its foot.

In the first chapter of this thesis, we will take off with the discussion on the motivation and scope of this research. Section 1.3 will concentrate on definition and growth of online education, which is followed by discussion on the relevance of online education as an information systems (IS) research in Section 1.4. Current state of online education literature will be the focus in Section 1.5 while the section next states the objective of this research. Finally, we will conclude Chapter One with a brief description on the organisation of this thesis.

1.2 Motivation and Scope of the Research

This research started with a general interest in using modern technology innovations to support teaching and learning. Within the wide ranges of interesting topics on the application of information technologies support teaching and learning process, this dissertation is particularly drawn to the development and growth of the CMC-enabled educational delivery over the past few years: *online education.* A more detailed discussion on its definition and growth will be offered later in the next section.

This new form of teaching and learning approach has caused quite exciting stir in the world of education and training. Numbers of existing studies have shown that the perceived learning outcome of online education can be better than, or at least as good as, that under traditional education methods. However, compared with the earlier generation of technology used to facilitate teaching and learning, the impact and scale of online education is greater. Take computer-assisted learning (CAL) or computer-assisted instruction (CAI) as an example, which is defined as "an interactive software program that provides information in sequential or non-linear modes to increase a student's knowledge and understanding of a subject matter (Leidner and Jarvenpaa 1995)." One intention of CAI use is to compensate the disadvantages of attention lost to some students in a large classroom. In the conventional classroom, one teacher normally is responsible for 20-30 students on average. Under this circumstance, a small amount of students especially who are shy might not have an opportunity to engage two-way communication with the teacher.

The role of computer-assisted learning tool such as intelligent tutoring system (ITS) is to provide an opportunity of one-to-one tutoring, hence, to enhance students' understanding of the domain knowledge (Hague and Benest 1996). In comparison with face-to-face teaching instruction, CAL tools allow students to control their own learning pace, which is consistent with the constructivist approach to learning. Another design concept of CAL or CAI tutorials is based on the idea of "trial and error learning", in other words, students are provided with immediate feedback on their learning process from the tutoring system. The above description shows how the pedagogical model underlying CAI is that of information processing and that the focus of CAI is individualist in nature. Eliciting from the above description, it shows that the pedagogical underpinning is information processing model and the focus of CAI is more individualist in nature.

In comparison, online education involves a different pedagogical approach and a larger scale of technological implementation i.e. group-oriented learning and CMC respectively. We will detail these two elements more in the upcoming section of this chapter as well as in Chapter Two and Three. So far, much remains to be answered about the educational, social psychological, economic and institutional effects of online education. For instance, at a micro level, what are the added values of such education to both teachers and learners when compared with face-to-face teaching and learning? What are the social psychological issues related to the online communication process in this particular situation? At a macro level, what impact does the adoption of this new approach to instruction have on both traditional and virtual institutions of education? And what impact does the adoption of online education have on society at large?

Of these, the motivation for this thesis arises from concerns about students' interpretation of technology and their online learning experience as a whole. To date, the majority of students have only experienced traditional modes of teaching and learning. The use of online learning technology and the concept of online education might sound rather foreign to them. From the IS literature, we have learnt that the implementation of new technology in organisations tends to have various

consequences because each individual or organisation interprets its purpose or functionality differently. Drawing on this research, this study explores how a group of students interprets and makes sense of a particular online learning technology and what the subsequent outcomes are.

1.3 Definition of Online Education

At the beginning of the preceding section, we briefly described online education as CMC-enabled education. Considering the study of online education lies at the core of this thesis, we feel the need to provide some details on our own view of how online education can be defined. Salmon (2000) explains that the word online "came from the days of the telegraph" because one could send a message by tapping directly onto the line and send it when the machine is connected to the telephone line later. In modern times, the family of online technologies has three members: informatics, computer-assisted instruction (CAI), and computer-mediated conferencing (Santoro 1995). In this thesis, we concentrate on the modern generation of online technologies, i.e. CMC.

From our perspective, the notion of online education refers to the implementation of web-based computer-mediated communication (CMC) technologies to support the learning process. Such implementation is aimed either at complementing physical campus education or at facilitating education at a distance.

Besides, this thesis takes the viewpoint that online education has slightly different characteristics from distance education. Traditionally, distance education is a term used to differentiate it from campus education. Keegan (1980:33) defined it as

> "The main elements of a definition of distance education are: the separation of teacher and learner which distinguishes it form face-to-face lecturing; the influence of an educational organization which distinguishes it from private study; the use of technical media, usually print, to unite teacher and learner and carry the educational content; the provision of two-way communication so that the student may benefit from or even initiate dialogue; the possibility of occasional meetings for both didactic and socialisation purposes; the participation in an industrialised form of education which, if accepted, contains the genus of radical separation of distance education from other forms. "

It has also been argued (Harasim, 1987:117) that online education:

> "..enables the development of a time and location-independent learning environment which in large part and with sound design may simulate education interactions, both cognitive and affective, that occur on-campus."

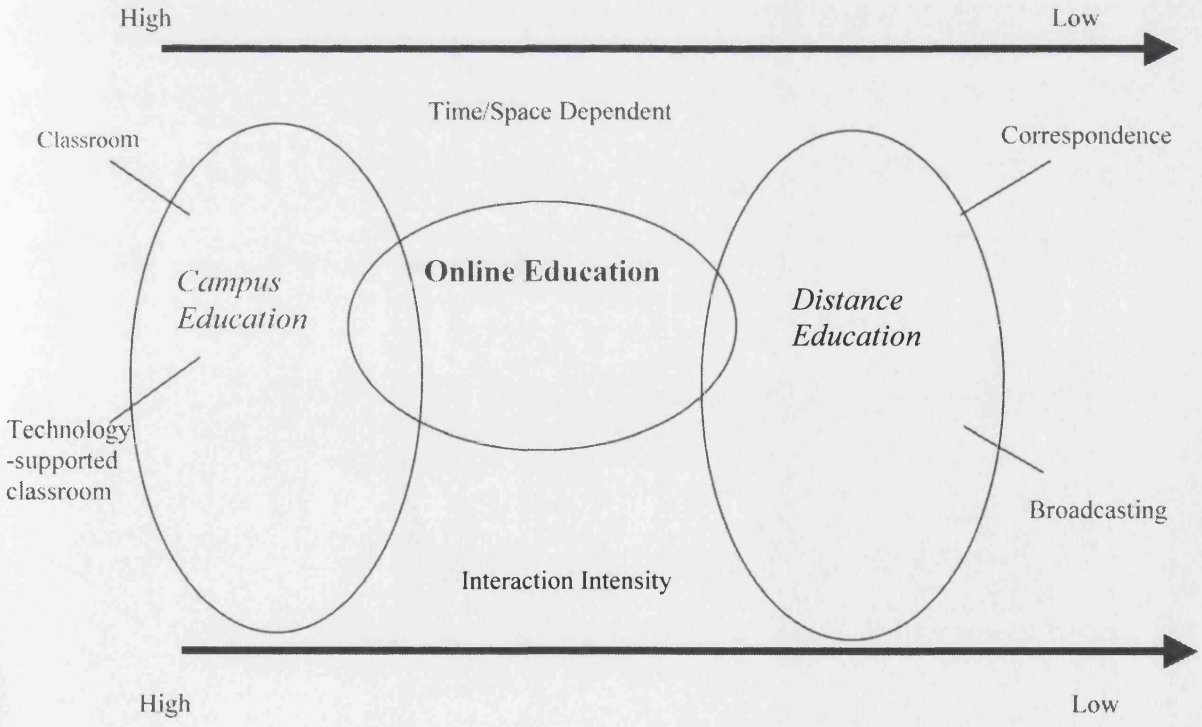

Figure 1: Online education

Figure 1 provides a graphical demonstration of how we can view online education in relation to distance and campus education. A horizontal circle represents online education while two other forms of education are shown by virtual bubbles. Distance education is linked with two generations: correspondence and broadcasting education. Correspondence education represents the first generation of distance education, which relies heavily on printed materials and the medium of postal delivery. The innovation and widespread use of radio and television technologies enabled distance education to embark on a second generation of distance education: broadcasting and video conferencing education. The development of CMC in the 1990s has led some distance educators to consider online education as the third generation of distance education (Jonassen, Davidson et al. 1995; Garrison 1997). This third generation is indicated by the overlapping area between online and distances education circles.

As for campus education, we can also see three kinds of educational methods: face-to-face classroom methods; technology-supported classroom methods and CMC-supported learning. The use of face-to-face classroom methods means that teacher and students interact without any aid of media. The difference between technology-supported classroom methods and CMC-supported learning is that the former involves the use of technologies such as group-decision support systems (GDSS), software packages or the Internet in the classroom while the latter refers to the use of CMC technology to facilitate traditional education outside classroom teaching. We consider that the third kind of educational method incorporates the area of online education.

Hence, from this standpoint, this dissertation considers that online education is a hybrid of traditional distance education formats and conventional campus education. While online education shares the two main characteristics of distance education, defined by Keegan (1980) as the physical separation of teachers and learners and the use of technical media, it also allows distance educators for the first time to stimulate a learning environment that was only thought to be possible in face-to-face classroom education. In this sense, we not only agree with the suggestion that online education forms part of the third generation of distance education, but also promote the idea that

online education is a form of traditional education extended into cyberspace (Harasim, 1987).

1.3.1 Computer-Mediated Communication (CMC) and Collaborative Learning

In Section 1.2, we commented that in comparison with the early use of CAI and its information processing pedagogical model online education adopts a different approach to both technology and learning. There are two key elements within the concept of online education: CMC as the technological element and collaborative learning as the pedagogical element. A brief introduction to each element is given below.

Broadly speaking, CMC refers to the exchange of information between or among people through networks of computers. It allows geographically dispersed groups to communicate and form a community without time and space constraints. CMC includes many forms of technological innovations such as electronic mail, computer conferencing, news groups, IRC (internet-related chat), bulletin boards, MUDs or MOOs and workflow applications. According to Hiltz and Turoff (1993), the first full-scale computer conferencing tool, EMISARI, was designed and implemented at the Office of Emergency Preparedness of the Executive Office of the President of the Untied States, in order to facilitate and increase effectiveness of the communication process. CMC systems are mainly based on text-based communication, or what Mason refers to as 'the written world' (Mason 1993), although some systems can be more advanced i.e. support other kinds of media (image, video, audio or graphics).

Although interactions in CMC can take place either asynchronously (at different times) or synchronously (at the same time), it is the facility for asynchronous communication that has been responsible for the popularity of CMC. The time-independent nature of asynchronous communication provides flexibility by allowing users to have control over the pace of their communications over time. It is also

argued that the time lag between receiving and responding a message in such systems allows participants to have time to digest what they have read, to think through, and then respond. However, if a time lag creates a problem of delay in a decision-making process, synchronous communication can then be used instead.

Apart from these benefits of time independence, CMC also allows users to communicate, discuss or chat without being physically at present at the same place. People can send messages asynchronously or chat synchronously through any computer that is attached to a network, modem and telephone line. This advantage allows geographically separated organisations or communities to either have lengthy computer-mediated discussions before meeting up physically or even to reach consensus and decision without having to meet up at all. Consequently, it saves companies on the cost of and time wasted on travel. Furthermore, with the growing number of Internet Cafes and the advent of mobile phone technology, people can truly keep in touch from nearly any place in the world.

As far as technical aspects are concerned, most asynchronous delivery systems do not require much bandwidth and are less expensive to operate on a global scale. Indeed on the World Wide Web (WWW) there are many free asynchronous bulletin boards or newsgroups that do not cost the user anything to use. In contrast, synchronous systems, especially involving those involving the transmission of voices or images, normally require a faster speed of connection, otherwise the benefits of real-time interaction might be lost.

The second element embedded in online education is the pedagogy of collaborative learning. This approach also forms part of our conceptual framework, a fuller discussion of which will be provided in Chapter Three. Here is a brief introduction to collaborative learning and its role in online education. Collaborative learning is rooted in the philosophy of social constructivism. This stream of philosophy holds to the epistemological assumption that knowledge is a social product and rejects the ontological view of an absolute reality. Consequently, this approach to learning transformed the once dominant educational practice of the

behaviourist approach. Behaviourist pedagogy holds that a pre-defined learning goal can be achieved through a process of reinforcement and of behaviour shaping designed by the teacher. Collaborative learning however centres on the process of knowledge construction and promotes learning through group interaction and collaborative activities. As we will identify later, the values of collaborative learning have been proven to enhance students' critical thinking skills and their development of higher order thinking. Nevertheless, in the situation of distance education, it was thought to be highly difficult, if impossible, to implement a group learning environment. Nowadays the development of CMC releases the constraints of time and proximity from the implementation of collaborative learning at distance. This is why Harasim (1987, 1990) suggests that online education has the capacity to extend face-to-face learning environments beyond geographical and temporal boundaries.

1.3.2 Growth of Online Education

Having defined and succinctly explained online education, here we examine the growth of online education over the past two decades. The discussion is presented in chronological order: Initiation, Taking Off, and Escalating.

We term the period from the middle to the end of the 1980s as the Initiation period. The pioneering research institution in this filed was the New Jersey Institute of Technology (NJIT) in the United States. One of their first projects on Electronic Information Exchange Systems (EIES), led by Roxanne Hiltz and Murray Turoff, was the early influential and comprehensive study on the use and impact of computer conferencing systems. Following this project, the researchers at NJIT commenced a project called "Asynchronous Learning Network", and later trademarked as Virtual Classroom. The research focus was on facilitating collaborative learning at a distance. During this period, the implementation of CMC was not yet web-based and the term online education was seldom used. Their early research findings however showed some encouraging results from the implementation of a collaborative learning environment with the aid of computer conferencing technologies (Hiltz 1985; Hiltz 1986; Hiltz 1990). According to our literature review, the first appearance of 'online

course' terminology was in the paper '*Teaching and Learning Online: Issues in a Computer-Mediated Graduate Course*' (Harasim, 1987).

Stepping into the 1990s, the first half belongs to the period of Taking Off. In the 1990, Harasim published a book "*Online Education: Perspective on A New Environment*". This book contains rich discussions of online education's definition, impact and future. The NJIT also continued with development and research linked to the Virtual Classroom (Hiltz and Turoff 1993; Belson 1994; Hiltz 1994). In addition, there were increasing signs of other publications on CMC mediated learning (Leidner and Jarvenpaa 1993; Alavi 1994; Fellers and Moon 1994; Jonassen et al. 1995; Kangas 1995). The focus lay on the potential of computer conferencing and groupware systems such as GDSS to enhance the quality of teaching and learning both within the context of distance education and within the traditional campus environment.

The second half of the 90s and the beginning of this new millennium, the phenomenon of CMC-mediated teaching and learning has been growing exponentially. Hence, we have named it as the period of escalating. We consider three reasons for such a rapid growth.

First, our society has become a so-called 'information society', where information and knowledge form the backbone of economic growth and prosperity. During the time of the promotion of the United Kingdom as being part of the Learning Age, the Secretary of State for Education explained the importance of education in the following way: "learning is the key to prosperity- for each of us as individuals, as well as for the nation as a whole. Investment in human capital will be the foundation of success in the knowledge-based global economy of the twenty-first century.[1]" This simple statement demonstrates the importance of high-quality education within a human society. For organisations or countries, to be able to gain new knowledge and information quickly and precisely is also the key to obtaining and

[1] See URL http://www.lifelonglearning.co.uk/greenpaper/ch-fore.htm

maintaining competitive advantage. This leads therefore to an increasing need for continuous training and education for both the labour force and for people in general.

Second, Alavi and Leidner (2001) point out that there is has been a rise in demand especially in America for post-secondary education by traditional students because of the 'baby boom' after the World War II. The phenomenon of the information society requires this generation of baby-boomers to constantly update their knowledge and skills in order to maintain their competitiveness within the job market. The relatively limited number of schools however makes it difficult to accommodate the extent of the baby-boomer population. Online education comes out as a better option for universities since they can provide education without stretching their physical infrastructure to maximum.

Finally, the cost of information and communication technology (ICT) has reduced dramatically over the past decade. In the meantime, computer performance has been increasing at a tremendous speed. Use of the Internet and the World Wide Web (WWW) has become conventionally common, especially in developed and some developing countries. Thus combining factors such as the growth of e-commerce, the rise of broadband connection and the decreasing cost of Internet usage, the idea of delivering education via the WWW started to intensify both commercially and academically.

During this period, other terms such as 'e-learning' or 'web-based learning' emerged to describe this new form of educational delivery. In this thesis, we decide to use the term online education instead of others for two reasons. First, we feel that online education covers a broader agenda than e-learning. E-learning seems to be too narrow as the name appears. Second, considering we derive our early understanding from the research of Harasim (1987 and 1990), it makes more sense to inherit the terminology used in her work as well.

To empirically demonstrate the speed at which online education has grown over the past few years, we also use some quotes in recent newspaper articles and

trace the development of online education software in the market. According to John Cambers, CEO of Cisco systems "the next big killer application for the Internet will be education" (18, May, 2000 in Business Wire). Besides, The Financial Times (FT) reported that "the global e-learning corporate market will exceed $23bn by 2004 - up from $1.7bn in 1999 - and rising at a startling compound rate of nearly 70 per cent a year" (June, 21, 2001). We suggest that such demand is coming from both organisations and individuals. First, the benefits of online education offer organisations a solution to achieve staff training at a lower cost. Earlier we reasoned that the occurrence of information society requires a high level of human capital investment. Traditionally, the company sends employees to a particular training location, which involves flight costs, hotel accommodation and productivity loss while employees are away from their place of work. The arrival of online education, more specifically online training in this case, reduces the cost of travelling and releases employees from the constraints of an inflexible training schedule. As indicated by the American Society for Training and Development (ASTD, 2000) there is an expectation of a fall in face-to-face training from 75 per cent to 55 per cent by 2003 (FT, 6, June, 2001). Companies such as Xerox Europe and Cisco Systems have already adopted e-learning methods to train thousands of their employees who are dispersed across different geographical sites.

In addition to organisations, the second source of demand for online education comes from individuals who want to embark on education but cannot afford to become full-time residential students owing to social and financial commitments. Online education allows for flexibility as well as providing facilities for interaction in comparison with traditional methods of distance education, e.g. correspondence education.

Because of the rise in demand for online education, the decreasing computer hardware/software costs and the advance of the Internet and the WWW, many companies and higher education institutions began to seize such commercial opportunities in this area. One strong indicator is the growing number of systems developed particularly for online education purposes. Companies such as Blackboard

(bloackboard.com), WebCT (webct.com), Lotus LearningSpace (lotus.com) and TopClass (wbtsstems.com) offer online education management tools and applications for both universities and corporations (Alavi and Leidner 2001). Apart from Lotus LearningSpace, which is a new product of Lotus Company funded in 1982, the rest were all established over the past five years. In addition to course management systems, we also see the growth of software specialising in course content design tools, for example, Quest 6.0 (allencom.com) and Authorware (macromedia.com) while companies such as Click2learn (click2learn.com) and Dynamicminds (dynamicminds.com) provide online courses and training for organisations. All the above products and services were either developed or initiated recently in order to meet the booming demand of online education around the world. Part of the motivation for this research is the hope of disseminating some knowledge about the use and impact of online education back into the commercial world, and thereby allowing for the opportunity for product vendors and service providers to make any improvements if necessary.

1.4 Online Education: An IS research?

Section 1.3 has laid out the definition and growth of online education. Before moving onto stating the objective sand organisation of this thesis, this section first discusses why we consider online education belongs, within the focus of this thesis, to the IS research tradition, rather than a purely educational one.

First, to a great extent, our interest is more IS-oriented than education-oriented. The background of the researcher centres on studying and researching the social consequences of information technology. Building on this foundation, the researcher approaches online education within an IS worldview. We see online education as an information system because it includes elements of technology, people and the surrounding context. Technology refers to the particular learning technology in use; people include teachers, students and technologists; and the surrounding context refers to the social and organisational setting in which online education takes place.

Second, the focus of this thesis is not on instructional method or cognition process *per sec*, but inclines towards studying student appropriation of technology for learning purposes and the subsequent learning outcomes. From our perspective, there is a rich IS literature regarding the use of CMC in the organisational context, this provides a starting point for this research to understand various issues with respect to CMC. Within our research scope, there are many fundamentally similar issues in these two areas. This will also become more apparent to the reader later when this thesis relies comparatively more on IS than on educational literature.

Apart from the influence of our own research background, this thesis indeed found some evidence that supports this type of work within IS field. Although there are only a limited number of publications on online education in mainstream IS journals, we have discovered that there are signs of a call for awareness of and research into online education within the IS community. Notably some of the important IS annual conferences including AMCIS 1999, ECIS 2000, ICIS 2000 and IFIP 16th World Computer Congress have all recently set up one particular conference theme dealing with issues related to collaborative learning technology or web-based technology supported learning processes. It is the hope of this research to build on the existing work on online education in the IS field and to further contribute to the knowledge construction process

Most recently, Alavi and Leidner (2001) publish the article '*Research Commentary: Technology-Mediated Learning- A Call for Greater Depth and Breadth of Research'* in Information Systems Research to endorse this area of research and recommend direction for future research. Despite not explicitly mentioning the word 'online education', their definition of technology-mediated learning (TML) is very close to our definition of online education. In this paper, they present three arguments on why IS research is critical to the development of TML:

- Long history of research on information technology to cognitive process;

- Capability for offering insight on implement technology-mediated learning at the institutional level;
- Knowledge of information technologies to advice the design of TML system.

Therefore, given the personal background and some support within the IS community as demonstrated above, we argue that this thesis is an IS-oriented study, which aims to contribute to the knowledge construction process in online education research from an IS standpoint.

1.5 Current State of Research in Online Education

Alavi and Leidner (2001) also offer their views on the current state of TML research. Many studies have shown that CMC has potential to improve and enhance the quality of collaborative learning both on-campus and at distance. Nevertheless, there were still various mixed findings about its teaching and learning effectiveness due to different measurement variables taken up by researchers. Some researchers have placed the focus on the general learning quality and students' satisfaction and acceptance towards this new mode of learning (Leidner and Jarvenpaa 1993; Alavi 1994; Hiltz 1986; McMurdo and Meadows 1996; Hiltz 1997; Hiltz and Wellman 1997; Newman, et al. 1997; Middleton 1999). Other studies have examined the advantages and disadvantages of an online course at the surface level (Harasim 1987; Kaye 1989; Mason 1989; Harasim 1990; Garrison 1997; McCabe 1998); while some researchers have concentrated on the social psychological aspects of online communication (Kiesler et al. 1984; Siegel et al. 1986; Feenberg and Bellman 1990; Kiesler 1992; Weisband et al. 1995; McDonald and Gibson 1998). Instead of concentrating on one area, Webster and Hackley (1997) conducted a more comprehensive study testing many factors that might affect learning using video-conferencing technologies. In this study, they incorporate factors generated from the field of education, IS and social psychology and formed hypotheses of learning outcomes. In their findings of using video-conferencing among six universities, they indicate that those factors such as quality and reliability of technology, the numbers of

student locations, and instructor's attitude all have certain impacts on student learning outcomes.

Here lies the hub. After analysing literature in online education, we identified a less developed area of research, where the whole learning and technology adaptation process are recorded and the contextual issues are included as part of the study. Chapter Two will describe and discuss this argument in depth. We maintain that the majority of the current studies concentrate on the end results, mostly in learning outcomes, and use methods such as field experiment or survey. Despite contributing to the knowledge construction process related to the study of online education, we have our concerns regarding this type of study. Learning from the work of IS research in organisations, many scholars have pointed out the problems associated with a positivist research approach that neglects the influence and importance of contextual factors on the implementation and use of information systems (Galliers and Land 1987, Lyytinen and Hirschheim 1987). Many studies have demonstrated how contextual issues play a crucial role on our understanding of people's use of information technology and on the success of system implementation (Lee 1994; Walsham and Waema 1994; Gopal and Prasad 2000). This approach to studying IS is known as interpretive practice. A research approach assumes multiple realities and subjective knowledge. Such work sets the foundation and creates the inspiration for this research. From our perspective, in the area of online education, we still haven't seen a great amount of work concentrating on students' perceptions and interpretations of technology and the following effect on students' behaviour towards online learning technology and online education in general. The work of IS research in organisations has already illustrated the value of conducting interpretive studies, and we consider that such a methodological approach will also enhance our understanding of online education and may offer some explanations as to why there are mixed learning outcomes regarding the use of similar learning technologies.

1.6 Objective of the Research

The theme of this research has two dimensions: theoretical and methodological. One of the main purposes is to make a theoretical contribution from an IS standpoint to the study of how collaborative technologies support the learning process. There is an abundant amount of studies on the adaptation of such technologies to improve productivity and communication processes in the context of organisations. The implementation of this new technological approach to learning is similar to the process of placing new information technologies in organisations. As a IS researcher, we hold the view that the implementation issues are not only restricted to the embedded properties of the technical artefacts but are also concerned with actions and communication among the human actors involved. Hence, in the process of forming the theoretical framework, this thesis relies heavily on lessons learnt from research findings on studies conducted in the organisational context. In doing so, our contribution consists in extending the applicability of socio-technical theories to the area of online education, and hopefully, the outcome of this thesis can serve as a gateway to understanding this the phenomenon of online education from an IS perspective. Furthermore, this thesis also attempts to make some methodological contributions through the interpretive research approach. Earlier, we mentioned that the existing studies neglect the importance of context, and part of this neglect was reflected in the choice of such research strategies as experiment and survey. The IS literature contain studies that have demonstrated the value of interpretive research for addressing contextual issues. Such studies lead us to a greater understanding of technology adoption in organisations. This thesis similarly intends to demonstrate the benefits of taking an interpretive research approach towards the understanding of online education.

The aim of this study is to, understand student perceptions of, interpretation of and use of online education and technology, and the subsequent learning outcomes. This understanding is achieved by using an interpretive research strategy. There are three main strands of literature that the thesis draws upon: IS, education and social psychology. Concerning IS input, the researcher relies heavily on rich research

materials regarding the use of CMC in the organisational context, which could help the researcher identify key human factors related to this particular technology. Educational school of thoughts lay the foundation that relates collaborative learning to CMC. Added to the value provided by the IS literature, social psychology theories help to provide some insights into how social psychology can influence the choice and use of information and communication technologies. With the resources drawn from these three fields, our research strategy is to build up a conceptual framework that guides the empirical study and establishes a starting point for the data analysis stage.

1.7 Organisation of the Dissertation

This dissertation is divided into seven chapters. This chapter introduces the research domain and examines the current research literature on online education. We indicate that online education aims to facilitate the group-oriented learning approach with the aid of CMC both at a distance and in the campus environment. From the history of online education, we have learnt that this is a relatively new field of study, which has begun to slowly catch the attention of IS researchers and to encourage IS researchers to explore the field in more depth. In our brief discussion of the existing research, we argue that one of the key problems is that most studies have restricted their focus to issues related to the evaluation of teaching effectiveness, without taking into account many of the contextual issues involved. This neglect of context is what we intend to deal with throughout the work of this thesis.

Chapter Two will first give the reader a fuller review of technological applications in relation to the development of online education. It will also organise the existing literature into different categories and provide a detailed analysis. The result of the analysis will lead to defining the research questions that this thesis intends to answer.

The conceptual framework is the core of Chapter Three. The framework is derived from educational and IS theory rooted in the philosophy of social

constructivism. In particular, we choose collaborative learning, situated learning and technological frames analysis as the theoretical foundation for the development of our conceptual framework. The framework will act as the basis on which to guide us through the process of empirical data collection and analysis.

Chapter Four is devoted to laying out the research design for this study. It will start with the discussion of two main research approaches within IS empirical inquiry, and the second section will focus on the analysis of research methods which have been used in the existing online education literature. Following the review, the reasons for choosing an interpretive research approach and for choosing the specific techniques used will then be given.

Chapter Five concentrates on the description of the empirical setting for this thesis: the implementation of online education at one higher education institution in the United Kingdom. In addition, it will describe the process of data collection using the instruments of interview, participant observation and survey. This chapter concludes with the fieldwork findings in accordance with the theoretical framework presented in Chapter Four.

Chapter Six is dedicated to an in-depth discussion and analysis of the empirical findings. Apart from highlighting the main results of the study, it will also examine the empirical findings in the light of the current literature discussed in Chapter Two.

The final chapter, Chapter Seven, reflects on the journey of this research and draws attention to the theoretical, methodological and practical contributions of this thesis. In addition to identifying these contributions, the researcher also addresses the limitations of the study and suggests directions for further research.

Chapter Two
Literature Review

The postal service was the earliest communication channel used for interaction between teachers and students located in different geographical areas. As information technology advanced, the medium adopted to facilitate teacher and student communication shifted from radio broadcast, television broadcast, videoconferencing, to CMC and the current use of the Internet technology. Various technologies have different related pedagogical implications, as we briefly discussed in Chapter One. Increasingly, due to the advent and complexity of new technological innovations, this relationship between technology, pedagogy and the users involved is becoming more complex and tightly intertwined.

On the subject of technological applications in education, our attention in this chapter narrows down to the field of online education. The first part of this chapter will provide a brief review of three distinct information technologies relevant to today's developments on online education. Here we intend to demonstrate the evolution of online education concept and practice through the history and applications of CMC. Following section 2.1, we will continue to examine the current research literature in online education from both education and information systems

fields. Building from these two sections, the gaps and needs in current research in this field will be identified and discussed: the problem of assuming technology as a passive tool, and hence the failure to reveal the use, choice and interpretation of technology in the online education process. To conclude, the final section of this chapter will present our underlying philosophy, formulate research questions and make an introduction to the appropriate theoretical underpinning for this study to be discussed at greater length in Chapter Three.

2.1 General Review of Technological Applications in Online Education

In this section, we will investigate the development and use of information technology innovations in education that have been deployed to channel the interaction between teachers and students. In our first chapter, we have already examined the key characteristics of CMC and broadly discussed its advantages and disadvantages compared to other information technologies. In this thesis, we identify three main CMC applications which have some distinct impacts on online education development and review them in a much greater detail: ARPANET, Computer Support Cooperative Work (CSCW), and the World Wide Web (WWW).

2.1.1 ARPANET

The concept of the Internet started with the work of Leonard Kleinrock and J.C.R. Licklider in 1961 and 1962. Kleinrock from the MIT wrote his Ph.D. thesis on the notion of packet switching, which demonstrated the theoretical feasibility of communication using packets instead of circuits. Licklider, who was also from the MIT, published the paper describing the concept of "Online Man Computer Network Galactic Network". In this publication, he envisioned a world where people could share information and data through networks of globally interconnected computers (Taylor 1990).

In 1962, the U.S Department of Defence's Advanced Research Project Agency (ARPA) started to develop the idea of human interaction through computers, which they called "ARPANET". Both Kleinrock and Licklider were joined by others from Carnegie-Mellon University, MIT, RAND Corporation, Stanford Research Institute, System Development Corporation, University of California at Berkeley, Santa Barbara, and Los Angeles University of South Carolina, and University of Utah. While the work on "ARPANET" was under the development, the first "Wide-Area Network" (WAN) was created in 1965.

After seven years of research and development, ARPANET connected four universities in the United States: UCLA as the first host computer, then Stanford Research Institute, UC Santa Barbara, and the University of Utah. The launch of ARPANET was a success and it grew quickly to connect many other universities in the United States. Within a matter of few years after ARPANET's launch, many scholars and researchers were able to share databases and information across the majority of U.S. universities. In 1972, the development of ARPANET was further advanced to include an "electronic mail" application. This innovation has opened up the opportunities for "individual-to-individual" or "individual-to-group" communication over the network of computers (Leiner et al. 2000).

In 1973, ARPANET went international with connections to University College London (UCL) in the U.K. and the Royal Radar Establishment in Norway (NORSAR). By the early 1980s, ARPANET had 213 host computers. Furthermore, during that period, it was estimated that every other 20 days, a new host was added (PBS 2001). By 1990, the year when it was decommissioned, the number of ARPANET hosts exceeded 100,000.

The original purpose of ARPANET was to facilitate communication and share databases among scientific and academic communities through remote computers. Later, electronic mail became the most popular application of ARPANET. According to PBS (2001), " the ARPANET becomes a high-speed digital post office as people use it to collaborate on research projects and discuss topics of various interests".

From our viewpoint, the development of ARPANET has two important implications for online education. First of all, ARPANET was one origin of the Internet, and its success had a strong influence on the progress of CMC. Moreover, we see that the connection of ARPANET was the first step to bridge the distance between teachers and learners located in geographically dispersed areas. Second, the concept of ARPANET is very much like online education today, considering that it was initially built for the purpose of knowledge sharing within the geographically dispersed academic community. Today, the idea of online education mirrors the principle inherited from ARPANET, i.e. to foster a collaborative learning environment without the restrictions posed by space and time.

2.1.2 Groupware

From our perspective, groupware represents the second relevant technological innovation related to online education. It refers to the technology employed to support a group of people to work cooperatively, communicate effectively, and solve problems efficiently. Some examples of groupware applications include collaborative writing, information database, e-mail, workflows systems and group decision support systems. One could further categorise groupware according to its use in time and place. For instance, group decision support systems (GDSS) is used synchronously (same time) and co-located (same place) in brainstorming and problem solving sessions. In contrast, computer conferencing is mostly an asynchronous (different time) and distant (different place) medium, which mainly supports the purpose for the text-based communication and information sharing.

	Same Time	Different Time
Same place	Group decision support systems (GDSS)	Shared computer
Different place	Chat system Videoconferencing Distributed group support systems	Workflows technology Computer conferencing E-mail

Table 1: Different types of groupware

In the late 1980s, research interests in such applications grew, and as a result, the study of groupware and its implications gradually became known as the field of computer support cooperative work (CSCW). Grudin (1994:19) elaborates:

> "Building technology was not enough. We need to learn more about how people work in groups and organisations and how technology affects that...CSCW started as an effort by technologists to learn from economist, social psychologists, anthropologists, organisational theorists, educators and anyone else who can shed light on group activity."

From this perspective, the term CSCW was used to refer the research domain that examines both the technical application and interface of groupware, and the behavioural, social and organisational impacts as the consequence of groupware implementation and use. At the early stage of CSCW research, most researchers focused their work on the area of 'small group dynamics', i.e. they limited the research issues to how people in a small group interact through groupware systems. However, in the 1990s the concentration on 'small group' extended to 'organisational context' largely as a result of the launch of Lotus Notes in 1989. At that time, Lotus Notes successfully branded itself as the solution for cooperative work and as a knowledge management tool for organisations, subsequently with a sales record of 35,000 copies in its first year. This sent out a strong signal that the groupware application was no longer only useful for small groups of people, but its user audiences could also extend to large and complex organisations. Consequently, research in CSCW took a new turn. Lots of studies emerged to investigate the use of

groupware in organisations (Karsten 1995;Ciborra and Suetens 1996;Orlikowski 1996).

In addition, according to Lin (2000), with the recent innovation of the World Wide Web and the developments in multi-media, CSCW systems and design are further advanced and equipped with different new interfaces and functionalities. Many web-based CSCW systems have evolved. For instance, Lotus Notes also produced Domino as its web integration. Moreover, the growing pressure of globalisation and of gaining competitive advantages in the information society have elicited the need for what so called virtual teams within or across organisations. In this sense, the context in which groupware systems are implemented and used become far more problematic and dynamic. Similarly, this has some implications on the trend of CSCW research. Some concentrate on the development of new CSCW architecture and design while there are an increasing number of studies investigating the complex organisational and social issues related to implementation or adoption of collaborative technologies.

One might question the relationship between CSCW and online education as there is no clear relation being demonstrated so far. In our view, we see two significant links between these two. First of all, the nature of online education is to establish a collaborative learning environment, whose root is about a group of people creating and generating knowledge through the process of interaction enabled by information technologies. In essence this concept is pretty close to the idea of CSCW, as described in Grudin's definition. In terms of the research history, CSCW research has existed relatively longer than online education research that only started to intensify since the late 1990s (See Section1.3.2). Therefore, it has much to offer on the subject of collaborative technology itself and the surrounding social-cultural issues related to its implementation and use. Although the context might be different, we found at the early stage of this study that the CSCW literature provided very good quality resources for understanding collaborative technologies. Second, there is also much evidence indicating interest in expanding CSCW research into the area of

education, or at least into collaborative learning in organisations. One indication came from the call for papers in recent CSCW conferences, CSCW2000:

> "[..] we also encourage submissions that explore the applications of collaborative technology to areas such as the domestic environment, health and education. Specific topics of interest might include augmented environments for collaborative activity, studies of specific work settings, the use of the Internet in the home, technologies for organisational knowledge sharing, the impact of The Internet technologies on organisational life, or collaborative practice in education." (Lin 2000:24)

In addition to the evidence in the call for papers for major CSCW conferences, there is also evidence of publications on CSCW systems for educational purpose in both CSCW and IS journals. The following discusses papers that fall within this category.

In the hope of contributing potential solutions to learning and educational effectiveness in the higher education, Alavi (1994) explores the opportunities of new information technologies to enhance teaching and learning quality. In her review on the problem of educational use of computers, she points out that neither traditional computer-assisted instruction (CAI) nor just transferring the text-based material on to the Web learning promotes opportunities for active learning. Instead, she proposes that educational methods should go beyond the traditional instruction approach and look to the prospect of collaborative learning facilitated by emerging groupware technologies. In her empirical study, she investigates teaching effectiveness and the student learning experience with the introduction of group decision support systems (GDSS) into classroom activities. In an experimental setting, she tests and compares the results of self-reported collaborative learning effectiveness of a class with GDSS support and of another without. The survey outcomes indicate:

> "students who used GDSS in support of their group learning activities perceive higher levels of skill development, learning, and interest in learning relative students who did not use GDSS. Furthermore, students who used GDSS had a more positive evaluation of the classroom experience and the group learning activities related to students who did use GDSS to support group learning process." (p170)

Using similar group support system technologies, Fellers and Moon (1994) look at distributed group support systems (DGSS) to facilitate teaching and learning at two geographical locations. As Table 2 illustrates, distributed group support systems share characteristics that GDSS has, but "used in a dispersed setting and overcoming many logistical barriers to collaboration"(p.142). The analysis results from two collected surveys showing that students were satisfied with their learning experiences in terms of discussion opportunities, with being actively involved in the course and with the organisational skills of the instructor. Overall, their findings were very similar to those in Alavi's work. However, this study also points out the importance of instructor teaching and style, and its consequent impact on student satisfactions.

Apart from concentrating on publishing research on groupware in organisational settings, *Computer Support Cooperative Work: the Journal of Collaborative Computing* has a special issue with a focus on Multi-User Dungeon (MUD) and MUD Object-Oriented (MOO) applications for educational purposes. In this 1998 volume 7 issue, O'Day et al. (1998) examine how several classes of K-6 elementary school students interact and participate in a MOO-based and text-based virtual world called Pueblo. Using the students' written transcripts in Pueblo, they studied four dimensions of learning process in such environment: 1) audience, 2) asynchrony and synchrony, 3) attention and awareness, and 4) prompts for reflection. They demonstrate through the transcripts how each dimension works and what are possible difficulties in a virtual world like Pueblo. In the same issue, Bruckman (1998) presents another interesting paper. Her empirical work centres on the nature of support and its role in a virtual learning community. In her longitudinal study of a virtual reality community, MOOSE Crossing, she observed how children participating in this environment learnt about computers and improved their writing and reading skills. She concludes that with embedded constructionist learning design, a virtual community could provide extensive support and motivation to enhance children's learning quality.

The implications of studying CSCW in the educational context are twofold: for research and for systems design. In the research aspect, the findings indicate that

CSCW research is not only suitable for cooperative work *per se*, but is also extendable to other contexts where collaboration or group interaction takes place. One could question the plausibility of extending CSCW research into other discipline such as education, since the issue of IS diversity has been discussed widely for the past few years (Benbast and Web 1996; Robey 1996). On this question, we share Robey's view (1996) on information systems diversity. With a carefully thought-through research framework and collaboration with others within our academic community, we believe that contributing to knowledge on this topic is feasible for the IS discipline. As for system design, the development of collaborative learning systems has just taken off during the past two or three years. The studies on CSCW design and development provide educational software developers with insight into certain technical features that can enhance the collaboration process. Using this, systems developers could have a better blueprint for collaborative learning software design.

2.1.3 World Wide Web

The most significant contribution to the growth and expansion of online education was sparked off by the development and mass adoption of the World Wide Web (WWW). In 1989, the research and development of the Word Wide Web was initiated in a paper entitled "Information management: a proposal" by Tim Berners-Lee and his colleagues at the European Particle Physics Laboratory, a Switzerland-based scientific research organisation (CERN) (Berners-Lee 1989). In the following year, Tim and his work colleagues continued to develop the idea of hypertext system, and they named this project World Wide Web. Since then, with a series of intense conferences and colloquia, the WWW design and development has progressed rapidly. Its global acceptance and adoption came after the 1993 release of the web browser, Mosaic, created by Marc Andersen, who later formed the Netscape Communication Corporation. By the mid-1990s, there were more than millions active users of the WWW as a result of critical mass achieved by the Netscape and the Microsoft Internet Explore.

The global adoption of the WWW advanced the information retrieval process on the Internet. The end-user can easily gain access to vast amounts of documents located in various interconnected computer networks by a means of 'point and click' on the hyperlinks. In addition to being a leading information retrieval engine, the continuing growth and improvement of the WWW and the Internet have recently further promoted commercial opportunities and created the phenomenon of Electronic Commerce (E-Commerce). For the past two years, e-commerce has become the way that many CEOs envision their business of the future and it also has generated tremendous academic and research interests in the IS field. However, as much as it would be interesting, this is not the focus of this thesis. Instead, we are more interested in the implications of the Web on education. From our perspective, the Web transforms education in a number of ways.

First of all, it increases communication effectiveness and quality. Before the era of popular Web use, students tended to communicate with either administrative officer or teachers through more traditional media, such as face-to-face, telephone or e-mail if available. Although face-to-face and telephone modes have the advantage of immediacy once communication takes place, one possible problem with these is the time and perhaps the money that might be wasted in the process of waiting and making enquiries to different people. Nowadays, most higher education institutions have well-documented information published on the Web and the majority also run Intranets within the institution with more detailed information available for the registered students and staff. Thus, both potential and current students can easily obtain relevant information and locate details of the right person to contact if necessary. For example, the institute where this research has been based has an interactive web-based system called "LSE for you" within the school Intranet. This system allows the student to access tailored information on course options, class schedule, and fee status located in the school central database. Before the arrival of this system, it would have normally taken twice as long to get such information, if not more. Consequently, the Web becomes another effective channel of communication among groups such as administration, academics and students. In a

word, the application of Web is 'the vision to informate down' in the educational context (Leidner and Jarvenpaa 1995).

Second, as we mentioned before, the Web was initially designed to become the leading information retrieval service. With its ease of access, the Web presents a world full of learning opportunities. There are not only enormous amounts of information within reach of "point and click", but also study materials or variety of multi-media files published by teachers to facilitate student learning, for example, the lecture handout, lecture audio, video and course syllabus on the Web. The Web offers a wealth of knowledge that is beyond the level available in lecture notes or academic textbooks. With the rapid improvement and increasing numbers of search engines, students are able to track down articles or relevant information without much difficulty. Web technology allows students to locate and retrieve learning resources quickly in terms of both quality and quantity. Nevertheless, the potential of accessing information at large scale also creates the opportunity of plagiarism, where students misuse the benefit of information resources and present other people's work as their own. This creates new problems for teachers who now might have to spend a great amount of time checking the authenticity of students' work.

Third, Daugherty and Funke (1998) report that apart from its academic value Web-based instruction also brings technical benefits to students. As we briefly pointed out earlier on, the Web has transformed the business trading process, namely the rise of electronic commerce. In order to maintain and create new business opportunities enabled by innovative technologies, the technical capability of employees has become an important asset for employers. Thus, universities now also have responsibilities for training students in some fundamental Web skills. Web-instruction, as demonstrated in Daughtery and Funk's study, was an efficient method for achieving both academic and technical goals since students reported that their experiences with Web-based instruction helped them gain competence with technologies(Daugherty and Funke 1998).

Fourth, the creation of virtual universities on the Web provides a solution for the galloping demand for continuous learning and the ever-decreasing government willingness to fund budgets for public universities and colleges. By comparison with the construction and maintenance of the traditional campus infrastructure, virtual universities appear to be more cost effective since they can reach more learners regardless of the distance and, at the same time, have smaller space requirement than campus universities. Barnard (1997) points as an example to the creation of a regional virtual university by the Western Governors' Association in the United States.

Finally, the Web also moves groupware systems to another stage of development. As we pointed out in the earlier section, many academics are now starting to adopt web-based CSCW systems or interactive educational software for teaching and learning purposes. The growing interest in the design, development and implementation of web-based systems to support collaborative learning environment has led to the field known as online education. This is precisely the area that we place our focus on. Overall, the Web not only provides a new and effective communication channel, but also breaks traditional time and geographical boundaries imposed on teaching and learning activities. In other word, the Web is also capable of fostering " a vision to transform" (Leidner and Jarvenpaa 1995).

In the first part of this chapter, we introduced three relevant and important information technologies considered to be influential on the development and research of online education. Table 2 sets out a summary.

Technology	*Relevant to the research and development of online education*
ARPANET	• The origin of the Internet • The first online academic information sharing and collaboration
CSCW	• The development of groupware systems • Rich literature on the impact of collaborative technology on the nature of group work and collaboration • The recent phenomenon of using CSCW to facilitate collaborative learning on campus
World Wide Web	• Advanced information retrieval service on the Internet • The development of hypertext and hypermedia • The birth of online education and virtual universities

Table 2: Summary of technologies relevant to online education

In the following section, we will move on to examine the current literature on online education research and identify the area we consider less developed and for which our contributions from this study are addressed.

2.2 *Current literature on online education*

In this part of Chapter Two, we review the online education literature and categorise it into three streams: one focuses on online education effectiveness, mostly in comparison with face-to-face classroom teaching, another centres on the online interaction pattern analysis, and yet another concentrates on student satisfaction and acceptance of technology. In the detailed discussion of these three areas, we argue that there is lack of study on the *perception* of students of online learning and the particular technology used, and the *process of change* for both as students engage online learning within the *context*. Most empirical studies take a rational or functional view of technology, concentrating on the cause and effect of online technology adoption for learning, and hence neglecting the context of complex social actions in which the technologies are interpreted, understood, and

used. Many in IS research have demonstrated the problem of the functionalist view of technology when studying technology use in organisations. Addressing such problems, interpretive studies show their value by incorporating issues such as culture, work norms, power and politics into IS research. It is the intention of this thesis to apply IS interpretive worldviews and approaches to study technology in use in the educational context.

In order to make a strong case of our above argument, we detail and analyse the previous studies in this field. To do so, we organise those studies into three areas of concentration: effectiveness studies; interaction analysis; and student satisfaction and acceptance of technology. Some studies might cover more than one area in our categorisation process. In each section, we offer a summary on some key studies and provide our views of their advantages and disadvantages. The outcomes of the examination here will also be reflected upon again in Chapter Six, where we provide a further discussion on our empirical findings.

2.2.1 Effectiveness Studies

When the idea of online education started to develop, the most frequently asked question was how effective is this new form of education in comparison with traditional face-to-face teaching. However, a history of comparing technology-enabled education with traditional face-to-face teaching can be traced back to the early 1920s, when "correspondence course emerged as the first challenge to the traditional classroom"(Navaro and Shoemaker 2000). Thus, one can find numbers of comparative studies in distance learning literature, especially studies on the effectiveness of telecourses. For the purpose of this thesis, we do not intend to include other forms of technologies but to concentrate mainly on CMC. In our review process, we divide studies on online education effectiveness into two kinds: micro analysis and macro analysis. The former is concentrated on student performance and learning outcomes whereas the latter is concerned about the impact of online education on institutions or on the educational sector as whole.

Micro Analysis

Leading a group of colleagues on the development of Asynchronous Learning Network (ALN) at the New Jersey Institute of Technology (NJIT), Hiltz and Turoff were regarded as two of pioneers in this field of research. We have briefly introduced their work in the pervious chapter. Here we offer a more detailed discussion.

In one of many studies on the application of ALN to support student learning at the NJIT (Hiltz 1985; Hiltz 1986; Hiltz and Turoff 1993; Hiltz 1994), Hiltz and Benebunani-Fich (1999) examine the problem-solving performance between individuals and groups using with ALN or not. They formed hypotheses in terms of three categories: 1) solution quality; 2) length of reports; and 3) process satisfaction. Their findings suggest that:

> "ALN-support--individual and groups—produced better reports than did their manual counterparts. It seems that in an ALN environment the potential visibility of individual response combined with in-depth reflection that can be achieved through asynchronous work resulted in higher quality solutions.... With respect to process satisfaction, online group were the least satisfied with the process due to the nature of asynchronous interaction." (Benbunan-Fich and Hiltz 1999)

On the subject of academic achievement, the findings of this work were consistent with those of studies on the Virtual Classroom, which was the name later given to ALN. In their 1997 paper, Hiltz and Wellman (1997) maintain that students in the Virtual Classroom perceived mastery of course material, collaborative learning, and motivation as superior than for students from the traditional classroom. On the question of process satisfaction, Hiltz and Benebunani-Fich (1999) disclose that the defect of delayed feedback caused students to feel less satisfied with the process of solving a case study. However, in the case of the Virtual Classroom, it was found that better access to teacher, spontaneous comments, and contributions from other fellow students actually augmented student motivation and satisfaction in their learning process. In addition, Hiltz and Wellman (1997) also point out some disadvantages related to the Virtual Classroom. Students in such an environment had the sensation that it was more difficult to develop new friendship and they were more

like to 'skip' the classes when compared with the traditional classroom. In their summary, the authors did touch on the social and cultural issues related to the use of the Virtual Classroom, however, they failed to incorporate or develop those ideas further in their studies.

Besides the ALN at the NJIT at the United States, there are also extensive studies on computer conferencing applications for educational use from this side of the Atlantic. Since 1988, the U.K Open University has used CoSy and FirstClass for their distance learning courses to enhance distance teaching and learning quality. Their findings seem to be consistent with the above research with respect to the better learning outcomes through online technologies (Mason 1989; Tuckey 1993; Alexander 1997; Alexander 1998; Mason and Bacsich 1998; Salmon 2000).

Instead of a text-based computer conferencing system, Webster and Hackley (1997) devoted their attention to the use of videoconferencing to teach cross-discipline graduate courses at six North American Universities. In this study, they examine four categories which they considered would affect teaching effectiveness: technology, instructor, course and students. Unlike the study in the Virtual Classroom, there is more emphasis on the technology itself since in this paper there were 6 out of 9 hypotheses addressing technological issues such as media richness, reliability, quality, and control over technology. Survey results from 247 students participating in 29 courses, indicate that technology played an important role in student perception of learning outcome. For example, they conclude that reliability and quality of, and attitudes towards information technology adopted are positively related to the student perception of learning outcomes. In particular, on the issue of attitude towards online technology, the study indicated that students are likely to experience positive learning outcomes when instructors exhibit control over technology and feel comfortable to use it as a means of educational delivery. This study is one of the few which has slightly taken into account of the impact on perceived learning outcomes resulted from the perception and the quality of technology adopted.

Apart from technological influences on teaching effectiveness, Webster and Hackley's (1997) quantitative and qualitative data indicated that instruction style and teaching methods are crucial for promoting student participation and involvement in an online environment. Their view on new instruction style reinforces the suggestions of others (Harasim 1986; Eastmond 1992; Garrison 1993; Leidner and Jarvenpaa 1993; Leidner and Jarvenpaa 1995; French et al. 1999; Salmon 2000). In these studies, most researchers contend that a traditional instructional style of teaching is not appropriate for an online learning environment. For the computer-mediated learning situation, the role of teacher is transformed from instructor to moderator or facilitator. The aim of an online teacher is to promote student interaction and facilitate the process instead of dominating the discussion flow. Furthermore, because most students would be unfamiliar with this new way of teaching and learning, it is important for teachers to design carefully instruction activities, to spell out the norms of behaviour at the outset of the course and positively to encourage student participation. Conceptually, those studies all pointed out the difference between tradition and CMC classrooms. Practically, Salmon (2000) offers a more practitioner-oriented approach as to how to facilitate CMC teaching and learning environment in the book "*E-Moderating: the Key to Teaching and Learning Online*". This book shows a five-step model to e-moderating: access and motivation; online socialisation; information exchange; knowledge construction; and development. Each step highlights the amount of technical support required and the e-moderating strategy. For instance, during access and motivation stage, an e-moderate needs to prepare to give a great amount of technical support as well as being welcoming and support.

Looking at the above cases discussed, it might seem that attention is centred on one or another particular technology. However, there also are others who opt for more than one form of information technology to facilitate teaching and learning. In their comparative study, Navarro and Shoemaker (2000) compare perceived student performance, attitudes towards instruction technologies, and interactions between traditional learners and cyberlearners, as they called them. For cyberlearners, there were three main types of technologies available: CD-ROM, electronic bulletin board,

and an online testing centre. In performance comparison, they show that cyberlearners had better exam results than the traditional ones when the data were evaluated by gender, ethnicity or class level. This once again confirms the findings of the previous studies of online student learning outcomes. What is interesting in Navarro and Shoemaker's work is that among the information technologies employed, CD-ROM was considered more useful than the electronic bulletin board, as "more enjoyable" and "essential" learning component for the course. They conclude that besides online discussion group, a common practice in online education, it is important to have multimedia lectures that "stimulate the classroom experience" (Navarro and Shoemaker 2000:28). Since most of today's online education programmes involve a variety of technological inputs, Navarro and Shoemaker's work provided some indications on the student perceived preference and effectiveness of different media in an educational setting.

Macro Analysis

Besides Hiltz and her colleagues, Alavi is another IS researcher who has undertaken a number of studies on the use of information technologies to manage education. Looking at Hiltz and Alavi's work dated so far, it seems that there are some differences in their research in terms of audience and technology. The work coming from the NJIT much centred on the development of ALN and on the effectiveness of the system for different disciplines from both graduate and postgraduate students. By contrast, Alavi placed her primary focus on examining different types of information technology to support MBA education in particular. In the early section on CSCW research, we already discussed Alavi's work on GDSS use to facilitate MBA. She holds that with GDSS facilitation, students are able to develop critical thinking and analytical skills in comparison with the conventional teaching.

Besides, Alavi also contribute to knowledge development of online education at a macro level. In another study, she and her colleagues (Alavi et al. 1997), adopt Venkatraman's framework on four types of IT-enabled interorganisational partnerships to gain competitive advantage, and extend it to the educational sector.

They suggest that knowledge-leverage partnership would create added value for universities, and 'leverage student learning experience with a broad array of faculty skills and knowledge' (Alavi et al. 1997:1310). In their 10-week empirical work on MBA students at two universities using videoconferencing and Lotus Notes, they analyse technology effectiveness in terms of four dimensions: classroom delivery and interaction, the joint team project, impact on the instructors, and cost implications. Apart from demonstrating the consistency with other findings on student positive learning experiences in a virtual environment at the micro level, they further make a suggestion that the university partnership also leverages instructors' resources at both universities through the exchange of knowledge and professional contacts. Electronic teaching also poses some challenges for instructors since they need to learn new forms of technology and adjust their instruction methods, as pointed out in the preceding section. Inter-university collaboration on teaching also requires lecturers putting more effort into discussing with their counterparts on division of labour and instruction strategies before the commence of the course. As for cost, they argue that some early investment might be needed in fundamental technical infrastructure, although in the long term it is cost-effective.

In another study on the potential of inter-universities partnership, Browne (1999) contends that there also should be a change of role for IT services in institutions. In his view, with the trend of publishing reading materials and teaching notes on the Web, the interdependence has increased significantly between academic and IT support service. He argues:

> "The institutional advantages of encouraging informal and enabling formal collaboration [between IT services and academics] to occur in the development of IT-influenced curriculum innovations can not be underestimated."

In order to achieve such institutional advantages, he calls for organisational and management restructuring around the issue of how to respond to the "telematics revolution"(Browne 1999).

At a much broader level, Chellappa *et al.* (1997) propose applying a management framework of virtual organisations to design a virtual university infrastructure. They demonstrated that the Electronic Education Environment (E3), being developed at the University of Texas at Austin, could serve as a working model for today's virtual university design. The model consists of a collaboratory, a payment system and a document filtering system. Along the same lines of argument, Hämäläinen *et al.* (1996) argue that the increasing demand for virtual teams and effective knowledge management in organisations creates the need for "distributed delivery" and "customized" education and training. Instead of taking virtual organisation as the base model, they consider online education as another form of electronic commerce. Their "education brokerages" framework incorporates such components as digital technologies, electronic commerce infrastructure, rapidly changing content, globalisation of business and education, and just-in-time on-the-job education. Nevertheless, both models are still at the stage of exploration and development. Further academic and empirical studies are necessary to identify their theoretical contributions and practical values.

Compared with the work on the analysis at the micro level, there are fewer articles we are able to locate that examine the impact of online education on institutions or inter-institutions relationship (i.e. at a macro level). These four papers discussed above illustrate that online education could also bring both academic and commercial value for higher education institutions by means of university partnerships or corporate-university strategic alliances. This looks like a trend of higher education online. In fact, such kinds of alliances have already been formed, and many more are expected to emerge (Baer, 2000). For instance, Unext.com formed jointly by four universities across the Atlantic, is example of this kind. Although not within the scope of this thesis, we feel that the potential of online education at the macro level deserves more attention from both IS and educational researchers.

2.2.2 Interaction Analysis

As seen in our early discussions on CMC characteristics (Chapter One), the text-based and asynchronous mode of communication are two CMC dominant features. Hence, the nature of communication within CMC differs from face-to-face, postal or phone interaction. Below we examine what has been researched on CMC interaction in general and then move on to investigate interaction analysis in the online educational context.

The interaction process in CMC seems to generate great academic interest on its social psychological effects (Kiesler et al. 1984; Siegel et al. 1986; Rice and Love 1987; Dubrovsky et al. 1991; Sherry and Connolly 1995) and organisational communications (Kiesler and Sproull 1986; Huber 1990; Sproull and Kiesler 1991; Sillince 1996; Warkentin et al. 1997). Bordia (1997) conducted a literature review on interaction analysis studies comparing face-to-face (FTF) and CMC, and reports that the majority of experimental studies set that the CMC environment, when compared to FTF, have: 1) greater equality of participation, 2) relatively less intense normative pressure, and 3) higher incidence of uninhibited behaviour. Furthermore, she also finds that most experimental studies use student subjects, although aiming to research organisational and social functions. Consequently, she considers the findings tend to jeopardise the research aim that was espoused at the beginning, i.e. organisational aims. Nevertheless, in the context of our research this problem becomes a benefit since the subjects under investigated here are indeed students. We are able to compare and discuss some of the findings from our case study with respect to others mentioned above, without endangering our research aim.

The text-based and asynchronous nature of communication also caused some debate on the richness of CMC as medium of information exchange. This argument originates from the information richness theory proposed by Daft and Lengel (1984 and 1986). From information richness theory perspective, one evaluates the richness of a communication media according to the criteria of 'immediate feedback', 'the number of cues and channels utilised', 'personalisation' and 'language variety' (Daft

and Lengel 1986). According to these criteria, face-to-face was ranked as the medium that can best convey rich information, followed by telephone, personal document, impersonal written document and finally numeric document. Although Daft and Lengel did not specify the level of richness of electronic mail or computer conferencing, based on the prescribed criteria it appears that electronic mail would fail to support the exchange of rich information since this kind of media does not allow immediate feedback or incorporate verbal cues.

Nevertheless, the assertion that CMC is a lean medium from an information richness viewpoint was not fully supported by other IS researchers (EI-Shinnaway and Markus 1992; Markus 1992; Yates and Orlikowski 1992; Fulk 1993; Zack 1993; Lee 1994; Huang et al. 1998). We briefly summarise a few of the disagreements on this subject. First of all, by adopting the philosophy and methodology of phenomenology and hermeneutics for interpreting numerical accounting data and reports, Boland's early work on managerial issues and experience demonstrated that through the process of interpretation and reflection, it is possible to generate rich information and meanings from text and numerical documents (Boland 1984; Boland 1985). Despite the fact that Boland's work was not particularly focused on issues of rich medium and information richness theory, his work indirectly provided the counter argument of text and numeric documents as a lean medium. More recently some IS scholars have provided empirical evidence to show that electronic mail or computer conferencing is not as lean a media as information richness theory claimed. To name a few, Lee (1994) adopted a hermeneutic interpretation method to demonstrate how richness of communication occurred in a text-based electronic mail system. Fulk, et al. (1993), Huang, et al. (1998) and Yates and Orlikowski (1992) offered explanations from social psychological perspectives or from alternative theories against assertions stemming from information richness theory. Learning from those studies, we see that the judgement on the richness of a certain medium should not be solely based on its inherent property, as information richness theory would suggest. Instead, the realisation of rich communication facilitated by a certain medium is situated and social. Hence, in our view CMC in the context of online

education is not static and lean, and this is the belief that we hold to later on when conducting our empirical study.

From the discussion in the previous paragraphs we identify the existing interaction analysis literature on CMC in general. Two main themes were identified: 1) there are qualitative differences between CMC and FTF communication in terms of social and psychological aspects, and 2) CMC is social, situated and can support the process of rich information exchange. In the rest of this section, we examine interaction analysis specifically carried out in the area of online education. Within this scope, there are two main analysis activities: structural analysis and content analysis.

Structural Analysis

The first type of analysis refers to the use of statistical methods to trace and present online communication activities. According to Mason (1992), such activities include 'logons', 'messages sent and read', 'level of participation', and 'number and length of entries in conference'. Normally, the unit of analysis for structural analysis is the message. The main purpose of analysing these activities is to map the interaction patterns and levels of participations in a CMC discussion, enabling us to gain some insights into the structure of group interaction, the levels of involvement between (among) teachers and students, and interaction differences in various computer conferences.

In order to explore the use of public and private electronic mail for a graduate class discussion, Riedl (1989) examines the messages contributed by each student and instructor, topics per message, and message flow within the same topic. He suggests that, as with traditional classes discussion, some students contribute and participate more than others in CMC classes. In this study the instructor was very actively participant both in public and private e-mail discussion. It seems that the instructor is the key to maintaining the level of involvement of students. In addition, Riedl also carries out analysis on the average length of messages sent by students. Plotting numbers of lines in length against message number over time, the results

illustrate a normal distribution. He explains that with increased familiarity with the system and the richness of teaching content, student contributions tend to increase in length. Further, the decreased length of messages near the end of the course was explained by the shift of student attention towards final class projects.

Levin and other colleagues (1990) conducted detailed studies into inter-message reference, i.e. tracing the relationship between messages. They suggest that this approach is the beginning of a full content analysis. Echoing Riedl's technique on student participation, Harasim performed analysis, but using much smaller units. By using computer-generated statistics on the numbers of lines in messages, she was able to demonstrate that 'the extent to which access is time-independent' and 'the distribution of communication among members of her course was relatively equal' (Mason 1992). Using words instead of lines as the unit of analysis, Howell-Richardson and Mellar (1996) discover that moderator-type of instruction style has relatively frequent and short messages, in contrast to the instruction style of expert or lecturer. With the same analytic unit adopted by Howell-Richardson and Mellar (1996), Jara and Mellar (1999) show that regardless of the task nature, there was a tendency for short messages in both conferences in their case studies. Furthermore, they found that there were significant differences of inter-message mapping between two conferences. However, detailed explanations of why such differences occurred were not given in their paper.

Each of the above researches seems to provide interesting findings on the interaction structure of CMC discussion. Nevertheless, it appears that there is no consistent outcome across those studies mainly because of the particular unit of analysis adopted in each study. Furthermore, interaction structure analysis does not reveal the quality and meaning of the interactions that occur within CMC discussion. Consequently, researchers began to develop another technique to address the problems that structure analysis encounters.

Content Analysis

Since most CMC discussions take place in the format of text, Henri (1992:118) contends that the richness of written messages:

> "[...] is proving to be a gold mine of information concerning the psycho-social at work among students, the learning strategies adopted, and the acquisition of knowledge and skills."

Using qualitative analysis techniques examined by Miles and Huberman (1984) and cognitive approaches to learning, Henri proposed five dimension of content analysis with respect to the process of revealing the student learning process: participative, social, interactive, cognitive, and metacognitive. In this framework, the participative dimension deals with quantitative measures of numbers message sent by a person or a group, similar to structure interaction analysis; social and interactive dimensions are concerned with messages with the intention for social support or implicit and explicit response to others; and cognitive and metacognitive are two dimensions containing messages related to development of understanding, critical thinking and reasoning. Although Henri does not provide empirical application of the framework in this paper, it was adopted or modified both by him and others in their empirical studies (Henri and Rigault 1996; McDonald and Gibson 1998) to demonstrate the value of such framework.

Contending Henri's choice of message as the basis of the analytic unit, Howell-Richardson and Mellar (1996) propose using the illocutionary act as a unit of analysis. The concept of the illocutionary act comes from Speech Act Theory, which initially is used to describe face-to-face discourse (Searle 1969). Using this theory, they derived an analytic model to describe a CMC illocutionary act according to its property (interrogative, declarative, directive, and elicitation), group focus (group or task), addressee (all, individual or sub-group), and inter-reference (yes or no). Extending this work, Jara and Mellar (1999) incorporate the pre-cooperative act as another additional illocutionary properties in the context of CMC educational discussion. Both studies were looking at the interaction differences, if any, caused by various instruction styles. It appears that neither study showed a significant move

in illocutionary properties if the nature of task or the role of moderator changes. The only significant difference in both cases is the focus of the illocutionary act. Therefore, although illocutionary analysis might be useful, there is a need for further development if it is going to be used as a mechanism for understanding online interaction. Among the problems, as pointed out by the above researchers themselves, include difficulties of locating each communicative act within the defined categories and the incapability of speech act analysis to identify the collaboration process occurring in the conference communication (Howell-Richardson and Mellar 1996; Jara and Mellar 1999).

Taking a different approach, Hillman (1999) modified the model of pedagogical move, which was originally developed by Bellack *et al.* to analyse face-to-face classroom discourse, and then used it to compare the interaction patterns of face-to-face and computer-mediated courses. By focusing on the purpose of sentences posted or uttered by teachers and students, Hillman was able to code the intention, meaning and discussion content of each sentence. After plotting sentences in these three categories, the results indicated that the patterns of interaction overall in a computer-mediated course mirrored 'discussion', while the discourse patterns in face-to-face class mirrored 'recitation' (Hillman 1999:37).

In addition to using content analysis to examine online learning outcome, content analysis is also adopted to understand group dynamics in the student interaction process. Hiltz and Turoff (1993) applied Bale's Interaction Process Analysis (1979), which contains extensive studies of face-to-face group problem solving, to examine the CMC group process. In this comparative study, apart from the two categories agreement and disagreement, they found that there are no significant differences in the group problem solving process between face-to-face and CMC. With the same intention to explore group dynamics and development, McDonald (1997 and 1998) aims to discover the interpersonal aspect of group dynamics. She adopts her content analysis model from Shcutz's group development theory based on interpersonal needs (Inclusion, Control and Affection). As a result of her coding analysis on three student conferencing groups over time, she found that

interpersonal issues were important for online group development although the level of significance decreased over time. Moreover, the cross-comparison of three conferencing groups shows similar distributions among them of different interpersonal issues. When the average result was compared with a face-to-face study, it was found to be 'comparable not only in direction of linear trend, but also relative proportions of different interpersonal issues' (McDonald and Gibson 1998:19). Overall, these two studies indicate through content analysis methods that in the educational context there is a similar pattern of group dynamics between face-to-face and computer conferencing group.

Summing up, most literature shows that people in CMC exhibit different social-psychological behaviours compared with face-to-face communication. The work of McDonald, and Hiltz and Turoff makes an exception of this assertion. Furthermore, against the claim based on information richness theory, numbers of IS researchers find that text-based and asynchronous CMC can readily support the exchange of rich information. In terms of the social psychological aspects of CMC, it also seems that this form of communication permits equal participation and flattens the power structure in both organisational and educational contexts. Nevertheless, it appears that there are no explicit reports on the issue of inhibited behaviours in the above online education studies, as those emerged from the general social-psychological research. This could possibly be explained by the fact that participants in the educational community are even more task-oriented and are more aware of social norms than in a CMC environment. The problem of inhibited behaviours tends to be caused by anonymity. However, this does not normally apply in the CMC learning environment since most students and teachers interacted with each other using their true identity. It would be interesting to see whether uninhibited behaviour would take place if students were able to contribute anonymously.

As well as analysing the general social behaviour in computer conferencing situations, online education researchers are also interested in the structure and content of messages. Structural analysis provides some insights into the flow of interaction and the level of participation by individuals involved in computer

conferencing. On the other hand, content analysis concentrates on the meaning of messages instead of other aspects of messages themselves. Using various pre-established criteria, one can, as shown in the above studies, carry out content analysis on learning outcomes or group development over time. Both Jara et al. and Howell-Richardson used techniques of structural and content analysis in their research in order to obtain a fuller picture of student/teacher interaction (Howell-Richardson and Mellar 1996; Jara and Mellar 1999).

2.2.3 Student Satisfaction and Acceptance of Technology

So far we have discussed studies on effectiveness and interaction analysis of online education. In the rest of this section we examine student satisfaction and acceptance of information technology. Student satisfaction is considered to be one of the factors to have considerable impact on student performance and student interaction (Navaro and Shoemaker 2000). Technology plays an important role in the context of online education, since it is the medium that channels the communication between teachers and students. Without it, there would not exist the phenomenon of online education at all. Furthermore, if students fail to accept or use the type of technologies employed for educational delivery, then the concept of online education can become meaningless and useless.

Starting first with student satisfaction, there are a number of studies in the field of distance education (Abel and Creswell 1983; McCleary and Eagan 1989; Fulford and Zhang 1993; Cadiz et al. 2000). Biner (1993) points out that although positive student reaction to distance learning courses does not mean equally positive learning outcomes, negative student reactions would certainly affect learning motivation and hence increase dropout rates. There are different views on the measurement of student satisfaction, for instance, logistics, management, technologies and instruction styles. In particular, satisfaction of teachers and students about interaction seem to be considered as a factor critical by many others. Hackman and Walker (1990) conclude from their study on televised courses that

those students at remote sites who reported high level of interaction were those who perceived high levels of interaction at the outset of the course. In Hilgenberg and Tolone's study (1999), they found that students who perceived high quality student-teacher dialogue tend to have high levels of satisfaction. Navaro and Shoemaker (2000) also confirmed that student satisfaction is positively correlated with various types of interaction, and subsequently, positively correlated with performance. Therefore on the basis of these studies, the extent to which academics are more able to facilitate or foster teacher-student or student-student dialogue, means that students are more likely to maintain learning motivation and have higher satisfaction in distance and online education.

Moving on to the issue of student satisfaction with technology, as discussed in the previous chapter, the information technologies used to facilitate teaching and learning became more complex and evolved rapidly, due to the constant improvement of system hardware and software. Student satisfaction with technologies for learning purposes becomes more important and relevant than before. With only a limited number of studies available this aspect might be a new issue in the context of online education. However, measuring end-user satisfaction with information technologies and innovation has been studied extensively within the field of IS. To cite just a few, there are studies on user satisfaction (Ives et al. 1983; Doll and Gholamreza 1988), system usage (Barodi et al. 1986; Strab et al. 1995), and user acceptance (Davis et al. 1989; Davis 1989; Davis 1993;Venkatesh and Davis 2000). One of the most influential theories is the technology acceptance model (TAM) first proposed by Fred Davis (1986) as his Ph.D. thesis in MIT in 1986. In TAM, perceived usefulness and perceived ease of use are two determinants of user acceptance of any given computing system. TAM has been examined and empirically tested intensively both on students (Davis et al. 1989; Taylor and Todd 1995; Szajna 1996) and non-student subjects (Davis 1993;Chau 1996; Hu et al. 1999), and has been quite successful in explaining and predicting the user behaviour across different types of end-user computing technologies. Within the context of teaching and learning, Liaw (2002) has applied TAM and social cognitive theory to study individual perceptions of Web technology in the university environment. The

results again show support for TAM and early research in social cognitive theory. Later we will show that although the TAM is not specifically mentioned in any online education studies, the findings regarding technology are fairly compatible with the TAM.

In the process of searching for empirical work on system acceptance and satisfaction, we found little research dealing with this aspect in detail apart from Webster and Hackley's work, mentioned in the earlier section on effectiveness studies (Webster and Hackly, 1997). As for other research, even when the technological dimension is taken into account in a research, e.g. student performance or instruction style, it is considered as a very small part of the research compared with the rest. In Harasim's exploratory case study, students described the conferencing system as convenient and flexible (Harasim 1987). Middleton (1999) investigated MBA student use of two similar asynchronous computing systems. In one case one system was successful while the second system was considered a failure. The student descriptions for the successful system are 'fast', 'accessible', 'convenient', 'very user friendly', and 'easy to use', while the failed system was labelled as 'unwieldy', 'cumbersome', 'graphics heavy', and 'too complicated' (Middleton 1999). When asked their opinions on the CMC systems used, students in McMurdo's study responded that 'easy access' and ' ease of use' are important factors in CMC use (McMurdo and Meadows 1996). Cited in Navarro and Shoemaker (2000), Hudson and Boyd argue that the success of a distance-learning project also depends on the performance of hardware and software.

Besides general student impressions about the systems adopted, Armstrong-Stassen *et al.* (1998) discover that there was a significant difference on attitude between male and female students toward videoconferencing. In their empirical research, female students in general tend to be less positive and are more likely to experience higher levels of anxiety about videoconferencing. They further suggest that compared with the male counterparts female students also felt more uncomfortable about taking course through videoconferencing. These exploratory findings discussed above, it appears that convenience and ease of use are the two

main factors in student acceptance of online educational technologies. The point of perceived ease of use here is fairly consistent with the TAM prediction. Although the word 'useful' was not exactly mentioned in the above studies, we consider that in this particular context terms such as flexible, and convenient are close to the concept of useful. However, more rigorous and carefully designed studies might be required in order to reach a definitive conclusion on this question.

From the IS perspective, user perception and acceptance of technology relate strongly to user performance, and equally, this must apply in the online education context. Thus, we speculate three explanations for the current limited numbers of studies on this subject: 1) online education is at the early stage of research, and researchers were more concerned with student academic performance compared to traditional education, 2) the technology adopted for online education was not as complex as today's and consisted mainly of simple computer conferencing system, and therefore the focus of analysis centred much on text-based interaction, as discussed previously, and 3) online education researchers implicitly assume student acceptance of online technology employed in their research and do not consider it as a key factor. We consider student acceptance of complex online technologies an important part of research and intend to explore this dimension further in our empirical setting. In our view, student interpretations, understandings and knowledge of online technology will influence their consequent behaviour and learning activities online. The core of this thesis is to demonstrate how such interpretations can be revealed through an interpretive case study.

The following table summaries current online education research in terms of: types of studies, research focus and research methods used.

Type of Studies	*Research Focus*	*Research Methods Used*
Effectiveness Studies	Effectiveness of online education compared with traditional education at micro and macro level	• Survey • Experiment • Interviews • Case study
Interaction Analysis	Analysis on the pattern of interaction in CMC courses in term of structure and content	• Statistical method • Content analysis
Student Satisfaction and Acceptance of Technology	Factors affect student satisfaction and attitude towards online technologies	• Survey • Experiment • Case study

Table 3: Summary of current online education literature

2.3 Research Question

The discussion in the foregoing sections (2.1 and 2.2.) has highlighted two issues in online education. The brief review of online education technologies in section 2.1 indicated that they have become more complex, and the state of art is constantly improving and changing. In particular, the Web offers new educational opportunities that were previously not possible, i.e. "a vision to transfer" (Leidner and Jarvenpaa 1995). With the increasing importance of the technology in assisting the learning process and the capability of the same technological application for both organisations and educations, online education has raised the research interests in between education and information systems discipline. This emerging discipline phenomenon can be seen as a consequence of the growing numbers of IS studies on education and of educational studies on information technologies. One of the research purposes of this thesis is to contribute to the knowledge building process in this new combined research field.

Following section 2.1, we went on to discuss the current state of literature in online education research. The majority of studies that we came across were more

concerned about effectiveness, particularly, when compared with traditional face-to-face teaching. Understandably, this is the normal question to ask when there is any new technology coming along to support the learning process. As most studies show, in general perceived student performances online are at least as good as, or even better, than those under the traditional education settings. The second focus of online education is derived from the work in CMC in general, which is questioning the interaction pattern and behaviours in the CMC discussion environment. Although such research provides some insights into student and teacher communication through CMC, we learnt that there is no consistency in findings because of: 1) different units of analysis employed, and 2) not enough studies to achieve the desired level of generalisability. Finally, with increasingly complex and advanced information technologies available for educational purposes, few online education studies have started to explore student reaction and satisfaction towards those technologies.

This brings us to the second issue: research design that we see as a current problem with work in the field of online education. From a closer examination of all the studies discussed in the preceding sections, it is not difficult to conclude that a significant number of empirical inquiries generated results from surveys or presented them in a quantitative fashion. Or, to be more specific, most follow a positivist approach to research (See Table 3 and 5). While we do not disregard the value of positivist research, we consider that it fails to realise and to explore the richness of the context in which learners, teachers and technologies interact. For instance, effectiveness studies through survey or field studies did not reveal the process by which each student appropriates technology for increasing learning effectiveness. The interaction analysis presented so far has only revealed a *contextless* explanation of online interaction. Student satisfaction and acceptance of technology studies did not tell the full story about how acceptance or satisfaction evolved, whether it happened in the first place, and how the interpretation of technologies altered throughout the process of learning. Furthermore, as the choice of technologies available increases and the notion of online education becomes more intersected with on-campus education, the relationship between technology and the people involved in the learning process can no longer be linear and mechanistic.

This thesis takes a social constructivist approach to examine: 1) students' interpretation of online education; 2) students' understanding and perception of online education technology; and 3) the relationship between technology and learning over time. In addition, we also emphasise the role of collaboration and community in the individual's learning and technology use in the situation when there more than one kind of technologies available.

Concluding from our philosophical belief in the nature of knowledge and community, and the analysis of the current literature, we now formulate our research questions so as to examine:

1) *How do students perceive and interpret online technology in the context of online education on campus?*

2) *How does the process of interaction and communication among students as a community change an individual's perception of technologies, and achieve knowledge construction?*

3) *Whether the implementation of online education on campus can enhance learning or bring other educational values?*

As a result of this study, we expect to offer some insights into the interconnected process of how individuals change their perception and appropriation of online education and technology in use, and acquire knowledge through the interaction and collaboration with others in the context. The predicted contributions towards the current state of online education research are as follows: to the knowledge of enhancement of learning through collaborative technologies in IS research, and to the knowledge on technology adaptation in online education research.

2.4 Summary

This chapter has reviewed and discussed relevant technologies and assessed the existing research on online education. Through the review of online education studies, we find that most researchers take technology as given, and 'ignore the context of complex social actions in which information technologies develops' (Dhillon and Backhouse 2001). As illustrated by many other IS studies, the appropriation and the benefits of information technologies in the workplace depend much on subjective interpretation and the influence of the surrounding situation. Taking a social constructivist approach to both learning and technology use, the present thesis hopes to provide some insights into how and what learning is achieved and how and which technologies are appropriated in the context of online education.

The next chapter will discuss the theoretical foundations and framework deployed to assist the empirical investigation.

Chapter Three
Research Framework

The discussion in the previous chapter on online education literature identified the need to focusing in studying the process of student appropriation of technology and learning in a context. It revealed that most studies took technology simply as the medium that channels the dialogue between teachers and students. These studies concentrate much effort on the analysis of how well students perform or learn comparing generally face-to-face teaching with the technology-facilitated learning environment. According to the research results gathered from the above studies, we know that CMC could foster a learning environment that enables students to achieve learning outcomes better than or at least as good as the conventional instruction methods. However, we contend that given the increasing complexity of technologies (Section 2.1) and of environment in which these education technologies are applied (Chapter One), one needs to relinquish the assumption of seeing technology as a passive tool, and to consider the surrounding contextual issues. This research project proposes that only if we view educational technology as a actor and take into account of social, organisational and cultural issues embedded or evolved in an online learning environment, can we understand learning and technology adaptation taking place over

time. As a result of this research, it will complement the existing research or offer further explanations of why certain learning outcomes or student reaction have been achieved.

Therefore, we believe that technology should be viewed as part of the learning cycle, and that neither learning nor use of technology is static, but are continuously influenced by people involved in the learning community. Different people have different perceptions towards online learning and technologies, and these attitudes will change over the course of interaction with others and with technologies. We believe that the social constructivist approach matches our assumptions and supports our arguments on both learning and information technology. Therefore we consider that it is appropriate to choose this approach as the analytical framework guiding our empirical study.

Social constructivism is a branch of philosophy that has strongly influenced the development of many education and social-technological theories. In the area of social constructivist education, we employ collaboration and situated learning to study how online learning occurs and how to evaluate it. In order to facilitate our understanding the process of student's technology appropriation, we consider technological frames analysis as the best candidate for allowing us to study the change in student perception and hence in behaviour towards online technology at each different stages of learning. We devote our efforts in the rest of this chapter to discuss the research framework. The discussion is arranged into three sections.

The first section (Section 3.1) introduces the philosophy of social constructivism and brings in collaborative and situated learning as a social constructivist approach in educational settings. The second section (Section 3.2) outlines the view of social-technological views towards technology, in particular of technological frames analysis. In the last section (Section 3.3), we will synthesis theories adopted from the area of education and IS as our overall research framework and further indicate how the synthesised framework will be applied later in the empirical study.

3.1 Social Constructivism on Education

In the early days of its development, constructivism was a branch of philosophy applied to both learning theory and epistemology- to both how human learn and the essence of knowledge (Henri 1992;Henriques 1999). From the epistemological view, constructivism has its roots in Kantian synthesis of empiricism and rationalism. In contrast to the Platonic school of thought on knowledge- knowledge is absolute and independent of any subject existing in the world, Kant asserts that "knowledge results from the organization of perceptual data on the basis of inborn cognitive structures" (Heylighten 1993). Following this idea, some philosophers and psychologists of the 1800s and 1900s elaborated Kantian's studies on the nature of knowledge and built up a foundation for the constructivist movement. Among the contributors, in the educational field Jean Piaget, and John Dewey were credited with introducing the constructivist philosophy into learning practices, and also Lev. Vygotsky produced some profound work advocated the rise of social constructivism in particular.

As a philosophy of learning, constructivism arose to challenge the traditional behaviourist approach to learning. Behaviourists apply the notion of objectivism as a learning theory, with a focus on the idea of "stimulus-response". Adopting from the objectivist's view of the existence of one single reality, the behaviourist model of learning asserts that there is a true and absolute knowledge existing in the world, and that knowledge is transmittable to learners through the teacher's instruction. Accordingly, this school of thought defines learning as the increasing, inculcating and shaping of behaviours towards a desired goal (Case and Bereiter 1984; Redding 1995). Hence in a behaviourist learning environment, the teacher sets a prescribed learning goal and identifies a series of required behaviours for performance. In contrast, constructivism sees the existence of multiple realities and knowledge is relative rather than being absolute. As Von Glasersfeld (1995) pointed out that 'from the constructivist perspective, learning is not a stimulus-response phenomena, it requires self-regulation and the building of conceptual structures through reflection and abstraction' (Von Glasersfeld 1995:300). This concept of education requires that

learning is not simply limited to a certain definable process in order to realise the true reality that is independent of the knower's world. In contrast, meaningful learning occurs when learners try to understand the new phenomenon in a context based on their interpretation of experiences and their existing knowledge structure. Therefore, a constructivist learning environment emphasises knowledge construction and supports meaningful learning through authentic tasks related to real world experiences, which leads to the rise of situated learning with which we will be dealing with shortly.

Within the constructivism of learning, there are two main strands: cognitive and social constructivism. Cognitive constructivism belongs to the school of thought initiated by the Swiss psychologist Jean Piaget. Piaget focuses his attention on the cognitive development of children. According to his theory of cognitive development, human beings cannot accept and understand given information as such, but construct such understandings through experiences facilitated by the mental process of assimilation and accommodation(Lavatelli 1973; Appleton 1993). This branch of constructivism strives to understand the psychological process of various transitions from one stage to the next stage in a continuum of cognitive development. Social constructivism, the central theme of this thesis, is initially proposed and developed by the Russian cognitive psychologist Vygotsky. Although it shares some common beliefs with the cognitive variant, it places more emphasis on a social-cultural context and the impact of environmental and social factors on learning. As Prawat and Folden (1994) suggested, social constructivism, has its roots in a contextualist worldview. The essence of contextualism asserts that "the meaning of an act may undergo change as it unfolds in a shifting environment, and new acts can spring up willy-nilly (Prawat and Folden 1994)."

This stream of philosophy argues that there is not an absolute reality and that knowledge is not the reflection of one single reality. Instead the nature of knowledge is a "social product"(Prawat and Folden 1994), "evaluative" (Henriques 1999) and context-dependent. The implication of this epistemological belief in learning theories is that an individual obtains his or her knowledge through a process of negotiation, verification and interaction with other members in a community, and agrees on shared

knowledge with members in a group, community or society. It argues that each individual's prior knowledge acts as his or her contributions at the outset of group communication, which inevitably produce the problem of conflict in a group. Through the process of interaction with others, individuals start to accommodate his or her view to that of the world with the rest of the group and finally reach the shared knowledge created by the group.

A social constructivist approach to learning, sometimes known as Vygotskian classroom approach, has given birth to different instructional strategies in practice. In this thesis we consider the importance of situated and collaborative learning in the online educational context. The following sections will examine the concept of these two educational practices and discuss how online technology can be applied to support both, before moving on to examine a social constructivist view of technology.

3.1.1 Situated Learning

The call for a situated learning approach can be traced back to Brown *et al.*, and also to Lave and Wenger's work dated back in the late 1980s and early 1990s. Brown, Collins and Duguid (1989) coined term first and made a significant impact with their article *Situated Cognition and the Culture of Learning* in *Education Researcher* 1989 issue. Soon after this article, Lave and Wenger also published their book *Legitimate Peripheral Participation* in 1991. These publications triggered a palpable shift in the contemporary teaching practice.

This new approach to learning was engineered to challenge the teaching practices rooted in the assumption of separation between knowing and doing. Building mostly upon their experiences in workplace learning and as well as upon Miller and Gildea's (1987) work on language learning, Brown *et al.* (1989) propose that knowledge cannot be taught or delivered through abstraction and out of the context in which knowledge is to be applied. According to their accumulated studies on workplace learning, they argue that knowledge is not separable from the situations in which learners find themselves, i.e. knowing and doing are indivisible. They further

maintain that the inability to apply techniques or methods learnt at schools in the real world context is a result of this separation of knowing and doing. For instance, the common problem of mathematics students who might get a good algebra grade in classes but not being able to apply the same concept in the day-to-day activities such as grocery shopping in supermarkets highlights the consequence of disconnecting knowing from doing.

In order to combat this educational problem, the pedagogy of situated learning states that knowledge is not abstract, but situated and context-dependent. Streibel (1993:22) further elaborates:

> "Learning is a social act..... Knowledge itself is the result of a social act, that knowledge is socially and interpersonally constructed."

In contrast with the traditional approach learning, Brown *et al.* (1989) see knowledge as tools which can only be completely appreciated through use: triggering a change in the user's worldview and hence the adoption of a new belief system in which the tools are employed. They illustrate this point with an example of the different use of a chisel by carpenters and cabinet markers (Brown, et al. 1989). According to their view, learning is a process of enculturation and involves three interdependent components: activity, concept and culture. From their perspective, enculturation is something that is lacking in the current schooling system and this lacuna is well demonstrated by looking at three types of learning activities. In their article, Brown et al. show that there are three ways of learning: Just Plain Folks (JPFs), Students and Practitioners. As shown in the diagram below, both JPFs and Practitioners act on situations and conceptual situations respectively, while students act on symbols. In terms of problem solving, JPFs and practitioners resolve either emergent or ill-defined rather than well-defined problems as in the case of Students. Consequently, the first two types are able to produce negotiated meaning and socially constructed understanding, whereas the latter type only manages to produce fixed meaning and immutable concepts, which risk being meaningless or useless in the real world.

	JPFs	Students	Practitioners
Reasoning with:	Casual stories	Laws	Causal models
Acting on:	Situations	Symbols	Conceptual situations
Resolving:	Emergent problems And dilemmas	Well-defined problems	Ill-defined problems
Producing:	Negotiated meaning And socially constructed understanding	Fixed meaning And immutable concepts	Negotiated meaning And socially constructed understanding

Sources: Brown et al. (1989)

Figure 2: Situated Learning

Therefore, in order to avoid such a danger, situated learning advocates that schooling should embrace the enculturation process and allow students to learn by engaging authentic activity i.e. through cognitive apprenticeship.

> "Cognitive apprenticeship methods try to enculturate students into authentic practices through activity and social interaction in a way similar to that evident- and evidently successful- in craft apprenticeship...[It] supports learning in a domain by enabling students to acquire, develop, and use cognitive tools in authentic domain activity" (Brown et al. 1989:37 &39)

This means that the role of the teacher is to help students construct knowledge instead of giving them a particular set of knowledge with a pre-defined instructional structure. Hence the design of situated learning should try to incorporate authentic tasks, "real-life problem solving including ill-structured goal and opportunity for the detection of relevant versus irrelevant information" (Young 1997). Furthermore, they suggest that knowledge should generate understanding through a community of practice and legitimate peripheral participation, which brings social and cultural factors into the learning process.

Legitimate peripheral participation through community of practice is another important component embedded in the concept of situated learning. It came from the work of Lave and Wenger, who combined educational concepts of learning by doing and apprenticeship with the analytical methods of Marxism (Lave 1988; Lave and Wenger 1991; Hay 1993). This conceptual notion refers to the social process in which a beginner, novice or newcomers starts with peripheral activities through observation and guidance from experts, and gradually progresses to master skills and ultimately become an expert or oldtimer himself. It implies the shift of a newcomer's peripheral position in a socio-cultural community of practice, becoming "progressively more engaged and more active within that socio-cultural practice" (Hay 1993).

Proponents of community of practice disdain the idea of classroom training, i.e. where professionals remain out of a context in which such knowledge might be applied. For these researchers, skill or professional knowledge is acquired and transferred in a real situation in which students or apprentices have a chance to observe and engage with experts and others. Examples of this kind of knowledge transformation process are seen in apprenticeships (Lave and Wenger 1991), physical working environments (Brown and Duguid 1991; Brown and Duguid 1992; George, et al. 1995) and virtual teamwork (Robey et al. 2000). In a teaching and learning context, teachers should use narratives and stories to allow students to enter the culture, help them progress from the role of listener to active participant, and engage in problem solving in the stories that mimic real life settings.

As discussed above, situated learning contrasts with conventional teaching practice, which separates knowing and doing. Pointing instead to workplace learning and professional apprenticeship of different kinds, advocates of this approach recommend that teachers should abandon the rigid and predefined instruction design, and the idea that learning is a response to teaching (Harley 1993). Instead, they should endeavour to incorporate authentic tasks, replace abstract concepts by stories, and promote social interaction and collaboration as a means of supporting student sense-making and the knowledge creation process. The last point of promoting social

interaction and collaboration in learning is the central premise of collaborative learning, which forms our second educational research framework.

3.1.2 Collaborative Learning

Sharing the belief with situated learning that knowledge is a social act, collaborative learning posits and stresses the view that a better quality of learning is achieved when students work together as a group. It promotes the development of higher-order and critical thinking through discussion, negotiation, debate, and collaboration in a group (Sullivan 1996). Rogers (1983) suggests that " everyone is entitled to an opinion, and it is out of such diversity that creativity emerges. Truth gradually evolves out of the interaction of all."

This approach transforms the role of teachers from authoritative instructors into mediated facilitators. The learning process here is not a passive one representing an instruction which is received through a one-way relationship between instructors and students. Instead, students are actively engaged in a learning process mainly with their peers in a classroom or a group and the communication flows are more dynamic and frequent since students are information-creators rather than information-receivers in such an environment. Consequently, the main purpose of teachers is to facilitate group discussion and provide guidelines when necessary.

However, it does not imply that collaborative learning completely disregards the benefits offered by the traditional lecturing method (Sullivan 1996). Instead of seeing it as a mechanism of structured knowledge transmission, collaborative learning has different interpretations of the function of the lecturing tradition. It proposes that lecturers, who generally are experts in the field, enable students to obtain some fundamental understanding of the subject they are studying. This argument lies close to central theme of situated learning. Information generated from lectures allows a student to go through the first stage of self-reflection with his or her prior experience of the world. The outcome of this process gives "an opinion" as suggested by Rogers (1983) and this opinion will then be shared, reshaped, refined and finally

accommodated as result of group interaction and continuous dialogue with teachers. Apart from helping students to develop critical thinking abilities, this approach also implicitly improves students' interpersonal skill as they need to learn to listen, communicate and liase with other members in a group (Leidner and Jarvenpaa, 1995). In addition, some studies indicate that collaborative learning increases student enjoyment and motivation and also is more cost saving in comparison with the individualist tutoring system (Sheridan 1990; Warmkessel and Carothers 1993).

The work of psychologists such as Johnson and Johnson (1987 and 1991) and Slavin (1985; 1988 and 1990) offer some good guidelines for educators who wish to pursue collaborative learning strategies in classrooms. In particular, the five fundamental elements of cooperative learning by Johnson and Johnson are widely adopted in practice:

1. Positive interdependence: group members must share a common goal and resources;
2. Promotive interaction: group members must help each other to work efficiently and effective, and work together as individuals;
3. Individual accountability: group members must have individual accountability and personal responsibility;
4. Interpersonal and small group skills: group members must communicate with, support, and resolve conflicts with each other constructively;
5. Group processing: group members must maintain good working relationship and provide feedback to each other. (Johnson and Johnson 1987; Johnson and Johnson 1991; Waggoner 1992).

Why collaborative learning?

In educational practice, helping students to achieve a certain learning goal could be structured under three different educational settings: cooperative, competitive or individualistic. A cooperative setting means that with the aid of guidance from a teacher, students are grouped to work together towards a shared goal. By contrast, a competitive structure requires students to compete against each other,

with the idea of winner and losers, in order to reach a defined achievement. An individualist environment permits one to work for her or his self-interests.

Proponents of collaborative learning hold that this method of learning can help students achieve higher-order thinking and longer information retention than those who work independently. The shared learning offers students a chance to engage in discussion and debate, take responsibility for their own learning and hence obtain a critical thinking ability. Over the years, many evaluative researches have been carried out on students' achievement and performance in order to verify the efficacy of cooperative, competitive and individualist teaching/learning strategies. According to a meta-analysis of over 120 studies at the college level, Johnson and Johnson (1993) found that most results showed strong evidence of higher achievement via cooperative learning. Those results held for various tasks, spanning the verbal, mathematical and procedural. In another study by Miyake (1986), she concludes from her experimental study that students generated more constructive criticism and self-critiquing when learning in collaboration than with individualist learning. In addition, in the study of Antil *et al.* (1999) on interviewing teachers from six different elementary schools at the United States, the result shows that 93% of teachers used forms of cooperative learning strategies. Teachers who were interviewed identified the four themes for subscribing to cooperative learning as "active learning", "active involvement", "social learning" and "personal experience as learners". Other empirical studies also suggest that students are more motivated, have a higher level of long-term memory, a lower drop out rate (particularly in the case of distance education), and collaboration with other ethnic groups improves race relations (Silverman 1995; Watabe, et al. 1995; Antil, et al. 1998). Furthermore, according to Johnson and Johnson (1993), the volume of accumulated researches on collaborative learning strategies has made this pedagogical method not only the most popular teaching practice but also acquire a validity and generalisability rarely found in the education literature (Johnson and Johnson 1993).

A Brief Summary of Situated and Collaborative Learning

The preceding sections introduced the fundamental concepts of both situated and collaborative learning. We can summarise these two approaches in terms of: learning activities, the role of teachers and learning outcomes. First, with respect to learning activities, both educational strategies equally regard the importance of context and group interaction as part of learning process. Although situated learning is more focused on the importance of authentic activities and anchored instruction, collaborative learning concentrates more on how to promote learning through group collaboration. Second, teachers posit different kinds of roles under these pedagogical designs. In the traditional instruction practice, teachers are seen as knowledge-holders responsible for knowledge transmission between themselves and the students in a class. The relationship between teachers and students is didactic in nature. However in order to conduct a situated learning strategy, teachers need to portray themselves as "coach/mentor" rather than "lecturer/grade-giver" (Young 1996). They present themselves as "models for performing learning tasks" (Winn 1993) and provide advice on how students can improve their performance. Furthermore, they confer on students the role of expert in a particular aspect of group task, and then promote the process of reciprocal teaching to others in the same group. As a result, "the role of apprentice-master is shared among the students and the teacher"(Winn 1993). Like the role of the teacher in situated learning, the teacher becomes a facilitator in the group interaction process. The job of the teacher is to create group activities such as peer critiquing, joint writing or problem solving projects, and to help maintain the group communication and discussion in order to assist individuals and groups to achieve the shared goal. The success of collaborative learning depends greatly on how well the teacher is able to promote group collaboration and negotiation effectively and efficiently.

Finally, proponents of situated and collaborative learning hold that there are several beneficial learning outcomes from these two learning strategies. They suggest that situated learning connects a specific context and in which the particular knowledge is to be learned and applied. As a result, students learn conditions under which the knowledge should be applied i.e. the ability of linking knowing and doing.

This idea of authentic activities renders situated learning outcomes more practical in nature. Besides, in their opinion learning *in situ* assists and stimulates the process of creative thinking. Observations show that students often learn how to apply their current knowledge in new situations as a consequence of situated and collaboration instruction strategies (Kumar 2000). Moreover, group collaboration contributes the course of friendship building among peers and improves student interpersonal skills. Such skills play an important role in both student career development and social ability in general. Lastly, with the process of negotiation, debate and reflection with peers and teachers, students are more likely to acquire critical and higher-order thinking skills, and to retain learnt information and knowledge much longer than those placed in a individualist learning environment.

Critiques of Situated and Collaborative Learning

Considering the many benefits created by situated and collaborative learning, there are still some criticisms of these social constructivist approaches to learning. Anderson *et al.* (1996) make a central criticism that the claims advanced for situated learning are not "theoretically sound". Although they do agree that situated learning makes a valuable contribution to the educational awareness regarding knowledge learned in the classroom and knowledge required in the real work setting, they disagree with some assertions of the situated learning camp. In particular, they raise objections to four main claims made from the situated learning perspective. The proponents of situated learning see that learning is grounded in the precise situation in which it occurs, meaning knowledge is specific to the situation in which it is applied, and that more general knowledge is not transferable to the real-world situation. First, Anderson *et al.* (1996) lodge a protest on the most often cited situated learning example of Brazilian street children, who are capable of calculating mathematical tasks while selling on the street, but fail to perform similar calculation at school. They argue:

> "they [proponents of situated learning] demonstrate at most that particular skills practiced in real-life situations do not generalize to school situations. They assuredly do not demonstrate the converse. That is, it does not follow these examples that arithmetic procedures taught in the classroom cannot be

> used by a shopper to make price comparison, or a street vendor to make changes. (p6)

In their view, one needs to consider the extent to which knowledge is context-dependent rather than viewing all knowledge as grounded in a situation. Otherwise, there will be a danger that students are only able to relate their newly learned knowledge to the specific situation in which learning occurs (Young 1996). This argument also provides a counter to second belief of the situated learning that knowledge does not transfer between tasks. They further provide evidence that demonstrate the existence of large transfer, modest transfer, no transfer or negative transfers of knowledge. In contrast with situated learning's claim, such evidence indicate that transferability is a function of the amount of practice and of the degree of shared cognition elements.

The third claim of situated learning regards the assertion that training by abstraction is of little use. This argument is formed mainly from the idea of apprenticeship and learning by doing, strongly promoted by Lave and Wenger (1988 and 1991). On this issue, Anderson *et al.* (1996) suggest that abstraction instruction can be effective, and the choice between abstract and specific instruction should depend on the cost and frequency of different training and the range of jobs to which such knowledge can be applied. Finally, they also object to the assertion requiring instruction to be conducted in a complex and social environment. With the examples of team sport and musician orchestra training, they counter that training is often more effective when nearly independent parts are practised first, before joining the whole parts together. For instance, student needs learn how to play violin independently first, before joining the orchestra and absorbing the orchestra culture.

In addition to their criticism of situated learning, the notion of learning in a social context leads to their further doubts on the effectiveness of collaborative learning as praised by many others. In contrast to the claim of Johnson and Johnson (1993) on generalisability, Anderson *et al.* (1996) cite the work by the Committee on Techniques for the Enhancement of Human Performance, and demonstrate that studies on collaborative learning frequently are "not being well controlled", and that

relatively few studies " have successfully demonstrated advantages for cooperative learning versus individual learning". In an ill-implemented collaborative learning setting, teachers sometimes could have problems identifying who is doing the work in a group, and consequently the problem of the free-rider might arise. Salmon and Globerson (1989) also report that some aspects of negative group interaction such as "the sucker", "the status differential" and "ganging up" effects emerge with collaborative learning activities. For example, group members with high ability and motivation might take on the main role in order to benefit themselves, regardless of any initial group collaboration agreement. If teachers are not able to detect, or choose to neglect such a situation at the early stage of group development, it may lead to the less-motivated and less capable students withdrawing from group learning or learning activities as a whole.

Moreover, Antil *et al.* (1998) suggest that although the concept of collaborative learning is well accepted by most teachers, there are still discrepancies between cooperative learning in practice and the models advocated by cooperative learning researchers. This problem is normally explained by the way that the teacher training itself takes place. It seems that such training is commonly delivered in the form of traditional tutoring system, therefore it is difficult for teachers to learn properly the techniques for collaborative learning facilitation. Also, it can be difficult for teachers fully to understand and appreciate the importance or value of collaborative learning if they themselves are not taught in that way. Antil *et al.* (1998) further remark that, compared with individualistic work, it is still debatable whether individual differences enhance everyone's learning quality or leads to a much longer learning time for some of the more able pupils in a group.

3.1.3 Situated and Collaborative Learning in Online Education

Despite some criticism of situated and collaborative learning in traditional classroom teaching, we consider that both these teaching practices have more advantages than disadvantages in terms of learning outcomes and other important skill developments. Moreover, the advent of collaborative technologies enables the

implementation of these two concepts extending beyond the physical learning environment. Traditionally, students at distance rely heavily on self-motivation and printed materials that guide the process of self-learning. This reflects on the behavioural approach to teaching and learning. However, the philosophy of social constructivism has quite an influence on the work of Garrison in distance education, that centres on two-way and interactive communication between (among) teachers and students (Garrison 1989; Garrison 1993; Garrison 1997). In his theory of communication and learner control, the learning process is a collaborative experience that depends upon the acts of communication. He explains that 'the educational transaction is upon seeking understanding and knowledge through dialogue and debate (Garrison 1989).' This belief is shared with social constructivists :- that knowledge is constructed mainly through interaction with others in a particular context.

In the case of distance education, the form of facilitation can be achieved by providing students with a good feedback- with characteristics of immediacy, regularity, explanation (rather than judgmental), conciseness and clarity (Store and Armstrong 1981). In Garrison's extensive studies on communication modes in distance education, he argues that the problem of one-way communication through media such as lectures or broadcasting does not allow feedback, or only very little. Therefore, using emerging technological innovation to facilitate feedback and collaborative learning becomes one of primary concern in two-way communication. Of those technologies, he proposes CMC as an appropriate candidate for fostering a collaborative learning environment in the situation of online education (Garrison 1997). Additionally, the asynchronous mode of communication and easy access to the system can extend group learning opportunities across time and geographical boundaries. Hence, students are able to discuss and socialise with other or with teachers at the time and place of their own choosing.

Furthermore, online education advocates suggest that text-based communication, the core of CMC, has high educational value. Proponents pointed out that the written word is strongly related to the development of higher order and critical thinking (Garrison 1997; McCabe 1998). Applebee (1984) argued:

> "The role of writing in thinking usually contributed to some combination of four factors: a) the permanence of the written word, allowing the writer to rethink and revise over an extended period; b) the explicitness required in writing, if meaning is to remain constant beyond the context in which it was originally written; c) the resources provided by the conventional forms of discourse for organising and thinking through new ideas or experiences and for explicating the relationships among them; and d) the active nature of writing, providing a medium for exploring implications entailed within otherwise unexamined assumption.

Text-based communication provides opportunities for students to practise and develop their writing proficiency, which otherwise would be fewer in the situation of face-to-face interaction. In addition, students can retrieve, review or possibly edit others' messages saved on the network. Being able to trace back the development of thought and the reasoning used on a particular topic allows one to develop skills of critical thinking and problem solving.

Apart from collaborative learning online, various technologies also permit opportunities of situated learning in the context of online education. First, the development of hypermedia allows teachers to incorporate authentic and interactive activities into instructional strategies. The Jasper Series is one of the most commonly used educational technologies in situated learning settings (Young 1996). Students are able to acquire knowledge in the situation in which such knowledge can be applied. Secondly, teachers can make a connection for students between what they learned in the classroom and the real-world condition in which they are expected to use acquired knowledge through various hyperlinks on the Internet. The WWW contains a wealth of resources and references created by different experts in a wide range of fields, as already being pointed out in the previous chapter. Through the WWW, students are able to acquire their views, observe their techniques through media files, and even ask experts questions using e-mail or computer conferencing. That is to say, students at school through computers and the Internet can access various communities of practices and consequently acquire context-dependent knowledge. According to this perspective, we would argue that the WWW and CMC enhance opportunities for legitimate peripheral participation and for the creation of apprenticeship relationships unconfined by time and space.

3.2 Technological Frames Analysis

Up to this point in this chapter we have examined and discussed the philosophical underpinnings, instruction strategies, benefits and pitfalls of collaborative and situated learning, and also their relevance in the context of online education. In our view, learning is only one of two crucial components within the concept of online education. This component has been widely discussed and examined (see Section 2.2.1) while the other, i.e. the active role of online technologies, has not been well studied so far (see Section 2.2.3). Although most of the research work on this topic recognises the importance and nature of information technology, it seems that technologies are normally perceived as a means to an end. That is to say, the majority of studies see technology as a useful artefact for creating and fostering a collaborative learning environment with the aim of helping students to achieve desired learning outcomes, such as problem solving or critical thinking skills. Hence, most studies concentrate on whether technology has lived up to expectations.

Despite sharing these researchers' views about the significance of situated and collaborative learning online, in this study we intend to make a closer examination of both the position and adoption process of information technology deployed for this type of education purpose. We want to understand how students assume, interpret, expect and consequently behave towards online technology at different points of time over the period of online education. Unlike other studies, we are not only concerned about student learning outcomes, but also about their assumptions, knowledge, understandings and use of technology. Thus, having understood the IT appropriation process, we are able to further examine the intertwined relationship between learning and IT adaptation. As a result, we might be able to offer reasons why different learning outcomes were achieved despite using similar form of technology.

In order to do so we introduce here the concept of technological frames analysis as the second approach in our overall theoretical framework. Technological frames analysis was developed to understand individual and organisational meanings of technology from the philosophy of social cognition and of the social construction

of technology (SCOT), which belongs to part of the social constructivism philosophy of technology. The discussion below on technological frames analysis will be organised into three sections. We will start with an overview on the current work on the sense-making process of IT adaptation within the IS field (Section 3.2.1). The overview will highlight the importance of technology interpretation in the process of technology appropriation, consequently strengthen the underlying argument of this thesis. This will be followed by the introduction of the notion of technological frames analysis in Section 3.2.2, which will lead to the discussion of its empirical applications in the third section (Section 3.2.3). The fourth section (Section 3.2.4) will outline some critiques of technological frame analysis. Later, we synthesise this approach with situated and collaborative learning to complete the theoretical framework, deployed to inform our empirical data collection and analysis process.

3.2.1 Making sense of Information Technology

In Section 2.2.3, we have demonstrated that current studies on student satisfaction have both explicitly and implicitly worked around the Technology Acceptance Model (TAM). We have also demonstrated that although TAM has received a wide recognition on the determination of technology usage, researchers from the IS interpretivist paradigm have shown that other than "perceived ease of use" and " perceived usefulness", contextual issues, such as management structure, power and work practice, also play an important role in the process of technology adaptation.

The inclusion of contextual issues has been an interest to organisational researchers over the past few years. This school of research opposes the notion of "technological determinism" and suggests that users make a decision as how and what to interact with various properties embedded in a technology in accordance with the time, place and circumstance in which they are situated in. Thus deploying different theoretical perspectives subscribing to this worldview, many organisational researchers have made an attempt to address the emergent and situated relationship

between technology and work practice. Henfridsson (1999) summarises that there are five theoretical perspectives in studying IT-adaptation: action; actor-network; phenomenology; structurational; interpretation.

In his work, Henfridsson categorises the work by Ciborra and Lanzarra (1990) on formative context, and by Orlikowski (1996) on situated change as an action perspective on IT-adaptation because these approaches consider " social action as the important source of interpretation" (Henfridsson 1999:23). Ciborra and Lanzarra (1990) developed a set of "interpretive vocabulary" that human agents use to interpret complex and unorganised changes in the organisational setting while Orlikowski (1996) used terms " planned change" and "situated change" to differentiate the intended from the unintended use of technology in organisations. The second perspective is an actor-network approach originated from the work of sociologists Law and Latour. Some organisational researchers have borrowed the concept of "enrolment" and "inscription" to study the process of social inclusion of technology (Monteiro and Hanseth, 1996; Lin and Cornford 2000). Phenomenology perspective in IT adaptation is rooted in Heidegger's thinking on the essence of information technology. Building on this school of thought, Ciborra (1996) argues that the process of technology appropriation involves three stages: perception, circumspection and understanding. Although identifying factors contributing to the success of IT appropriation, Ciborra (1996) does not offer further explanation on how these factors are associated with three suggested stages. Structurational perspective applies Gidden's structuration theory to study the relationship between IT and organisations (Barley 1986; Orlikowski and Robey 1991; DeSanctis and Poole 1994). The application of structuration theory in IS research have offered insights the process of IT integration and structuration in organisations.

Interpretation perspective, which is also subscribed by this thesis, builds on social cognitive philosophy on information technology. Orlikowski and Gash (1994:175) consider the importance of such understandings:

> ".... people's interpretations of a technology is critical to understanding their interaction with it. To interact with technology, people have to make sense of it; and this sense-making process, they develop particular

> assumptions, expectations, and knowledge of the technology, which then serve to shape subsequent actions toward it. While these interpretations become taken-for-granted and are rarely brought the surface and reflected on, they nevertheless remain significant in influencing how actors in organisations think about and act toward technology."

The last point about "interpretations become taken-for-granted" perfectly describes the current research status on online education. Apart from broadly showing online technology as a " convenient", "easy-to-use" or "useful" tool (Section 2.2.3), little study has revealed student and teacher's assumptions and interpretations of different technologies, and the changes, if any, of these assumptions and interpretations over the period of technology use. With the third input from the concept of technological frames analysis, we intend to explore this rarely studied phenomenon in the field of online education.

3.2.2 Concept of Technological Frames Analysis

The notion of technological frames analysis was developed by Orlikowski and Gash (1992 and 1994) to investigate the underlying assumptions, expectations, interpretations and knowledge that individuals hold towards technology. Apart from drawing on the original work of both Orlikowski and Gash, this thesis also builds on the analysis on technological frames provided by Lin (2000).

The Notion of Frames

The frames idea was originally developed by Marvin Minsky in the field of artificial intelligence. Minsky (1975) introduced the term 'frame' to represent "a data-structure representing a stereotyped situation" (p212). In addition to artificial intelligence, the similar concepts or notions have also developed and applied in other fields such as cognitive psychology and linguistic study. There are many terms used to describe the formation and existence of such understanding: "schema", " cognitive maps", " mental models", "frames", "paradigms", "scripts" and "thought worlds" (Orlikowski and Gash 1994). Of those, Minsky (1975) suggests that the idea of frame

was rooted in "the tradition of the 'schema' of Bartlett and the 'paradigms' of Khun" (p213).

The idea of technological frames analysis was inspired by the social cognitive approach to studying organisational behaviours. The social cognitive approach shares the same belief with social constructivism that knowledge cannot effectively construct meaning in isolation, and reality is a personal interpretation dependent on how individuals perceive their experiences. With these views of epistemology and ontology, social cognitive theorists maintain that action is subject to interpretation of the individual on the basis of his worldview and the surrounding environment, as Bandura (1986) argues " what people think, believe, and feel affect how they behave" (p25). Gioia and Manz (1985) made a point that despite being interested in cognition/behavioural relationship, social cognitive approach concentrates "more on behavioural and environmental influences than on cognitive influences such information processing" (p527).

Within the scope of organisational studies, a frame owns several characteristics. First, a frame is a mechanism for an individual's sensemaking. It allows people using it to reconcile their current knowledge with new information presented by the environment and then to construct meaning to their understanding of the world. With this new understanding, a frame provides people a guide to enact on the interpretations of their experiences and of the world around them. Second, a frame acts as a filter system with which people decide whether to interact or ignore a piece of information. This means that a frame permits people to " select and process sensory information, rather than simply react to whatever impinges on their sense organs" (Bandura, 1986:198). For instance, if people face similar situation which has occurred in the past, they are most likely to react in accordance with experiences and knowledge obtained from the past and anticipate similar outcomes. However, if such behaviours fail to produce expected results, a frame will take control again and screen for extra information required in order to achieve the desired outcomes. As Minsky (1975:213) explains,

> "The frame systems are linked, in turn, by an information retrieval network. When a proposed frame cannot be made to fit reality- when we cannot find the terminal assignments that suitably match its terminal marker conditions-this network provides replacement frame. These interframe structure make possible other ways to represent knowledge about facts, analogies, and other information useful in understanding."

Another important component of frame is to do with time and space. A frame of the individual is always situated in particular time and space context. Despite deploying the same frame as a reference, the context in which individuals are located might constrain and elaborate their interpretations of an object or event and therefore lead to different understandings and actions as a consequence. This explains the distinct implementation results of two geographical information systems (GIS) by two different groups: geographer and computer scientists. Although both groups might use the same reference to make a sense of GIS, Robey and Sahay (1996) reveal that the opposite perceptions of space held by these two groups resulted in different decisions as how GIS should be implemented (Robey and Sahay 1996;Sahay 1997). Finally, Orlikowski and Gash (1994) also make a point that frames normally operate in the background and do not exist in physical forms. They act as mental models through which people actively transform and construct information and hence are able to enact things. Therefore, one can not directly measure or detect frames but can understand them by gathering the meanings that people ascribe to things and observe them through people's actions in which cognitive meanings are embedded.

Although frames are held independently by individuals, there are the existence of shared frames. Social cognitive approach suggests that in the course of socialisation, a certain group of people generate or share the same beliefs and assumptions towards some phenomenon. Taking again the carpenter apprenticeship mentioned in the previous chapter on situated learning as an example, a carpenter apprentice initially might hold a certain set of knowledge, expectations and interpretations of the use of the chisel before entering the apprenticeship. However, having gained working knowledge and observation of the practice of experts, the apprentice unconsciously reshapes his assumptions, beliefs and interpretations of chisel use. Consequently he shared a group frame with others in the carpentry profession. But this shared frame of chisel use would be different if the apprentice

enters the apprenticeship of cabinetmaker instead. Shared frames commonly exist among a group of people having similar educational background, social upbringings, interests or profession. Nevertheless, it is important to note that group frames do not necessarily imply all members of a group hold exactly the same belief system. Rather through experience, interaction or communication, group frames refer to members of a community sharing a core set of assumptions, expectations and interpretations of objects and events around them, and they "achieve a certain similarity in the way they process and evaluate information" (Gioia and Sims 1986:8). Hence, group frames serve as a basis for groups to make sense of events and determine any necessary actions in response to the event. In the situation of an organisation, an organisational frame permits members of the organisation to assign meanings to activities and events taking place and subsequence behave appropriately within the context of organisation (Lin 2000).

Orlikowski and Gash (1994) also remark on the difference between shared frames and subculture, which sometimes might cause some confusion for people. From their perspective, culture is a social system embedded with the particular language, pattern of behaviours, norms and customs that govern how people behave, judge and talk, while frames refer to cognitive structures or mental models that assist individuals' understanding of the world...

> " where cultural and subcultural analyses provide interpretations of context-socially established webs of meaning and actions- frames of references offer a crisp and powerful lens for focusing specially on how people make sense of particular aspects of the world" (p178).

Technological Frames

Building upon the concept of frames in social cognitive approach to organisation behaviours, Orlikowski and Gash (1992; 1994) extend the applicability of frames analysis in organisational science and further develop it into the idea of technological frames since they find that technology issues are not specifically addressed *per se* in social cognition studies. They use the term 'technological frames' to address the mental models of how members of an organisation member assume,

expect and interpret the technology he/she uses in that particular organisation. Subsequently, technological frames not only include the nature and functionality of technology itself, but also embrace "the specific conditions, applications, and consequences of technology in particular context" (Orlikowski and Gash 1994:178).

Technological frames share fundamental characteristics rooted in the general concept of frames discussed above. The concept acts as a sense-making device for individuals to ascribe meanings to and process interpretation of the role of technology. With assigned meanings and interpretations, individuals can in turn make decisions on the appropriate action to respond to the role and use of technology. Also, technological frames serve as a filter system to help people construct their understandings, expectations of, and confidences in technology, based on their past experiences of interacting with similar technology, and therefore to direct the desired actions towards technology. In an experimental study carried out by Compeau *et al* (1999) on social cognitive theory applied to computing technology, they find that the higher the individual's computer self-efficacy i.e. the perceived computing ability, the higher his/her use of computers. Correspondingly, in an online learning situation, at the outset of their courses some students might have more positive or negative expectations of technology than others because of their experiences in using similar technologies in the past. Therefore, in our empirical study we expect to observe various kinds of reactions and behaviours towards online technology at the beginning of its use.

In addition, a frame is also structurally flexible and context specific, and this is equally true of technological frames. Many IS studies have demonstrated that implementations of the same technologies can result in different social consequences because of distinct and complex organisational structures and cultures in which information technologies are developed and adopted. These findings overturn the early IS assumptions that technology is objective and independent artefact with known properties and lawful order, and the way to understand such technology is through a reductionist or functionalist approach. Rather, these findings suggest that information technology is part of a social system and actively interacting with other

components such as politics, economics, social and legal norms and working practices. As a result, meanings of information technology are not directly derived from its technical features but indirectly from interpretations of human actors involved in this social system, that is, information technology is socially constructed and shaped. This philosophy of technology is normally known as the social construction of technology (SCOT) initiated by Bijker and Pinch (1987). To further develop the concept of technological frames, Orlikowski and Gash incorporate this philosophy to explain how social groups arrive at similar understandings of technology through a series of discussions and negotiations and through the encounter with and interaction with technology.

The SCOT consists of three prime concepts: relevant social groups, interpretive flexibility, and closure (Sahay and Robey 1994;Brey 2000). Relevant social groups refer to different sets of people who share common interests or backgrounds interacting with technology. These groups might be line managers, vendors, technologists, shareholders or end users in the organisational context, or students, teachers, administration staff and technologists in the situation of online education. The identification of relevant social groups is crucial for the SCOT studies. According to Bijker and Pich (1987), only when relevant social groups are located, one can start defining the problems and hence tracing the common technological frames shared among members of relevant social groups. Different relevant social groups might define problems or share technological frames differently, that is, technology has interpretive flexibility. One relevant social group in an organisation tends to define problems in a different manner from another social relevant group, and hence each group assign different meanings to the surrounding artifact or technology, subsequently different actions.

This interpretive flexibility offers an explanation of diverse social consequences with the implementation of identical technologies. In terms of technological frames analysis, Orlikowski and Gash (1994) term this situation the incongruence of technological frames, whereby " there are differences in important expectations, assumptions, or knowledge about some key aspects of the technology"

(p180) between groups. By contrast, when congruence in technological frames takes place, it equally refers to the closure of technology in the SCOT sense. This means that, for instance, people or relevant social groups "share similar expectations around the role of technology in business, the nature of technological use, or the type and frequency of support and maintenance" (p180).

However, despite their similarities, Lin (2000) points out some differences between Bijker, and Orlikowski and Gash on technological frames analysis. In her view, the former is strongly influenced by the SCOT and is more concerned about the process of technological change and stabilisation, while the latter develops on the basis of social cognitive theory and places more attention on the meanings that individuals ascribe to the technology. Furthermore, she argues that a technological frame in the SCOT is an outcome of jointly agreed interpretations determined by the relevant social group, and is external to the individual. Nevertheless, a technological frame based on the view of social cognition means that it is unique to individuals and "at the same time individuals who may share the same group can share a technological frame which is sustained continuously through interactions" (Lin 2000: 54).

3.2.3 Applications of Technological Frames Analysis

As we pointed out earlier, the premise of technological frames analysis is to understand individuals' understanding of technology and hence technology use in organisations. The explicitly empirical applications of technological frames analysis were mainly carried about by Orlikowski and Gash, although there are a number of articles by other researchers referring to or implicitly adopting the idea of technological frames (Sahay et al. 1994; Sahay 1997; Barrett 1999; McLoughlin et al. 2000). In the following, we will briefly discuss the outcomes and implications of some technological frames analysis available within the IS literature.

In her article of *Learning From Notes: Organisational Issues in Groupware Implementation,* Orlikowski (1993) explored changes in employee's working practice

and social interaction patterns as a result of introducing the Lotus Notes technology into one local office of a large organisation. Using social cognitive theories, this study indicates that without appropriate mental models and structural properties in place, the implementation of groupware technology is less likely to be adopted by user groups to achieve collaborative work as that was originally intended. In terms of mental models, she argues that when facing a new technology, people tend to make sense of it through their existing technological frames. In this case, without any new information given or communication available, employees can only draw on their existing technological frames, i.e. e-mail system, to assign meaning to groupware technology. Therefore they use the Lotus Notes as if it were an e-mail system instead of sharing data or working collaboratively as initially intended in the Notes design.

The results of this empirical work suggest that the extent to which people will change their technological frames depends on: 1) the kind and amount of information about the technology given to them, and 2) the availability and types of training programmes they receive on technology. Furthermore, according to this study the success of technology implementation also relies on the structural elements in organisations. If the nature of technology is consistent with the organisational structure the chance of successful implementation is higher. Collaborative technologies are more likely to used and adopted positively in an organisation that has a collaborative working culture or supporting policies and reward systems.

The continuing development of technological frames analysis in organisations was demonstrated in Orlikowski and Gash's first joint paper: *Changing Frames: Understanding Technological Change in Organisations* (Orlikowski and Gash 1992). In this paper, they argue that tracing the refinement of technological frames across groups in an organisation can act as the indicator for organisational changes around the information technology over time. They further define such changes into seven dimensions of technological frames along with types of technological changes. With this theoretical framework, they propose that the:

> " diagnosis of frames should indicate areas of congruence and incongruence, allowing change agents to identify the order of change people are expecting

> and prepared for, and their implicit and explicit measures of success. This should lead to more effective management of the communication, direction and timing of technological change efforts." (Orlikowski and Gash 1992 24)

Building on their 1992 article on technological frames analysis and the exploratory fieldwork discussed previously, Orlikowski and Gash (1994) continued to refine the technological frames concept with the publication of *Technological Frames: Making Sense of Information Technology in Organisations*. In contrast with the previous two articles, this paper contains a detailed description of the underlying theoretical strands and arguments complemented by the continuing empirical work carried out in the same office as before. In addition, they abandon the earlier idea of seven dimensions derived from their literature review in the 1992 paper, instead they opt for inductive approaches to study technological frames. They explain that technological frames should be interpretively flexible and context specific, so that the validity of technological frames analysis is higher when frames are examined *in situ* instead of with imposed categories.

Using interpretive research methods, they define that within the organisation Alpha, there are two social relevant groups: technologists and users, and three domains of technological frames: nature of technology, technology strategy, and technology in-use. The technologist group is comprised of mostly technical staff working in the information technology department, while the grouping of users includes all levels of staff who are at the receiving end of technology, such as consultants or administrative staff. Nature of technology refers to people's understanding and images of the technology, while technology strategy represents people's reasoning on the technology implementation and its value to the organisation, while technology use refers to people's interpretation of the day-to-day use of technology and the potential social consequences of such use.

Orlikowski and Gash find that two groups held very different interpretations and perception in all three aspects, i.e. incongruence of technological frames. According to their findings, technologists had much better understandings of the nature of technology and hence use Lotus Notes effectively to enhance collaboration

leading to the result of changing work practice and social interaction In contrast, with little communication and proper training programme available, user groups made sense of Lotus Notes only as a technology to replace the old e-mail system and telephone. Thus they saw Notes as a means of increasing individual productivity and the use did not change much of their day-to-day work practices. As a result, the findings of the study indicate that if the significant incongruence between technologists and user groups is not resolved at the early stage of technology use, it might be problematic in the long run, since " the cognitive habits formed through initial exposure could prove difficult to change later" (p198).

Despite highlighting the pressing matter of incongruence of technological frames in organisations, Orlikowski and Gash do not provide suggestions or elaborate on how such incongruence can be resolved. To address this shortcoming, Lin and Cornford (2000) use the idea of social translation from actor network theory to explain how a process of social translation of technology at the early stage of project formation leads to shared technological frames among different social relevant groups in organisation. According to their data collection and analysis on three interests group at the early stage of implementation, there were different interpretations, expectations and knowledge about the particular technology to be adopted by the organisation. Following the line of argument taken by Orlikowski and Gash (1994), the apparent incongruence tends to result in project failure. However, the project in Lin and Cornford's study was reported by the OIS (technologists group) as a big success. In a closer scrutiny of the situation, Lin and Cornford (2000) discover that recognising the differences, OIS embarked a series of social translation process with the intention of reframing people's understandings and expectations of technology. For instance, members of the OIS actively promoted their preferred product with a greater degree of confidence. As a consequence of such efforts, the user groups altered their technological frames and abandoned their initial preference for another product, and went along with the OIS choice. The findings of the study indicate that despite early incongruence of technological frames across various interests groups in organisations, with careful management and sensitive responses, it is possible to

translate successfully the technology into something commonly understood by the various relevant groups and see the emergence of congruent technological frames.

3.2.4 Critiques of Technological Frames

So far, we have examined the underlying theoretical underpinnings and demonstrated the empirical applications of technological frames to understand individuals' perceptions and subsequent behaviours towards technology. However, this framework also has its weaknesses as shown in the following discussion.

One main problem with technological frames analysis is associated with its philosophical premise. As we mentioned at the outset of this chapter, there are two key streams of constructivism: cognitive and social constructivism. Although Orlikowski and Gash (1994) regard their approach as social cognitive with additional input from the social construction of technology (SCOT), one can still spot strong influences from cognitive theory. Cognitive constructivism, sometimes known as the social cognitive approach, objects to the idea of a direct relationship between stimulus and response proposed by objectivists, and strives to understand the psychological process of various transitions from one stage to the next stage in a continuum of cognitive development Nevertheless, there are still differences between cognitive and social constructivism. This is best explained by Folden and Prawat (Prawat and Folden 1994; Prawat 1996), in a series of articles in which they try to distinguish some constructivists' approaches according to the work of Pepper's *World Hypothesis* (Pepper 1942) that provides a classic comparison on different world views emerging through history. Prawat (1996) argues that the underlying philosophy of cognitive constructivism is consistent with a mechanist worldview. This suggestion implies that information processing does not completely rule out the objectivist tradition- the world is objective and knowledge is a representation of reality (Duffy and Jonassen 1991; Henriques 1999).

On this philosophical account, we find that technological frames analysis, to a certain extent, identifies with assumptions and beliefs held within the cognitive

constructivism paradigm. This concept of frames suggests that individuals use frame as a sense making device to help them with the process of understanding and to guide their actions when encountering a new technology (Orlikowski and Gash 1994). Hence technology can be seen as a stimulus that triggers the process of travelling back and forth between assimilation and accommodation within one's cognitive structure, reaching a 'stable equilibrium' at the end, at least in the claims of information processing theorists. Furthermore, the analytical model of technological frames also maintains that the model can capture people's prior mental model about technology, and so can predict behaviour in advance. This resembles the view of cognitive constructivism on predictable relationships between certain input and output, like computer processing.

However, opponents of social cognitive theory contend the appropriateness of seeing mind as a machine or processor whose functions are completely identifiable. They counter that knowledge formation is not a straightforward and predictable story of cognitive change, but is a complex and unpredictable process through social interaction. That is to say, knowledge is an emergent and social product. We refer to this school of thought as social constructivism, discussed in the early section of this chapter. From this perspective, individual interpretations of and reactions toward a technology are not only influenced by their technological frames, but also by their interactions with others in the context. As Lin (2000) points out, technology sense making process involves both self- and social- interaction.

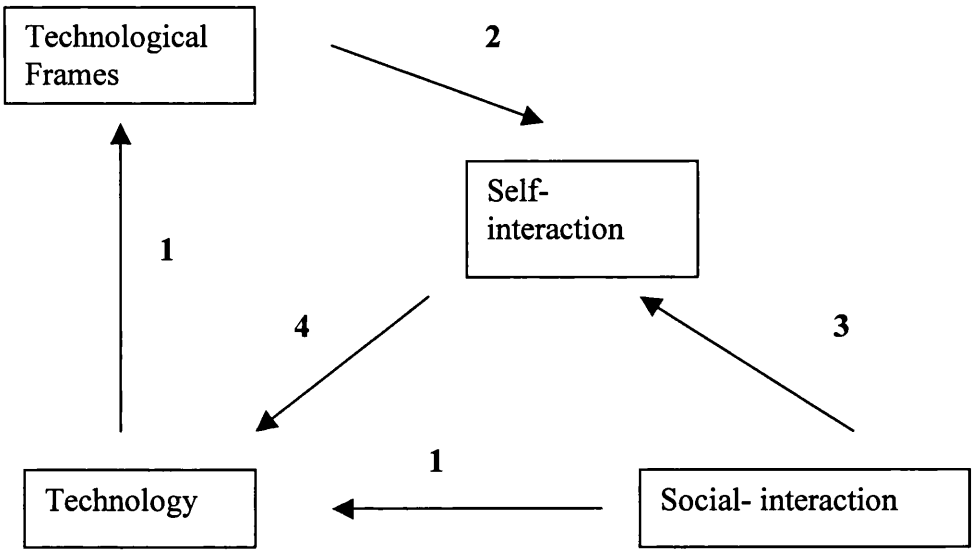

Figure 3: Technology Sense Making Process

Source: Lin, 2000

She describes how when an individual faces a new technology, he/she will use the existing technological frames (arrow 1) to understand it (arrow 2), and then make a decision on how to act towards the technology (arrow 4). The analysis of technological frames would terminate here, however, she argues that there is more to explain. According to the social constructivism approach to technology, the individual will also try to observe others' reactions towards the technology and be influenced by such reactions (arrow 3). Consequently, the meanings that one has assigned to technology are collectively reached through both interaction with one's technological frames and with others in a social-cultural context.

Despite mentioning the role of communication to facilitate changes of one's technological frames in the article *Learning From Notes* discussed above (Orlikowski, 1992), this analytical framework arguably overlooks the importance and impact of social interaction on the meaning formation process. For instance, Orlikowski and Gash (1994) suggest that the significant incongruence of technological frames at the early stage of usage is concomitant with a high tendency of project failure. On the contrary, Lin and Cornford (2000) evidently demonstrate that one can successfully translate incongruence towards congruence through the process of social interaction.

Nevertheless, the criticism on 'stable equilibrium' and 'overlook the influence on social interaction' made towards technological frames analysis was indirectly dealt with in one of Orlikowski's recent papers, *Using Technology and Constituting Structures: A Practice Lens for Studying Technology in Organisations* (Orlikowski 2000). In this article, drawing on the concept of "cognition in practice" and re-examining two propositions associated with structuration models, Orlikowski (2000) proposes the notion of " technology-in-practice" as the extension of structurational theories, which offers a practice lens for studying use of technology. Reinterpreting the empirical findings from her pervious technological frames case study (Orlikowski 1993; Orlikowski and Gash 1994), she illustrated that how technologist and consultants produced different technology-in-practice because of difference in organisation norms, technical knowledge, power structure and work practice. For instance, she explained that the origin of a limited use of technology-in-practice by consultants came from Alpha's time-based billing work practice. In this article, although she did not use the term technological frames directly, by revisiting findings from the same case study, we consider that she indirectly offers justifications of how technological frames are recurrently shaped by social, political, organisational and environmental forces. As Orlikowski (2000:420) elaborates:

> "people enact different technologies-in-practice with the same type of technology across various contexts and practices...they do so in response to various technological visions, skills, fears, and opportunities, influenced by specific interpretations and particular institutional contexts, and shaped by a diversity of intentions and practices to collaborate, solve problems, preserve status, improve efficiency, support work process, learn, and improvise."

She further comments that a technology-in-practice primarily acts as a "behavioural and interpretive template" (Barley 1988 cited in Orlikowski 2000:410). Such views are consistent with her early idea of technological frames analysis. She comments that the modification of technology-in-practice might take place,

> "[because users] have become more knowledgeable about using their technology (through attending training course or watching a colleague's use) or because they have changed jobs and now need to use technology differently in their new work community...as people enact modified technologies they also change the facilities, norms and interpretive schemes used in their use of technology" (Orlikowski, 2000:412)

This statement provides answers to the weakness of technological frames analysis, discussed in this section earlier. The initial technological frames analysis provide little room for the influence of social interaction as well as little elucidation for the change of frames across contexts and over time. However, the concept of technology-in-practice "entails the examination of emergence, improvisation, and change over time as people reconfigure their technologies or alter their habits of use." (Orlikowski 2000: 425)

Having recognised the weakness of technological frames analysis and reflected on the notion of technology-in-practice, this study considers that the formation and change of technological frames influences, and is influenced by, students' ongoing learning experiences and a particular institutional context. The next section provides further explanations on social constructivist learning coupled with technological frames analysis as the synthesised framework to guide us through the enquiry of this research.

3.3 Synthesised Conceptual Framework

There are two elements that make up for our synthesised conceptual framework: situated and collaborative learning, and technological frames analysis. A detailed discussion and investigation of each element have been offered in the previous sections (Section 3.1 and 3.2). In order to have a comprehensive understanding towards the transformation and consequence of student online learning experiences, we cannot only consider learning outcomes or look at online interaction patterns and take technology as static, as did most of studies described in Chapter Two. Rather, we have to take into account both learning and technological factors and recognise their active relationships over the duration of online education. Applying this conceptual framework to guide the process of data collection and analysis, we hope to demonstrate from our case study findings that how contextual elements make an effect on student technological frames, consequently their learning activities and the system use as well as how the evolving interaction with the

technology contribute to reshape their understanding of online education and the system itself.

3.4 Summary

Given our philosophical views on knowledge and technology which we stated at the end of the first chapter, we chose situated/collaborative learning and technological frames analysis as the appropriate theoretical foundation for this thesis. The social constructivism approach to learning posits that knowledge construction is a social and emergent process through group interaction related to real world experience. In the field of education, many studies have shown the importance and effectiveness of situated and collaborative learning in fostering students' critical and high order thinking skills. The advent of CMC provides an ideal environment to enable such kinds of learning activities to take place, mostly without time and space constraints. Part of this study is to explore the process and outcomes of collaborative learning in an online situation.

In addition to the educational factors, we argue that technology in this situation is not only a means to an end, but should also be considered as a actor that affects, and is affected by, student learning experience over the period of interaction. In order to explore students' understanding of online technology, we employed the analytical framework of technological frames which refers to people's assumptions, interpretations, expectations and knowledge about the nature and role of technology. With the references of frames in a specific context, people can then assign meanings to technology and use these meanings to make decisions on how to enact it. Although this framework is so far used in the organisational context, we see no serious problems or conflicts in applying this model in this study. In our view, technological frames analysis is a conceptual framework that offers a mechanism to understand meanings reflected through people's behaviour toward technology in a particular context, which may be either an organisation or an education institution.

In the previous section, we explain the combination of situated/collaborative learning and technological frames analysis as our synthesised conceptual framework for this study. This synthesised framework operates at two levels. First, it serves as the mode of analysis informing the relationship and continuous interaction among context, technological frames and learning. Second, it provides the basis that assists data collection and provides broad category for sorting data at the early stage of data analysis. Applications of the synthesised framework in our fieldwork will be demonstrated in Chapter Five.

We also identify a few theoretical contributions made by this chapter. First, we provide a detailed discussion on the philosophical underpinnings and educational value of situated and collaborative learning in general and then specifically within the context of online education. Second, the concepts, applications and critiques of technological frames analysis are carefully presented and closely examined to demonstrate the benefits and pitfall of this model. Third, we extend the concept of technological frames as originally intended for organisations generally to the education environment in particular. Finally, the synthesis framework shows that the relationship among context, online technology and learning is highly intertwined.

The next chapter details the research design deployed to exploit our research paradigm, methods and techniques.

Chapter Four
Research Design

In Chapter Two, we examined the current research status of the field of online education. Continuing the thread of these discussions, Chapter Three presented a social constructivist approach to technology and education as the underlying theoretical framework guiding the process of empirical enquires in this thesis. In this chapter, we place our focus on the issues of research approach, method and techniques to be followed and adopted in our field study.

Hence we will begin the discussion with two main research approaches of empirical inquiry: positivist and interpretive approaches. In this section, the merits and pitfalls of applying each approach to study information systems are to be examined and compared. The second section of this chapter will investigate various kinds of research strategy and design deployed to study different aspects of online education. After reviewing these common research methods, we will discuss and explain the reasons for adopting an interpretive case study approach as our chosen strategy for this particular study. We will also provide justification for why we select

our own institution as the site of study and finally conclude with the details on the techniques of data collection and analysis used.

4.1 Positivist vs. Interpretive Research in Information Systems

Broadly speaking, any piece of information systems research has a tendency to be categorised in one of two distinct approaches: positivist or interpretive. Other researchers might term this distinction as quantitative or qualitative. Although a quantitative research inclines towards positivism, the philosophical underpinnings for qualitative research are more heterogeneous compared with quantitative research. Guba and Lincoln (1994) suggest that there are four paradigms which a qualitative research can subscribe to: positivism, post-positivism, critical theory and constructivism. Instead of these four paradigms, Orlikowski and Baroudi (1991) suggest that one could categorise qualitative research in terms of positivist, interpretive and critical. Therefore, in order to be much more clear about the research terminology used in this thesis, we will use positivist and quantitative interchangeably as one research stream and qualitative and interpretive as the other research stream in information systems research.

Each research approach embodies different assumptions and views towards ontology, epistemology, axiology, rhetoric and methodology (Creswell 1998). Ontology refers to the nature of reality, epistemology addresses the nature of knowledge and the process of acquiring knowledge, axiology deals with the question of value in research, rhetoric considers the style of language used in the research and finally methodology refers to the way of conducting empirical research. In this section, we intend to compare and contrast the two approaches on the basis of the above five philosophical assumptions and to carry out an examination of their associated advantages and disadvantages in the information systems field. Following this discussion, we demonstrate why we consider a qualitative interpretive research approach to be most appropriate for this thesis.

4.1.1 Positivist Approach

Before the arrival and rapid growth of interpretive research in the past few years, in information systems research, the positivist approach was a longstanding research tradition employed to understand the nature of technology and its consequent impacts in organisations. Originally positivism was rooted in the field of natural science research. The underlying perspective of this approach, "the thesis of the unity of science", was introduced and advocated in social science research as a means to explain, predict and ultimately control social phenomena. The dominance of this approach for studying a wide range of IS issues was apparent in the 1980s. Looking at a number of articles which reviewed and summarised trends of IS research methods (Galliers and Land 1987; Orlikowski and Baroudi 1991; Hamilton and Ives 1992;Horn 1973; Vogel and Wetherbe 1984) it was not surprising to find out that most research methods in the 1980s came from the camp of positivism. On the definition of this approach, Creswell (1994:2) proposes that:

> "quantitative study is an inquiry into a social or human problem based on testing theory composed of variables, measured with numbers, and analysed with statistical procedures, in order to determine whether the predictive generalisations of the theory hold true. "

According to this definition, we can reveal five philosophical assumptions rooted in this research tradition. At the level of ontology, researchers under the positivist camp hold the belief that there is a single reality and that it is external to individual cognition. Based on this perspective, reality consists of hard components connected by a lawful and rigid order. This view of reality also reflects directly on the nature of knowledge perceived by positivist researchers. From the standing point of epistemology, they maintain that knowledge is objective and that it is the results "emerging from the search regularity and casual relationships and scrutinise them through empirical testing" (Hirschheim 1985:16). Consequently, the methodological approach to acquiring objective knowledge is to follow 'the rules of formal logic' and 'the rules of hypothetical-deductive logic' (Lee 1997). In this approach there are no values given in addition to the pre-defined variables and biases are carefully eliminated or controlled by rigorous research steps. As for the rhetorical assumption,

researchers who subscribe to a positivist view of research should distance themselves from the phenomenon or subject that is under investigation and should report their findings in a formal and impersonal fashion.

Although this approach to information systems research is widely recognised and used since the early 1980s, increasingly there have been doubts about its capability and feasibility for allowing information systems researcher fully to investigate technology use in organisations. Galliers and Land (1987) maintain that although the positivist approach "may well be academically acceptable and internally consistent, all too often it leads to inconclusive or inappropriate results" (p900). They reason that information systems is not only about technical systems, but is also concerned about the environment in which technology and human interactions take place. That is to say, an information system is a social system which consists of technical, formal and informal components (Libenau and Backhouse 1990). Unlike a technical system, the environmental and human factors create levels of uncertainty and complexity for IS researchers when studying the impact of technology implementation in the real world.

Positivist research design, such as laboratory experiment and survey, requires researchers to define a limited set of variables, to manipulate these variables using the scientific rules of logic and to represent the result in the form of statistics. These methods might be appropriate in natural science but are likely to be inappropriate for investigation of social phenomena with many factors not easily predictable or controllable. Guba and Lincoln (1994) point out that there are problems with quantification in the study of social science: 1) problem of context stripping, 2) problem of exclusion of meaning and purpose, 3) problem of disjunction of grand theories with local context, 4) problem of inapplicability of general data to individual cases and 5) problem of exclusion of the discovery dimension in inquiry. Hence, because of these problems, it is clear that an quantitative research might be able to demonstrate the relationship between certain technological and organisational variables, but nevertheless would certainly fail to capture the uncertainty and to embrace the diversity embedded in the process of technology implementation in organisations since the positivist research approach tends to oversimplify situations

into a few variables and to disregard the value of context. This is why positivist researchers might have difficulties in explaining the different social consequences in organisations with the same type of technology. Thus, in order to embrace the complexity of social interactions in which information technology is part of, an interpretive approach has evolved as an alternative research method for information systems inquiry.

4.1.2 Interpretive Approach

In contrast to a positivist perspective on social science research, interpretive researchers hold the belief that in order fully to understand the meanings of a complex world populated by human beings, we must interpret through the eyes of those who live in it (Schwandt 1994). Creswell (1994:2) describes the interpretive approach as:

> "an inquiry process of understanding a social or human problem based on building a complex, holistic picture, formed with words, reporting detailed views of informants, and conducted in a natural setting."

Comparing this definition with the one given for quantitative research on the basis of five philosophical assumptions, the contrasting worldview is evident. Proponents of the interpretive approach to social science research believe in the existence of multiple realities perceived by different social actors in different places and at different historical periods. The underlying epistemological assumption is that the nature of knowledge is subjective, and the construction of knowledge is subject to an individual's interpretation in a context in which his interaction with others takes place. In addition, interpretivists argue that knowledge is not fixed, but constantly revised by an individual whenever there is a change of social, economic, cultural and political factors in a context. In other words, knowledge is not all-scientific fact but emerges through one's day-to-day life experiences. Since the purpose of an interpretive study is to understand the meaning of the real world through interpretations of individuals, this type of study is value-laden and recognises the existence of bias. Consequently, the research methodology of this stream should have characteristics of being hermeneutical and dialectical (Guba and Lincoln 1994). The

family of interpretive research includes a number of research strategies such as ethnography, phenomenology, biography, action research and case studies. In this thesis, we choose the case study as our strategy of empirical inquiry and will discuss this in a greater length later in Section 4.3. Finally, on issue of the style of language used, an interpretive study should be "formed with words" (Creswell 1997) and allow the voice of the "passionate participant" to be heard (Lincoln and Guba 1994).

Drawing an worldview described above, an IS interpretive researcher sees that an information system is a socio-technical system in which the relationship between artefact and human being is not all straight forward and clear. As discussed earlier, the positivist research does not allow researchers fully to capture the richness of interactions evolved around information technology in organisations. In contrast, interpretivism posits that the social phenomena must be understood through interpretations that are used by social actors to make sense of themselves, others and the world. Therefore, the aim of an interpretive research, as argued by Walsham (1993), is to "produce an understanding of the context of the information system, and the process whereby the information system influences and is influenced by the context."(p4). As a result, the greatest strength of this approach is to help researcher to 'focus on actual practice *in situ*', to obtain a more holistic view of how members of the organisation give meanings to a particular information systems and enact on it in response to these given meanings (Silverman 1998).

The practical value of interpretive studies in information systems was first vividly demonstrated through the work of Markus in 1983. In her classic paper *Power, Politics and MIS Implementation*, she points out the importance of contextual factors on the consequence of technology implementation in an organisation. Her findings were consistent with the argument that most information systems failures are the consequence of social factors (Lyytinen and Hirscheim 1987). Since then, there are a number of influential IS interpretive studies, such as Orlikowski and Gash (1994) on technology appropriation, Boland and Day (1989) on system design, Walsham and Waema (1994) on information systems strategies, Lee (1994) on the use of electronic mail, and Gopal and Prasad (2000) on the use of group decision support

systems (GDSS), to name a few. More discussion on the purposes and implications of interpretive case studies will be presented in the section of research design later on.

Despite the benefits that enable researchers to grasp the social outcomes of an information system in organisations, several concerns are raised regarding the interpretive research in the information systems field. Since the essence of this approach centres on interpretation, Nandhakumar and Jones (1997) identify some limitations of interpretation that might endanger the research quality: 1) the ability of the researcher to understand the actor's interpretation correctly, especially if both are from different social and cultural conditions, 2) the problem of the difference between what is said and what is done, 3) the issue of secrecy in social interaction. Some actors may not want to raise certain issues or may intend to mislead the researcher's understandings and 4) actors themselves might not be able to give an account of their action since those behaviours form part of their social routine of which they may not fully be aware. However, Klein and Myers (1999) believe that if a researcher can follow seven principles underpinning interpretive research, a high quality interpretive study can be expected. The list of principles guiding interpretive research includes:

- The principle of contextualisation,
- The principle of interdependence between the researchers and the subject,
- The principle of abstraction and generalisation,
- The principle of multiple interpretations,
- The principle of suspicion,
- The fundamental principle of the hermeneutic circle.

Up to this point in this chapter, we have stated what we understand by positivist and interpretive research, as well as discussed the strengths and weakness associated with each approach in information systems research. Next we provide reasons why we consider that interpretive research is more appropriate than positivist research for the purpose of this thesis. First, we find our belief on the nature of information systems fits better into the interpretivist camp. We think of an information systems as a socio-technical system because it influences, and is

influenced by, the surrounding social structures and activities. Second, the underlying philosophical assumptions of interpretive research are consistent with the theoretical framework guiding our empirical study. Recalling our earlier discussions on social constructivism in Chapter Three, there is a synergy between constructivism and interpretivism on the view of knowledge and technology in use. Both paradigms see knowledge construction and technology adaptation as a situational and social process. Third, in Chapter Two, we have presented the argument that because of the use of positivist research methods, the current problem in the existing online education literature is dearth of studies revealing and exploring the richness of the context in which learners, teachers and technologies interact. In order to combat this problem, an interpretive study seems to be a better solution. Taking accounts of these three reasons, we decided that interpretive research is more suited to deal with the phenomenon investigated in this dissertation.

The following table summarises the comparisons of five philosophical assumptions held by positivists and interpretivists.

Assumption	Question	*Quantitative /Positivist*	*Qualitative/ Interpretive*
Ontological Assumption	What is the nature of reality?	Reality is objective and singular, Apart from the researcher	Reality is subjective and multiple, As seen by participants in a study
Epistemological Assumption	What is the relationship of the researcher to that researched?	Research is independent from that being researched	Research interacts with that being researched
Axiological Assumption	What is the role of values?	Value-free and unbiased	Value-laden and biased
Rhetorical Assumption	What is the language of research?	Formal Based on set definitions Impersonal voice Use of accepted quantitative words	Informal Evolving decision Personal voice Accepted qualitative words
Methodological Assumption	What is the process of research?	Deductive process Cause and effect Static design-categories isolated before study Context-free Generalisations leading to prediction, explanation and understanding Accurate and reliable through validity and reliability	Inductive process Mutual simulations shaping of facts Emerging design-categories identified during research process Context-bound Patterns, theories developed for understanding Accurate and reliable through verification

Table 4: Comparison of five philosophical assumptions of positivist and interpretive research approach

Source: Creswell (1998)

4.2 Research Methods in Online Education

The preceding section has examined the philosophical assumptions and the related advantages and disadvantages of positivist and interpretive research in the information systems field. In this part of the chapter, we turn our attention to review research methods that have been adopted to examine the online education phenomenon over the past decade. The review is then followed by a discussion of our chosen research design for this particular study. There are two main sources from which we draw in order to identify research methods for investigating online education issues. The first source comes from our literature review in Chapter Two, where we categorised the research purposes of different studies into three areas (effectiveness studies, interaction analysis and student satisfaction). Here, we go back to these three areas and focus on research methods instead of research purposes. The second source is drawn from the paper *Evaluation Methodologies for Computer Conferencing Applications* by Mason (1992), which provides a comprehensive summary of common research strategies for evaluating the use of computer conferencing in distance education.

Table 5 gives a summary on research methods employed to examine three different kinds of online education focuses and is followed by a more detailed discussion on each method.

Research Methods	Effectiveness studies	Interaction analysis	Student satisfaction
Survey	*		*
Laboratory experiments		*	
Field experiments	*		*
Case studies	*	*	*
Content Analysis	*	*	

Table 5: Summary of research methods in online education

4.2.1 Survey Method

According to our analysis, the survey was the most frequently used method in this area of research, particularly for those studies looking at learning effectiveness and satisfaction issues. Henry (1991) suggests that there are two main reasons for choosing a survey research strategy: one is to 'present information without trying to test a model' and the other is to 'find a causal relationships among variables' (p 274). He argues that the latter counts more research contributions than the former since the results of a model-testing survey enhances our understanding on the relevance of the chosen variables compared with an information-only survey research. However, we find both types of survey research in online education. Using the first type of survey strategy to evaluate student Virtual Classroom experiences, Hiltz states that:

> "pre- and post-course questionnaires completed by students are the most important data source. The pre-course questionnaire measures student characteristics and expectations. The post-course questionnaire focuses on detailed evaluations of the effectiveness of the online course or course segments, and on student perceptions of the ways in which the Virtual Classroom is better or worse than the Tradition Classroom." (cited in Mason, 1992:77)

This type of survey is used extensively to provide information on the extent of online learning effectiveness or attitudes towards the adopted technology (Hiltz and Wellman 1997, Hiltz and Benebunani-Fich 1999, McMurdo and Meadows 1996, Navarro and Shoemaker, 2000). The second type of survey research, i.e. model testing, is normally used to conduct hypothesis testing. A demonstration of this kind is in the work of Webster and Hackley (1997). Using a variety of relevant theories, they form several hypotheses on factors that might affect student learning outcomes and adopt the survey as the main instrument to test prior hypotheses. The discussion on their findings has been made in Chapter Two.

Mason (1992) further points out a number of benefits and problems related to the use of survey research. The main benefit of survey research is that with a large sample size and well-formulated hypotheses, survey results could provide valid and reliable quantified information on different aspects of online learning. Besides, the ability of replicating survey research in various settings offers researchers a mechanism for achieving high external validity. Nevertheless, Henry (1991) maintains that without any secondary data or enough numbers of samples, the quality of such research might be jeopardised. Furthermore, a high quality survey research relies on the development of compelling hypotheses and on the wording of the questionnaire itself. If these two stages of research design are not thoroughly thought out and carefully constructed, then poor and biased survey research results are likely. King (1996) also criticises the inability of the survey method to disclose the context in which information technology is implemented and used.

4.2.2 Laboratory and Field Experiment

In addition to survey method, laboratory experiment is another research strategy stemming from the positivist research tradition. According to Mason (1992), this method is mostly used to explore the social and psychological aspects of CMC, in particular, in the work of Kiesler and her colleagues at Carnegie-Mellon University. In the section on interaction analysis in Chapter Two, we mentioned that CMC is qualitatively different from face-to-face communication and hence generates different kinds of group dynamics. Using the experimental method, researchers at the Carnegie-Mellon University are able to compare patterns of communication and interpersonal behaviour in CMC groups and face-to-face ones. Their key findings on group process are that CMC groups take longer to reach consensus, participate more equally within the group, show more uninhibited behaviours and seem to have higher choice shift (Kiesler *et al.*1984, Siegel *et al.* 1986). In addition to use experiential studies on social psychological aspects of CMC, Alavi (1994) also embraces this method to investigate the effectiveness of GDSS in the collaborative learning process in a field setting.

Laboratory and field experiment methods offer the advantage of allowing researchers to concentrate on factors that they are particularly interested in. For instance, in the case of the above studies, experiment methods grant researcher a controlled environment in which dependent and independent variables, such as computer experiences, age and educational level can be defined and specified in advance, in order to investigate some pre-determined hypotheses regarding the psychological aspects of CMC. However, there are some problems related to this type of research design both at a general and specific level of the online education context. In general, this method suffers from the same criticism of positivist research approach, for example, the problem of context stripping and of exclusion of meaning and purpose (Guba and Lincoln 1994) and the problem related to the use of statistical analysis (Baroudi and Orlikowski 1989). At a more specific level of online education, Mason (1992) argues that manipulating students to fit into an controlled experiment can be neither 'ethical' nor 'possible' in many circumstances and hence quasi-

experiment is normally used instead in order to compromise the proposition that full access and control to the environment in laboratory settings. Furthermore, she also maintains that although the result from laboratory experiments could offer some useful insights into certain phenomena, 'the real complexities of educational issues are not addressed' (Mason 1992:111).

4.2.3 Case Studies

The merit of the case study approach is to enable researchers to concentrate on a specific instance or situation and to carry out an intensive study on few entities in order to grasp the complex and dynamic issues in a particular online education setting. Bell (1993:9) reasons the choice of case study strategy in education:

> " a successful study will provide the reader with a three-dimensional picture and will illustrate relationships, micropolitical issues and patterns of influences."

Unlike other research methods, case research allows various means of data collection including questionnaire, interviews, documents and participant observations. Moreover, it is also suitable for the purposes of both hypothesis exploration and testing. Using case research design, Middleton (1999) sets out to explore the reasons behind student acceptance of two similar conferencing systems while Alavi *et al.* (1997) focuses on the IT-enabled university partnership for the delivery of graduate education. Moreover, the unit of the case can be single or multiple. Instead of using a single case as in the above two studies, Leidner and Jarvenpaa (1993) opt for a multiple case study strategy for their investigation on the use of computer-based technology in classrooms, in order to address the problem of external validity associated to single case study.

On advantages and disadvantages of case research, some suggest that this type of research enables researchers to have insight to the use of online technology in educational settings (Bell 1993; Mason 1992). Yin (1994) also recommends that when the existing knowledge on the phenomenon to be examined is poor, the exploratory

case study can contribute to the early stage of theory building process. However case research, in particular single case study, usually comes under attack on the issue of generalisability. Mason (1992) further explains that the findings generated from a single case study tend to be 'rich in process' but is difficult to replicate in other situations. However, Bassey (1981:86) defends such studies, asserting that:

> " if case studies are carried out systematically and critically, if they are aimed at the improvement of education, if they are relatable, and if by publication of the findings they extend the boundaries of existing knowledge, then they are valid forms of educational research." (cited in Bell 1993:9)

4.2.4 Content Analysis

Survey, laboratory experiment and case study are common research methods both in information systems and education research. However, the unique nature of CMC creates the opportunity of using content analysis as another popular method of inquiry related to online learning activities and behaviours. The history of content analysis started off by researchers of mass communication after World War II as a mechanism to compare and contrast documents based on measurable units (Manning and Cullum-Swan 1998). We have discussed the nature and application of such methods at length in Chapter Two (Section 2.2.2), and hence will not sin by repetition here. There are several advantages of using content analysis. First, it offers researchers some insights into patterns and frequencies of different interactions. Second, teachers can benefit from the results of content analysis to see whether the intended learning outcomes have in fact occurred online and hence whether to take any necessary action accordingly. Third, the typical content analysis technique tends to start with setting up categories of measurement, that is to say, its ontological and epistemological assumptions are positivist. The shortcoming with this technique is that it only permits the researcher to achieve understanding at a surface level (Manning and Cullum-Swan 1998). By contrast, with hermeneutics as a mode of analysis, which comes under the branch of the interpretive paradigm, researchers can perform a content analysis that further reveals contextual meanings hidden in the text

and makes sense of the interaction that takes place in a particular computer conference.

To sum up, this section has provided an overview and a brief discussion on the advantages and disadvantages of common research methods in examining three different aspects of online education issues. Next, we put our effort into presenting the research strategy and design employed for our empirical study.

4.3 Research Strategy

In the discussion on the interpretive approach, we pointed out that our philosophical assumptions for conducting this research are rooted in interpretive tradition. Of the interpretive research methods, we have also indicated that we chose the case study as the research strategy in this thesis. In the next few pages, we will lay out a more detailed examination about case study as a research method in general and then focus on its applications in the field of information systems in particular. Following this analysis, we will provide justifications for using an interpretive case study and identify some limitations of the case study as our method of empirical inquiry. Finally, more specific research issues such as site selection, data collection and data analysis techniques will be addressed.

4.3.1 Case Studies

Unlike other research methods, cases studies can be used as a research strategy in both positivist and interpretive traditions. For instance, case study approaches described by Yin (1994) and Benbasat *et al.* (1987) are implicitly grounded in the positivist stance whereas Walsham (1995) and Creswell (1998) offer guidelines on case research method from an interpretivist perspective.

Another issue frequently brought up in such discussion is the contrasts between ethnography and case study. Walsham (1995) suggests that ethnographic

research highlights research concepts and principles such as second-order concept and thick description, that case study researchers should take into account in the process of their empirical inquiry. Many also share the view of Walsham and point out that the significant differences that distinguish these two approaches are simply a question of time spent on the site and the use of narrative form (Klein and Myers 1996; Creswell 1998; Bell 1993). Creswell (1998) states that an ethnography requires researchers to conduct a prolonged participation observation, where some researchers might be integrated into part of participants' daily activities in order to understand fully why people behave and interact the way they do. The period of intensive observation normally takes up six months or much longer time in some cases. In terms of research product, an ethnography study tends to present the story in a book-length form with a thick description of behaviours, languages, customs and interactions taking place in a cultural or social system. By contrast, a case study is bounded by a pre-defined set of time and place. Researchers tend to spend relatively less time on the site compared with that required for an ethnography study. Also, Yin (1994) makes the argument that while an ethnographic study depends heavily on participation observations and interviews, case study relies on multiple sources of information including interviews, documents, observations and physical artifacts. Sometimes researchers might not even need to be physically present at the site if other sources of information are rich enough to conduct a case study. As for the narrative form, the outcomes of a case research are usually presented with the analysis of themes emerging through a single case study or with a thematic analysis across multiple cases.

Yin (1994) and Stake (1994) have different interpretations of the types of case studies. From a positivist stance, Yin distinguishes three main types of case studies: explanatory, descriptive and exploratory. In his explanations, the purpose of the explanatory case study is to discover 'the causal links in real-life interventions that are too complex for survey or experimental strategies' (Yin 1994: 15). Descriptive case study centres on description of an event or activity which has caused certain impacts in the real-life context. Exploratory case study is useful when the existing knowledge is poor and hence it is difficult to derive a conceptual framework or hypotheses from

the available literature. Looking at the use of theory in research can also differentiate these three types of case studies. Explanatory case study uses theory as an initial guide to form a conceptual framework and hypothesis. Descriptive case study normally sees the role of theory as part of an interactive process in research design. Exploratory case study tends to result in the development or refinement of a theoretical statement as an end product. Alternatively, Stake offers a different view of the nature of case studies: intrinsic, instrumental and collective. Intrinsic case study refers to the situation that is unique and hence that requires a study to unfold the story. Instrumental case study centres on using the case to illustrate certain issues, therefore the role of case is supportive with the aim of facilitating the readers to understand a particular topic or theory that the researcher wish them to understand. Finally, when more than one case is studied, Stake terms this type of research as collective case study.

In information systems research, case studies are considered as the most common research strategy (Hamiltion and Ives 1992; Farhoomand 1992; Dark *et al.* 1998). With respect to the stages of a case research design, because of the different philosophical assumptions variances are expected. As we pointed out previously, case studies can either be positivist or interpretive. Yin (1994) sees case research design as ' a logical model of proof that allows the researcher to draw inference concerning causal relations among the variables under investigation.' (p 20). In his view, in order to ensure the quality of a case study, a good case research should follow the structure of clearly identifying research questions, the scope of research, units of analysis, the logic linking the data to the proposition and criteria for interpreting findings. Benbasat *et al.* (1987) also highlight the importance of case research strategy in hypothesis generation and hypothesis testing. Such descriptions of the nature and structure of case research design strongly reflect positivist ontology and epistemology. In contrast, Walsham (1995) stresses the significance of case studies for revealing meanings that social actors construct and that govern social actions in a context. Creswell (1998) argues that a case study analysis is rich in the context of the case and this allows themes to emerge as the process of analysis takes

place. On these accounts with the belief of social constructed reality and subjective knowledge, the philosophical underpinnings of case study are indeed interpertivism.

The key strength of the case study is to give an opportunity for the researcher to focus on a particular problem or phenomenon in depth within a limited period of time (Bell 1993). In return, the findings of case study reveal a rich and detailed picture of social phenomenon in which there are different actors and interactions. Benbasat *et al.* (1987) point out three main reasons why case research is well-suited as a method of information systems enquiry: 1) the researcher can undertake the investigation in a natural setting, capture knowledge of practitioners and generate theoretical framework from the field work, 2) the case research method enables the researcher to address the 'why' and 'how' research questions. In other words, this method allows the researcher to explore and understand the nature and complexity of the context in which an information systems develops and 3) since information systems are constantly evolving and changing, the case research method is considered as an appropriate way to research an area in which a limited number of studies has been conducted before.

However, there are certain limitations and concerns with respect to the case research method. Of those three are most often identified: 1) the problem of generalising results, 2) the issue of lacking rigour and of subjectivity in data collection and analysis and 3) the practical difficulties of timescale and access to the selected case study site (Yin 1994; Darke *et al.*1998; Walsham 1995; Cavaye 1996). Often questioned is the generalisability of results from case studies, in particular single case study, as mentioned previously. Galliers (1991) raises the point that researchers who adopt case study approach tend to restrict their focus to a single organisation, and consequently it is more difficult to generalise using statistical techniques. Responses on this criticism are various. Yin (1994) points that there are two types of generalisations: statistical generalisation and analytical generalisation. In his view, case study researchers should pay attention to the latter not the former. He reasons that despite its common recognition and wide acceptance in other methods such as survey and experiments, statistical generalisation is not applicable in the case study

approach because cases are not 'sampling units'. Hence, case study results are naturally not statistically generalisable to a larger population (Cavaye 1996). Analytical generalisation refers to 'a previously developed theory (is) used as a template with which to compare the empirical results of the case study' (Yin 1994:31). This method enables the researcher to test the plausibility of the research outcomes and to make a claim about replication if the findings from two or more case studies support propositions derived from the developed theory.

In addition, Walsham (1995) proposes four possible types of generalisations from an interpretive standpoint: development of concept, generation of theory, drawing of specific implications and contribution of rich insights. He further exemplifies each type of generalisation with the existing IS studies. For instance, he demonstrates that the work of Orlikowski and Robey (1991) serves the purpose of generating theory on system developments and the consequent impact on organisations while Walsham and Waema (1994) use an in-depth case study to draw several implications as a result of information systems development in a financial services company.

Subjectivity and bias are the second criticism that case study researchers face during the process of data collection and analysis. Galliers (1991) makes a point that although case study permits the existence of more variables than other methods, it faces the situation of lacking control of the individual variables, and hence has 'the difficulties in distinguishing between cause and effect' (p155). The longitudinal case study is seen as a possible remedy for this problem. Darke *et al.* (1998) suggest that additional subjectivity and bias arise from two sources: the influence of the researcher over participant's behaviours or events at the case study location, and of the researcher's own belief, value and prior assumptions on the validity and reliability of the research process and outcomes. Both biases are difficult to avoid whatever philosophical stance the researcher takes, however, action to reduce the level of biases should be undertaken. First, to reduce biases caused by the influence of the researcher over participants at the site, Miles and Huberman (1994) recommend that the researcher can prolong time spent at the site, as well as make sure that participants

have a clear understanding of the purpose and method of research to be used. Secondly, triangulation of data is seen as the most appropriate strategy to minimise the impact of the researcher's own subjectivity on research quality. By comparing and contrasting results from a variety of case data, the researcher is able to eliminate errors and to identify omissions caused by their own perceptions. Besides, triangulation using both quantitative and qualitative techniques not only brings confidence to researchers on their research findings, but also increases the validity of theoretical development and generation.

The last difficulty related to case study research is a more practical one. On the one hand, the findings from a case study are highly relevant and intensively rich. On the other hand, this means that the amount of time required for data collection and analysis can be worryingly excessive if time is a luxury that the researcher cannot afford. Furthermore, the limited access to the site in terms of time length and frequency poses other concerns. To deal with such practical difficulties, Darke *et al.* (1998) urge that the researcher should study background information well and interview participants effectively with questions that are normally unobtainable through secondary information, say, internal company magazines. Besides in order to gain trust and cooperation from participating organisation, the preparations such as obtaining principles of agreement, providing statement of project objectives and outline and discussing the issue of confidentiality are equally, if not less, important as the research itself (Bell 1993). On the idea of reducing time pressure without jeopardising the quality of the research, Richards and Richards (1998) suggest that, within certain limitations, the use of computer software to manage complex and rich qualitative data can help the researcher more easily organise concepts and perhaps develop theory construction.

Having taken into account the nature and weighted the associated strengths and weaknesses of the case research approach, we consider that this research strategy is still well suited for the purpose of this thesis in comparison with other research methods. The decision is based on the following reasons. First, the central theme of this research lies in discovering how the process of interaction among online actors

changes their perception of technology and achieves knowledge construction. This type of research question is pertinent for case research strategy and experimental method since both allow the researcher to answer 'how' and 'why' questions. However, here we disregard the possibility of laboratory experiment: we do not have the control over participants' behaviours necessary for the experimental method and this empirical investigation is undertaken in a natural setting rather than in a controlled environment. Second, compared with methods such as survey and experiments, case study strategy does not require the researcher to pre-define all variables prior to the study and this enables the flexibility of variables emerging through the phases of data collection and analysis. Accordingly, the case study allows the analysis of significantly greater numbers of variables than that is possible with any other research methods. Such as strength is crucial for this study since this research is exploratory in nature and it is necessary to permit the emergence of new variables during the research process in order to grasp the reality and the complexity of interactions that students and online technology produce in this particular context. Third, case study strategy is also appropriate in the circumstance where existing knowledge is far from mature and the available literature is limited. In Chapter One and Two, we have shown that compared with other forms of education online education is a relatively new phenomenon. Therefore, many aspects of online education still currently remain unexplored and exploratory case study serves well to deal with this problem.

4.3.2 Research Design

In the pervious section, we have described the nature and types of case study, examined its strengths and weaknesses and also reasoned why case study is an appropriate research strategy for this thesis. This section covers more pragmatic research issues such as site selection, research timeline and the process of data collection and analysis.

Site Selection

As we pointed out at the outset of this thesis, this research started with a broad interest in education and in the implications of information technology to facilitate the learning process. Through the process of literature review, we take the next step of listing a number of potential institutions that might suit well our research interest and purpose. Such institutions include the U.K. Open University or other traditional universities offering distance education programmes. At the end, we decide to carry out the fieldwork at our own institution for the following considerations. The first reason for selecting our institution as the site of study is pragmatic. Funding and resources are primary concerns for the researcher owing to financial constraints during the years of her Ph.D. study. The research aim of this thesis is to record and study the online learning and technology appropriation process. This aim requires the researcher to exercise the role of 'inside-researcher', i.e. to spend a great deal of time with participants at the site in order to gain some insights and trace changes occurring at any stage of online learning. A field study outside London where the researcher is based would mean that high costs of travelling and accommodation are ultimately unavoidable. Because of the limited amount of funding and other financial support available, carrying out a case study at our own institution becomes an ideal and practical solution.

The second consideration is again related to the issue of 'inside-researcher'. Walsham (1995) suggests that there are two types of research roles that can be exercised in the conduct of interpretive case studies: the outside observer and the involved researcher. The outside observer might have advantages of having participants express their opinions freely since participants see the researcher as an outsider, and hence consider no real danger in revealing what they really think of various organisational issues. The problem with such a role is that the researcher might encounter difficulty of gaining further access to some organisational documents or meetings because these might be classified as 'the insider' only. In contrary, adopting the role of participant observer or action researcher grants the researcher opportunities for being counted as a member of a group or organisation and hence of getting an insider's view from other members of the organisation. On the other hand,

being an insider means that participants are more likely to perceive the existence of political interests between themselves and the researcher in the organisation, and consequently will be more reserved with what they want the researcher to know. In addition, compared with the role of outside observer, the inside researcher has more problems in terms of writing the final report, in which they need to justify and explain the various roles the play and their effects in their field group or organisation. Taking into account both strengths and weakness, we feel that being an insider is more beneficial than being an outsider in this thesis since this allows us to gain insights into students' interpretation and to understand better their daily interaction with online technology.

Therefore, choosing to conduct the field study at our institution makes it easier to be included and be trusted. First of all, the researcher has studied at the same institution for the past seven years, therefore the amount of knowledge accumulated regarding study culture and student life here enables the researcher to build up trust and friendly relationships quickly with students involved in the online course. Second, the researcher needs to acknowledge up front to students the research purpose, explain that the work is not related to their academic assessment and answer any questions they might have in terms of the research itself. We consider that the best policy is to remove any doubts and uncertainty that they might have at the outset of the project. All these are easier to organise and be taken care of if the researcher is based at the same institution as the students. Third, the researcher was also able to take up the position of students' technical support in the online learning course. This position offers the opportunity of interacting constantly with students formally and informally, and of gaining first-hand information about the interoperations of online learning and the technology used, which are all crucial to this dissertation.

Finally, the selection of the site is also based on the decision of the potential benefits that we can bring to our own institution. As stated in Chapter One online education is applicable for both traditional and distance education and the development of this form of educational delivery is just taking off. This research project that we study here is the first initiative of such kind at our institution. The outcome of this study can provide some insight into the application of online

education, in particular for our institution, and hence help the decision-making process for determining the future of online education. Because of this value of this study, we in turn have found more financial and organisational support forthcoming from the top management than would otherwise be the case.

However, we also recognise certain limitations with our choice of the site. One limitation is concerned with the choice of strategy in general, while the other is more specific regarding the selected site. At the level of case study, we acknowledge that the choice of carrying out an in-depth case study will not allow us to generate the findings statistically to a larger population. Our intention here is to provide an analytical generation that deepens understanding of the relationship between online education and the adopted information systems. Another pitfall of interpretive case study in general is the problem of subjectivity and bias of the researcher.

We acknowledge the danger that our actions and interpretations might directly or indirectly influence the participant's view of the investigated phenomenon. The way to deal with this is to make sure that a sound research design is in place and to invoke the strength of triangulation by using multiple sources of information and both quantitative and qualitative techniques. At a more specific level, the limitation with this particular site is that, as mentioned previously, the researcher has studied at the same institution for the past seven years, and hence it is possible that her own bias or predisposition towards the institution might be stronger or more influential than otherwise. Another concern is that the researcher was working closely with the lecturer responsible for the online course. Because of this close working relationship, students might worry that what they said to her would be passed on to the lecturer, i.e. the thought that 'she is the spy', and consequently their honest, but negative, comments might cause the lecturer to have negative impressions of those students. Although we are aware of these constraints, nevertheless, we consider the potential advantages surpass the disadvantages in carrying out the field study at our own institution. For the rest of this chapter, we turn our focus to the techniques of data collection and analysis that will be used in this thesis, with the aim of making sure

that the above limitations will be carefully minimised and constantly reflected upon throughout the whole process of the empirical study.

Data Collection

Our methods of data collection include questionnaire, semi-structured interviews, statistics of online activities, participant observations and online messages. We will now explain the purpose, advantages and disadvantages of each method used in this dissertation.

Here, the questionnaire serves the purpose of gathering background information about participants such as their computing expertise, past experiences with online education, their early expectations and their educational history. This allows us to have a rough picture of the frame that students employ to interpret their initial understanding of the online education phenomenon and the implemented information systems. Apart from the use of questionnaire at the outset of the course, we use a similar, but extended, questionnaire at the end of the course. We expect to use these two sets of data in several ways. First, by comparing these two surveys, we can have a means of identifying whether there is any change in students' expectation and the pattern of online technology usage. Second, we intend to use questionnaire results to triangulate with our interview findings. In this way, this triangulation helps to minimise the bias and subjectivity that we might introduce when interpreting our interview findings. Third, we draw up the existing survey variables from the literature of technology usefulness and evaluation of collaborative learning effectiveness. We reason that by doing so it increases the validity of this research although this is not a primary validation criteria in the area of interpretive case studies. Besides, using the same survey variables give us the chance of being able to compare and contrast our questionnaire outcomes with others, and therefore of contributing the process of theory generation in the field of online education.

The essence of an interview is 'a conversation, the art of asking questions and listening' (Denzin and Lincoln 1998). When conducting an interpretive case study, Walsham (1995) asserts that interviewing is the primary method of data collection.

There are different types of interviews: structured, semi-structured, unstructured and group interviews. Fontana and Frey (1998:56) describe the difference between structured and unstructured interviews:

> " the former aims at capturing precise data of a codable nature in order to explain behaviour within pre-established categories, whereas the latter is used in an attempt to understand the complex behaviour of members of society without imposing any a prior categorisation that may limit the field of inquiry.'

The semi-structured interview, as its name suggests, is somewhere in between the structured and unstructured interview. All these interviews techniques can be implemented in the form of a one-to-one conversation or a group activity. The latter is normally referred to group interviewing. Examples of group interviews include a 'focus group' in which the interviewer directs respondents to discuss a certain topic or a 'brainstorming' in which the interviewer moderates the discussion among the participants in an attempt to explore the solution, problem and pattern of the investigated phenomenon. In this thesis, we decide to opt for semi-structured interviews. We established a set of questions that related to our theoretical framework, but the nature of semi-structured interviews also has room for students to elaborate their experiences and to express their opinions in a manner that is not permitted by the pre-established interview questions. With this technique, we are more able to capture what we set out to explore with the established questions, as well as to give ourselves the freedom to grasp other rich interpretations within our topic of investigation. The interviews took place in two stages: one in the middle of the online course and the other after the completion of the course. Students are asked to participate in interviews on a voluntary basis. The purpose of a two-stage interview is to trace any change in student interpretations or attitudes towards learning and technology and to find the motivation or reason behind such changes. We conducted 28 semi-structured interviews with 12 at the first stage and 16 at the second stage, and each interview last on average between 45 minutes and 1 hour.

One issue related to interview is whether to use tape-recording. The recorded interviews give the researcher opportunity of having a record of conversations.

Compared with note-taking, i.e. no tape-recording, interviews, it reduces the risk of missing out some key points raised by participants. However, one could argue that tape-recording interviews might inhibit participants to talk about sensitive issues since there is a psychological block of 'going on record'. At the beginning we were not so sure how students might react to the recording of interviews. Therefore, the researcher asked each interviewee whether they would mind her recording the interview, as well as told them that she would turn off the tape recorder at any stage of the interview if they become uncomfortable about expressing their opinions with the presence of a tape recorder. No students who participated expressed any particular concern with recording interviews. The researcher also noticed that most students were very relaxed and expressive over the course of interviews, and hence this gave her the confidence to go ahead with the tape-recording procedure.

The third type of data collection is through the technique of participant observation. The theoretical background of participant observations is rooted in a symbolic interaction perspective (Alder and Alder 1998). Observations can take place in two forms: quantitative observation and qualitative observation. The former refers to the environment in which is set up by the researcher in order to ensure the issues of validity and to maintain control over the participants, whereas the latter is undertaken in a natural setting in which the researcher endeavours to capture the meanings and interpretations that social actors produce over the course of their interactions. In this thesis, our observation style is qualitative. We recognise that there are certain criticisms of this technique. Cohen and Manion (1989) remark that qualitative observation suffers from the problem of bias and subjectivity and of lacking the established quantifiable measures. However, Silva (1998) argues that the objective of statistical measurement is to enable statistical generation, which is crucial in the quantitative research tradition. Nevertheless, if the case study is interpretive by nature, then the requirement of statistical generation is not applicable.

Over the period of the online course, the researcher sat in each weekly face-to-face lecture with students and tried to engage in friendly chat or have coffee with them after the lecture. She was also invited to attend various MSc. parties in which

she built up friendships with the students. In addition, the researcher has an office that is geographically close to students' study room. Strategically, she made an effort of coming to school nearly everyday and left her door half open so that many students would just drop by to have a quick conversation, since they considered her as a member of their group rather than part of the teaching staff. A number of notes were taken after many informal conversations that the researcher considered as important to the study.

In addition to these three types of resources, we further collect data stored in the online learning system. There are two types of information available from the online system: log on statistics and message content. The researcher tried to record the number of daily access and the structure of message flow. As we stated previously in Chapter One, CMC discussion takes place in a text-based format. Consequently, it provides the rich information in respect of student learning process, use of online technology and various aspects of group dynamics. The researcher printed out all 587 messages exchanged by both teachers and students, and private e-mails sent to her either within the system itself or through other e-mail accounts. These messages do not only provide the primary indicator of student collaborative learning experiences over the period, but also serve the purpose of establishing triangulation and of maintaining the research credibility.

Yin (1994) advocates the use of multiple sources of information in the case study research strategy. The preceding section has described four types of data that we will rely on in this thesis: survey, semi-structured interviews, participant observations and online messages. The next discussion centres on our method of data analysis.

Data Analysis

There are different ideas on what data analysis consists of in case study research. Stake (1995) suggests four forms of data analysis and interpretation: categorical aggregation, direct interpretation, pattern establishment and naturalistic generation. Yin (1994) advises that case study analysis can take place in the form of time series or pattern matching. Myers (2001) maintains that the distinction between the stage of data collection and analysis in interpretive research is normally not as clear as in positivist research. He argues that the presuppositions of the interpretive researcher will have a certain impact on what kinds of data are to be gathered or questions to be asked, and subsequently will influence the outcome of data analysis. Therefore, he suggests that in interpretive research, the term 'mode of analysis' suits better than 'data analysis' since it refers to 'different approaches to gathering, analysing and interpreting qualitative data' (Myer 2001:8). He further remarks that an interpretive mode of analysis includes approaches such as hermeneutics, semiotics, narrative and, arguably, grounded theory. In this thesis, we subscribe to Myer's view of data analysis and use hermeneutics as our mode of analysis.

The use of the word "Hermeneutics" can be traced back in the ancient Greek history, where initially "Hermes" was named as the messenger of the Gods, and subsequently gave rise to *"hermêneutike"* meaning to interpret. In the field of philosophy, hermeneutics is the study of text. Broadly speaking, hermeneutics refers to "...the natural human act and process of interpretation and understanding of the world" (Rathswohl 1991:236). It is concerned with how a reader can correctly interpret the meaning of a text written by another individual, who has come from different social and cultural backgrounds. The following diagram demonstrated the hermeneutic problem.

Person-------[Interpretation]------Text-----World

Language

Documents
Situation
History
Information Systems

Figure 4: The Hermeneutic Problem

Source: Rathswohl, 1991

Several writers have developed a methodological principle called the "hermeneutic circle" or "hermeneutic process" to aid the researcher to understand the correct interpretation. (Lee 1991; Rathswohl 1991; Forster 1994). The central theme of the hermeneutic circle is "learning the whole through learning the part" (Rathswohl 1991: 237). This involves the process of interpreting/reinterpreting back and forth between the part and the whole. Repeating this process enables researchers to inject new interpretation and refine some presuppositions, which in turns help them to capture the true meaning of the whole.

One can argue that a full understanding of the use, design and implementation of information systems is a hermeneutic task. As Boland (1991) points out "..research in information systems can profitably be seen as the study of how texts are produced and read in modern organisations" (p440). By engaging in the hermeneutic process, it can show that the success of information systems lies in the correct interpretation by users of technologies implemented and the interaction between them, as shown in Boland's case studies.

In this thesis, we see our task is a hermeneutic one. Only if we can obtain and interpret fully the meanings that students ascribe to interact with technology and to guide their online learning will we bee able to build a rich and complex picture of online technology in use. Our hermeneutic process starts with our early understanding of online education and technology as a whole, then through interviews of participants and observation of online activities, we are able to refine our understanding of the whole through the parts. If we encounter conflicting or incomplete interpretations of a certain event or statement we go back to participants and ask for clarification, or if it

is not possible to have access to the participant, we endeavour to find other sources of information that might have answers to our enquiry. This process continues and only stops when we are fairly confident with our understanding of the online learning environment under scrutiny.

Besides in addition to qualitative analysis as our main approach, we will also deploy the quantitative technique to analyse certain sets of data and to support our qualitative findings. The reason is threefold. First, in the earlier section on data collection, we referred to the inclusion of computer statistics and survey as part of the data collected. Due to the nature of data, it seems more feasible to conduct a quantitative analysis that identifies the trend and pattern of technology usage and of the learning process than completely to deny the benefits of quantified information. Second, in the previous discussion on the triangulation of a case study, we pointed out that establishing triangulation could be achieved by both multiple sources of information and the combination of quantitative and qualitative techniques. The results from our questionnaire analysis offer benefits in supporting our qualitative findings and also act as another source of information in our hermeneutic process. Subsequently, we consider that the conclusion generated from both methods gives us more confidence of our findings. Third, we use survey method and quantitative content analysis in order to achieve certain aspects of analytical generation in online education in this thesis. In order to analyse the quality and effectiveness of knowledge construction online taking place over time, we decide to adopt some measurements that have been used in other studies such as Webster and Hackley (1997) and Alavi (1994). These measurements derived from the relevant theories well tested in many other studies, and hence using the established variables and analysis techniques allows us to compare and contrast parts of our findings with the existing literature generated from the same or similar sets of measurements. We see this as creating the opportunity to contribute to the process of theory generation about the online learning phenomenon.

In short, by using various types of information with a constant crosschecking process and triangulating our data with both quantitative and qualitative techniques, we hope to demonstrate the credibility and dependability of this research.

4.4 Summary

In this chapter, we have stated our understanding of both positivist and interpretive research paradigms and have explained the suitability of the latter as the underlying set of philosophical assumptions behind this research. Following this, a review of various research methods used in online education studies were discussed. The review indicates the dominance of positivist research methods. The second part of this chapter turns its attention to the issue of research strategy and design. On the choice of research strategy, we have identified the nature, types, and strengths and weakness of the case study before laying out the reasons why we consider an interpretive case study approach is more appropriate for this thesis. Consequently, we see that one of contributions of this thesis will be to demonstrate the value of interpretive case study in the investigation of online education. Considering the issues of funding and resources, access and benefits to the participating institution, we decide to carry out the fieldwork at our own institution. The detailed discussions on our multiple methods of data collection and analysis are also presented in response to the criticisms of case study research. Finally, we conclude this chapter with Table 6 that offers an outline of the overall research design in this dissertation.

Research Strategy	Description of the choice
Research Questions	How does the process of interaction and communication between online learners and teachers as a community change an individual's perception of technology and achieve knowledge construction?
Theoretical Framework	A synthesised framework consists of collaborative learning and technological frames analysis
Philosophical Assumptions	Ontology- recognising the existence of multiple realities constructed and seen by social actors Epistemology- knowledge is constructed through the interaction with one's prior experiences and with others in a socio-cultural context
Research Methodology	Interpretive case study
Data Collection	Questionnaire, semi-structured interviews, participation observation and online messages
Data Analysis	Hermeneutic mode of analysis Using quantitative analysis for triangulation purpose

Table 6: Summary of the Research Design

Chapter Five
A MSc. Online Learning Course

In the previous two chapters, we have presented our theoretical framework and research design to be followed at the fieldwork stage. We also briefly indicated that the case study has been conducted at our own institution because of the reasons of funding and resources, the required role of the researcher and the potential benefits to the participating institution. This chapter lays out a detailed description of the case study in which a group of MSc. students undertook their learning activities mostly through the Web. This case study started with the course introductory session a few weeks before the launch of the system, continued with 10-week use of the system use during the teaching term (Lent Term) and followed on until students took their written examination (Summer Term). The focus of the study is to grasp fully students' technological frames and their consequent online learning activities and further to trace and explore the relationship between these two factors over the period of time.

Earlier, in Chapter Four, we stated that there are five main methods of obtaining information for the purpose of this thesis: interviews, questionnaire, participant observation, system log on statistics and text-based messages. Here we

provide more detail on the timeline of the study and a summary of information collected during this period. The first contact with students was at the presentation and introduction of the online information systems security (ISS) course in October 1999. At this presentation, the lecturer laid out the teaching structure of the course while the researcher introduced herself and explained the aim of the research. There was also a short demonstration of the online learning system. Any early questions and doubts that students might have had about the motivation of this research were taken care of at this one-hour long presentation. The field study started in the Lent Term and finished in the Summer Term of academic year 1999/2000. Data collected in the Lent Term (January to March 2000) included: 1) the first questionnaire- 26 respondents, 2) the first round of interviews- 12 conducted, 3) 587 online messages collected, and 4) notes from informal conversations with all students. Data collected in the Summer Term (April to May 2000) included: 1) the second questionnaire- 30 respondents, 2) the second round of interviews- 16 conducted, and 3) notes from information conversations with all students. The reason for holding the second interviews and the second questionnaire in the Summer Term was that we had to avoid the assignment deadline, the Easter holiday break and the exam period.

We have organised the presentation of this chapter into five main sections on the basis of our theoretical framework. In Chapter Two we argue that frames are bounded by time and context. In addition, frames not only influence, but also are influenced by, online learning activities over the period of system use. Therefore, section 5.1 presents the background of the case study, i.e. the institutional context. Findings based on our theoretical framework make up the second section of this chapter. The third section describes the final learning outcomes as the result of using the system, which is followed by the descriptions of other findings that are not covered in Section 5.2 and 5.3. The last section summarises our empirical results and discussion.

5.1 Case Study Background

In the first part of this chapter, we provide detailed descriptions of online education development at the institution, the delivery mechanism of the course, and the learning culture and environment that was unique to the institution.

5.1.1 The Development of Online Education

Recognising the potential and benefits of online education, the London School of Economics and Political Sciences (LSE) decided to explore this area both externally and internally. Externally, it joined forces with Fathom and Unext.com, which both are devoted to the development of online education. Both are commercial companies that serve the growing demand for knowledge acquisition outside the campus learning environment. Fathom is a company created by Columbia University and Enterprise LSE. The company further obtains collaborations from other top universities and libraries in the world such as British Library and Chicago Business School. The concept of Fathom is to disseminate knowledge through free lectures or fee paying short courses online. Although with the same intention of delivering education online, Unext.com has a different approach from Fathom. Under the company Unext.com, the LSE entered the alliance with some prestigious universities such as Columbia Business School, Standford University, Carnegie Mellon University and Chicago Business School. Through Unext.com, this alliance of universities created the online university known as Cardean University that is specialised in business education and offers both corporate training and open enrolment programmes. The unique nature of Cardean University lies in each programme consisting of courses developed by different universities, in contrast with the traditional way where the university is normally responsible for the delivery of all courses.

In addition to the external alliances, there was also an internal strategy for online education. In the academic year of 1999/2000, the School set up a small research and development unit the 'Learning and Teaching Technology Group', to

look into the opportunity of teaching and learning through the Internet technology for its students on campus. This group consists of members of staff from the academic departments, administration and IT Services. A course taught in the information systems department had been chosen as the first trial online course to bring to life the concept of online learning on campus. This course became the case study of this thesis.

The online course under this study forms part of the MSc. ADMIS (Analysis, Design and Management in Information Systems) degree at the LSE. This degree is a one-year programme with an average intake of 150 students each year. The recent teaching structure of this degree requires all students to complete four units worth of courses. Students are asked to take compulsory courses in the first term and then to choose two or three optional courses in the second term of their one-year study. The third term is mainly for the purpose of revision and examination before students work on their dissertation over the summer time period. The online course is designed as an optional course. Although the teaching content and activities are identical, students have a choice of taking it as a full unit or half unit option. For administrative reasons, the full unit is coded IS476: Security in Information Systems for Organisations, while the half unit is known as IS484: Aspect of Security in Information Systems. The only difference between the two lies in the assessment method. The assessment scheme for the full unit comprises 70% for the written examination, 20% group essay and 10% online class participation. The half unit students are assessed entirely by the final examination.

The core syllabus of this course is 'to identify and develop durable principles and to illuminate underlying concepts for the management of security which cover the full range and scope of information systems in organisations." Apart from having some fundamental understanding of information systems, which students gain from the teaching given in the first term of their study, there are no prerequisites for students taking this course.

In the academic year of 1999/2000, there were 146 MSc. ADMIS students. Of those there were 36 students registered for the online ISS course: 20 students taking IS476 and 16 taking IS484. In terms of the distribution of age and sex, most students were aged between 20 and 30, and female students made up 33% and male students 67% of the course. With regard to the student nationalities, there were 5 Americans, 15 Europeans and the rest were Asian and African.

Our background information also indicated that there were only three students who reported having experience with online education or similar kind before taking part in this course. All students had basic computing and Internet skills and about three-fourth of students had an Internet connection at their accommodation.

5.1.2 Delivery of information systems security course

Course Design

The delivery of information systems security (ISS) course consisted of ten weekly face-to-face activities and use of an online learning environment.

There were face-to-face teaching activities. Since this course was part of the degree that is delivered by the traditional method of education, the lecturer considered that it was also important to offer lectures in a face-to-face mode. In each two-hour lecture, the lecturer covered different topics regarding the information system security. Considering most students did not have any entry level of knowledge, the lecturer normally spent half of his time to introduce the concept before being able to talk about the subject in depth. As well as providing the lectures, the lecturer organised a series of security colloquia, to run under the aegis of the Research Centre of which the lecturer is the director. In the two-hour colloquia sessions, students had an opportunity to engage with IS security experts in the industry. The content of each talk is usually related to what has been taught in the lecture session.

The online learning environment served the purposes of offering recorded lectures, course information, communication and other learning tools. To both utilise the technology available and enhance learning quality, the lecturers also decided to make them available through the online learning environment. Besides the face-to-face lectures, all the other learning activities such as class discussion, teamwork and reading materials collection were performed online. The online learning environment was designed using WebCT, the commercial off-the-shelf distance learning software, and Real Media technology. The diagram displays a simplified graphical structure of information systems security course.

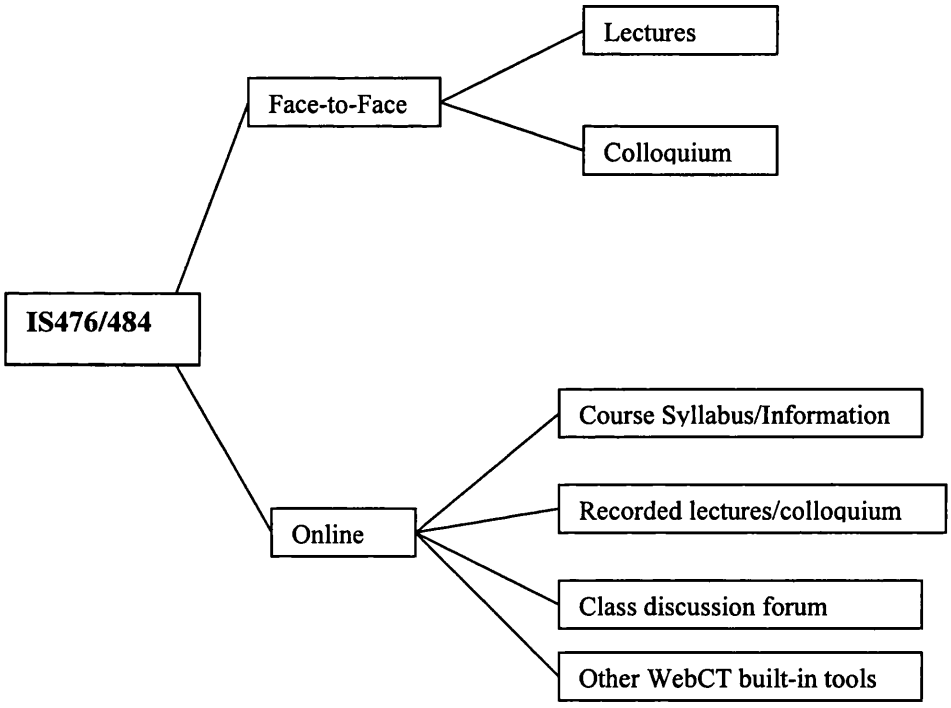

Figure 5: The structure of IS484 and IS476 course teaching and learning

Roles and Responsibilities

In addition to the structure of the online course, we also need to point out the people involved in this project and their relevant responsibilities in order to show the extent to which the researcher was involved in the course. There were five people directly responsible for the delivery of IS484 and IS476. Two were the lecturers who took care of course content, face-to-face lectures and recording. Each of them equally

shared the numbers of taught lectures and assessment marking. One of the course lecturers was also in charge of the organisation of the IS security colloquium series.

The online class teacher had the responsibility to participate in and monitor weekly student class discussions. Additionally, he helped the lecturers to develop the reading materials required for each lecture topic. Apart from the teaching team, two people were in charge of technical aspects of the online learning environment. As mentioned in the last chapter, the researcher was part of the technical team and her responsibility was to maintain the web site and resolve any technical questions that students might have. For instance, the researcher helped the online teacher to make reading material available online and set up the online discussion group. The other member of the technical team looked after the system server as well as having responsibility for recording face-to-face lectures and editing the recorded media files. During that period, the researcher also attended both face-to-face lecture and colloquium talks. This was not part of any responsibility as the technical member of the team, however, the researcher considered that it was crucial quickly to establish a rapport with students.

We have already pointed out before that the role of technical support enabled the researcher to engage the role of 'inside-researcher' in this case study. By being the students' technical support, the researcher had a chance to be much closer to students while not intervening or influencing their online learning experiences as much as if the researcher had been lecturer or class teacher.

Online Learning Environment

All registered students were assigned a username and password in order to prevent the online learning environment being abused by other students who had not officially registered for the course. Figure 6 shows the homepage of the online learning environment using WebCT software and that is followed by a brief description of each component.

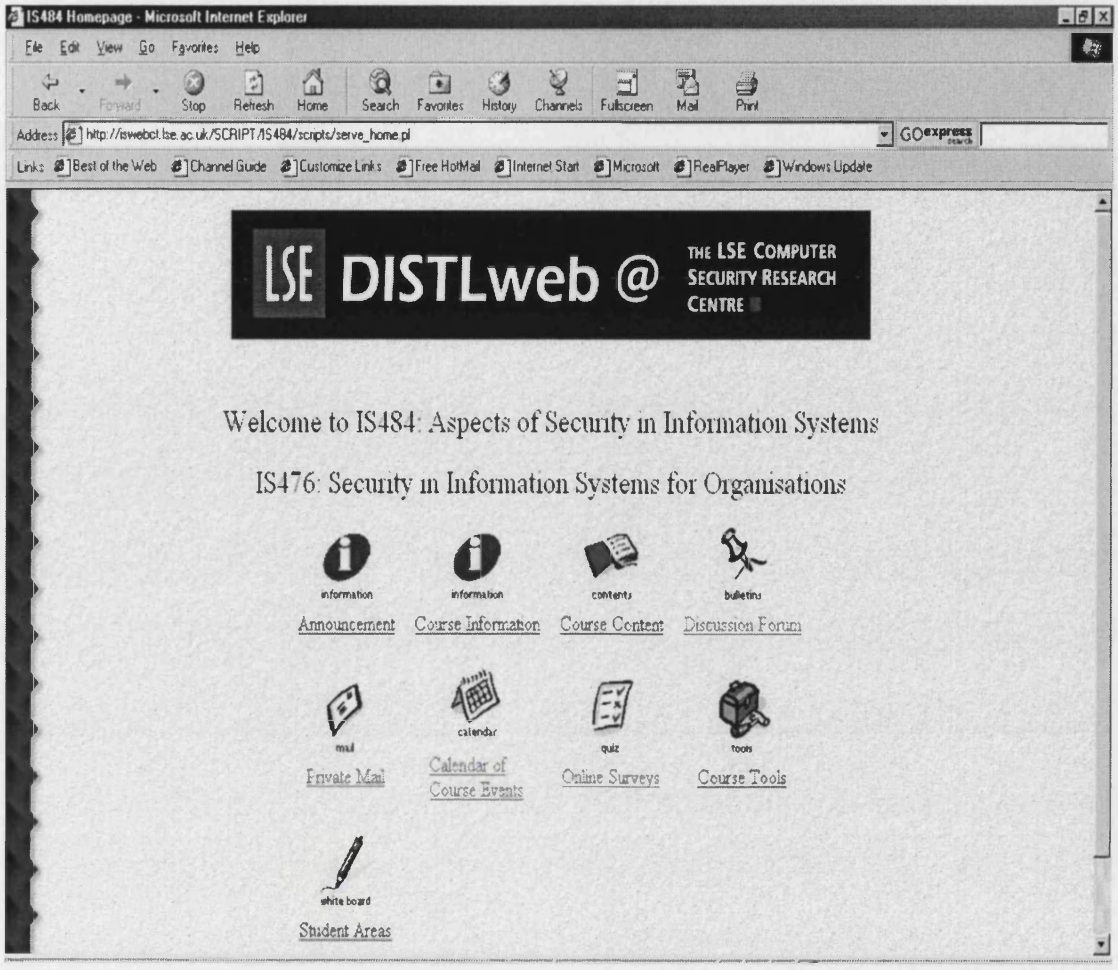

Figure 6: Homepage of the online learning environment

The 'Announcement' and 'Course Information' contained essential information regarding the course in general and administrative matters. It was maintained by the technical support, i.e. the researcher herself. The 'Course Content' section was one of the most important elements in the online learning environment. It consisted of the Real Media lectures, the key concepts of each lecture and the reading lists required for each lecture (see Appendix Two). Real Media lectures include two types: the recorded live lecture and recorded voice over PowerPoint slides. All these were released on a weekly basis in accordance with the face-to-face lecture schedule. The preparation of course content was carried out by the lecturers themselves or the class teacher and uploaded to the system by the technical team. It is worth mentioning that all video and audio files were recorded as streaming media, instead of

as downloadable files. One main reason was the concern for the control of intellectual property rights by the lecturers.

For the purpose of communication, the online learning environment offered 'Discussion Forum' and 'Private Mail'. The teacher differentiated groups between half-unit, IS484, and full-unit, IS476, students and then randomly grouped them together in numbers of 4 to 6 people. All groups were set up as individual private discussion groups. Each Wednesday after the face-to-face lecture, the online class teacher would post to each group the discussion questions related to the lecture. Although the online class discussion was mainly moderated by one particular class teacher, on some occasions, the lecturers would also join in the discussion to either compliment good contributions or to reinforce the level of participation. At the end of the two-week discussion period, the online class teacher would post a model answer and comment briefly on each student's answer (see Appendix Three). Despite the forum being 'closed' at the end of two weeks, it still remained accessible to group members who wished to revise or continue the discussion, but without facilitation from the online class teacher or lecturer. Besides the private student group discussion forum, there were also several other forums: 'Reading Suggestion Forum', 'IS Debate Forum' and 'Summer Project Forum'. The purpose of these forums was to facilitate discussion and such forums were open to all members of the course to provide students with a virtual environment in which they could discuss issues that were not directly related to class questions. In addition to forums, the system offered the function of e-mail to channel private individual or group communication.

Another main design feature of the system was the function of 'Course Tools'. The function consisted of such facilities as 'Generate Customised Study-Guide', 'View Your Progress' and 'Student List and Their Homepage'. Most of these tools were already built into WebCT and considered as an additional facility for students to help students manage their own learning progress.

5.1.3 The Background of the Institution

In the discussion of our theoretical framework in Chapter Two, we stated that the context in which the online system is used has certain influences on the formation of student perception of online education. Hence, here we offer a brief description of the historical background and student characteristics of the institution and such information will be used later in our analysis. The London School of Economics and Political Science (LSE) is part of the University of London and was founded in 1895 by Beatrice and Sidney Webb. The LSE is specialised in the social sciences, and in particular in the area of economics, law and politics. It has a record of outstanding academic excellence. Among universities in the U.K., as indicated by the Guardian education report in 2000, the LSE came second behind Cambridge University in terms of overall teaching quality. In 1996 the Higher Education Funding Council for England (HEFCE) carried out the most recent research assessment exercise, the result showed that the LSE remained within the ranking of the top three universities for all different four ways of presenting the research assessments. Among others, the subject of information systems received the highest rating of 5.

In terms of its student populations, according to the School report 1999/2000, the numbers of full-time students has remained between 6000 and 7000 for the past three years, evenly distributed between undergraduate and postgraduate. Furthermore, its international recognition also reflects in the large numbers of international students. In the academic year 1998/1999 for example, 50.3% of taught graduates came from non-EU countries. The record further showed that the LSE is very popular with Asian and North American students.

Because of its good reputation and the limited intake each year, there is severe competition for student places and consequently student standards tend to be higher than other universities. When studying at the LSE, especially in the case of graduate students, students are expected to be self-motivated, competitive and to produce high quality work. These expectations are well defined in the LSE graduate prospectus (2000/2001). It describes the postgraduate learning environment:

> "At LSE we believe you should largely responsible for organising your own work and meeting the requirement of the programme. Although support with your studies is always on hand if required, a strong emphasis is placed on self-reliance. You will spend the majority of your study time on your own work rather than with formal instruction." (p18)

In addition to its international recognition and academic excellence, students at the LSE also face a different living environment in comparison with other U.K. universities. Since the school is located in the central London, which is one of the biggest cities in the world, it is very difficult to create big and centralised campus environment as found of, say, at Oxford University. With a very limited amount of School residential accommodation available and the need to obtain affordable accommodation, the majority of the LSE students have to find their own living arrangements, often at some distance from the school. Consequently, the LSE students are more geographically dispersed than in other U.K. campus universities. Most normally spend approximately 30 minutes or more travelling to the school. As a result of its geographical characteristics and stress on self-motivated learning style, the LSE students, especially graduate students, are more individual learners and value more highly communication with faculty staff than with fellow students.

The aim of the above description is to provide the readers with detailed information about the organisational setting in which this case study took place. According to our theoretical framework, we expect the LSE learning culture will have a certain degree of influence on students' online learning experiences. More discussion on this finding will be found in the next part of this chapter and the following chapter.

5.2 *Technological Frames and Online Learning Activities*

There are two elements of our theoretical framework: technological frames and online learning activities. Considering the purpose of this study is to trace and explore the interaction between the associated technological frames and students' online learning activities as an on-going process, we decided to present the study in terms of two time periods: phase one and phase two. The decision on which time

point to name 'Phase One' and 'Phase Two' was made on the basis that there was a significant change of online learning activities from week three onwards. By separating the time line into two phases, we considered that it would be easier to identify the factors underlying such changes in their technological frames and online learning activities or styles.

In accordance with our theoretical underpinnings, the description of our findings starts with dividing each phase of our data under two headings: technological frames and online learning activities. In each category, the transcribed interview data, questionnaires, field notes were then studied and organised into different themes as the fieldwork progressed. As indicated in Chapter Four, this hermeneutic process not only allowed the emergence of new themes at different stages of the study, but also assisted the researcher in gaining a sound understanding of students' perceptions and interpretations of online education and technology. For instance, for technological frames, we started with the term used in the work of Orlikowski and Gash (1994). Later, through the recurring exercise of reading the field notes and interview data, we arrived with another theme of 'understanding of online education'. The process was repeated numerous times and only stopped at the stage when we were fairly confident with our understanding of the online learning environment under this study.

The following descriptions is organised around two phases of the study and each phase is addressing themes emerged within two theoretical elements that were established earlier in Chapter Three.

5.2.1 Phase One: Exploration Time (Introductory Presentation plus Week One – Week Three)

We include the introductory presentation and the first three weeks of the use as our phase one of the study. We name this phase 'Exploration Time' because students had just started to incorporate online technology as part of their learning routines following on from the one-hour introductory session back in October 1999.

Technological Frames

We begin with findings on students' early interpretations of online education and technology. From the field data, we divide our findings of students' technological frames in three parts: understanding of online education, understanding of technology and expectations of technology. Understanding of online education looks at students' views about online education in general as well as reactions towards its implementation at the LSE. Understanding of technology refers to students' knowledge, assumption of and experiences with technology, in this case, the WebCT. Expectations of technology deal with students' anticipation of how they would use the system for their learning purpose.

Understanding of Online Education

According to our interviews, students overall seemed to have very little knowledge about online education. When asked about what they knew about online education, most responded 'learning through web', 'having reading material on the website", or 'get lecture handout from the web' but were not able to provide more explanations or elaborate this concept further.

Our interview findings illustrated that the majority had not considered the relevance of online education on campus. From their perspective, most saw this type of learning as the advent of distance education, which was considered completely irrelevant to campus education. Nevertheless, it was evidence that because of press coverage they had started to get the impression that the idea of online education or e-

learning was becoming more popular. During our conversations with them many made references to press reports. Recently there had been numbers of news articles carried in particularly in the Financial Times (FT) and the Economist, on the expansion of online education. These two newspaper and journal were those most frequently read by the LSE students since they were sold in great quantity at the LSE Student Union Shop and students were seen holding copies of FT or the Economist in the lecture or colloquium. During this period the FT's regular column on business education reported several times on the growth of the virtual classroom and the use of technology to facilitate teaching and learning for MBA students at business schools. Furthermore, as described in the last section, the LSE had noticeably been making an effort to promote its external online education programmes. At its web homepage, there was a direct link to the Fathom homepage and constant news updates about the development of Fathom. In contrast to the publicity given to the external online programme, not much had been done to spread the idea of online education on campus. Consequently, when students first heard about this initiative at the introductory session, a number of them were a little shocked and confused. Thus some students reacted with a more positive response towards this idea while others voiced their concerns.

The following section reviews the underlying reasons accounted for two completely opposing types of attitudes towards online education on campus during Phase One: excitement and resentment. From our field notes and interviews data, we find that 15 students had a positive attitude, 18 students had doubtful and negative attitudes, and another 3 showed no real different in their attitude at the early stage. The definition on positive attitude and negative attitude was determined on the basis of their verbal expression and facial expression during the interviews and informal conversation. We also tried to triangulate this qualitative finding with the results from our first set of questionnaire.

Excitement

We found that students with a positive attitude were those with the following characteristics.

- Better understanding of online education;
- Had good experiences with online education and Web-based discussion before;
- Strong appreciation of web access to class and material online.

Although the majority of students had no experience of using online education system before embarking this course, some appeared a curious and were prepared to be adventurous. In particular, we found that there were about 8 students strongly aware of the involvement of the LSE in online education having followed the various news reports. To certain extent, these students felt honoured to be the first group of students using such a system inside the LSE:

> "I feel it is quite an innovation. I have never experienced this in my previous academic environment. There are so many people looking into this now. Oh, LSE has this Unext thing going on as well, right? I think that this will be the way that people would learn in the future."

> "Excellent, I was very excited about it. I was hoping to see anything like this at the LSE since my friend from the U.S is using similar thing for his course."

> " My first reaction was that I am very excited about it, and it was the deciding factor that made me take the course."

The positive and frequent reports from the FT and other newspapers also reflects on the excitement students felt. Two students commented in the interview:

> "..I read about e-education lot recently from the FT. It seems lots of MBA programmes are using it. I guess, I am kind of curious and interested to find whether it is as good as it says on the newspaper."

> " yap.. I saw some articles about this [online education] from the Guardian and Financial Times. Interesting.."

Orlikowski (1993) suggests that one source that an individual uses to ascribe meanings to the technology is the priori experiences with similar technology. In our background information about the course, we indicated that three students reported having similar experiences before. Of those, two had had a successful learning experience while one considered it had made no difference to his learning.

Consequently, the former were more willing to try it again whereas the latter was not very keen on this idea. As one who had a good experience before expressed that,

> "Yes. I can do another online course. Actually, I have done an online course before. The university I was with before was trying to connect with different universities in the world. So, I have some experience in online learning."

The third characteristic of students who welcomed the use of the online education system focused on the benefit of convenience and flexibility, i.e. appreciation of web access. As described earlier, the majority of LSE students did not live within walking distance to the school. Our first questionnaire showed that there were 17 students living at the LSE residential hall. The geographical distribution seemed to make the system more attractive. At the introductory session, the system was presented as a web-based learning system with the recorded media, course reading materials and online discussion and would be accessible 24-hour with an internet connection. The system was appealing because students thought that as well as saving time and cost of travelling, they would still obtain the necessary materials for the course. Of 17 students, during different occasions of conversations, 7 students expressed their appreciation of online learning systems to overcome the problem of travelling to LSE.

> "Given my work schedule and where I live, I probably can not attend all the lectures or will be late for the lectures. This system would be useful, downloading lectures at your own choice of time."

Flexibility was the other benefit in the eyes of students. Since the masters programme was only one year in duration, many students had to embark on job searching while studying for their degree. The course was taught in the second term when many job interviews were taking place. During our early conversations with them, students reported that they would have to miss some of their lectures or classes in order to go for job interviews or recruitment fairs in the first term. Because of this, students were attracted to the system since it would allow them to make up what they would miss if they were not able to attend the lectures or classes in the second term. The benefit of flexibility was repeatedly mentioned after using the system for two weeks:

> "For one thing it enables me to manage my time more efficiently. I need not go physically to college. Also, I can participate whenever I want to and not simply in a time slot."
>
> "oh, love the flexibility. I still can attend class at my own choice of time each week..great!"

Resentment

However, there were also 18 students who were not very impressed when the course lecturer introduced this new concept of educational delivery. This reaction was observed as early as the introductory session in the first term. At that session, 70 students attended to find out what both the ISS course and online delivery were about, so that they could make up their mind whether to choose this course as their option for the second term of their study. At that point, several students raised questions regarding the need and effectiveness of online education on campus. In the second term, we spoke with students who initially were thinking about to take this course as their option, but did not do so in the end. Students explained that they changed their decision after realising that the course would be not delivered by the conventional method. Students also confirmed this finding in the interviews:

> "some of students I know said that the reason for not choosing security course at the beginning is this online learning stuff."
>
> "I remember what people said this and that about security course online, they said that it is not going to work. "

The reason that the 18 students still decided to take this course was because of their strong interest in information systems security. Through interviews and conversations with these students, we also identified three reasons as the cause of resentment:

- Fear of losing interaction with the faculty;
- Understanding online education system as a automation system, not an interactive learning system;
- Little trust in system reliability and quality.

Students who were not happy about adopting the online system as the means of class discussion reported that they were worried about losing contact with faculty. As indicated earlier, most LSE students are foreign students who are willing to pay higher fees and living costs in order to study in one of the best universities in the U.K. For them, paying high fees also means that they can expect to interact with top experts in the field of their study. However, because of the great demand for lecturers' services, such as on research projects or as advisors on government bodies, and because they often lived far away from campus, most faculty keep a strict time schedule regarding their meeting with students. Among 18 students, 8 students told us that they experienced little contact time with their tutors during the first term, and hence were afraid that the implementation of the online education system would completely take away this already limited contact. Examples of such a feeling was expressed in the interviews:

> "It was not a very good reaction. I was not very happy about this. It just scared me that my contact with the lecturer will be lost when I already had a minimum contact with my supervisor. I know that now people try to bring business to the Web, but I very much doubt the quality of bringing education to the Web."

> " I was not too pleased with it because I didn't think it would work with me. I am not a person who could sit down and do that. I am the person who needs personal interaction. Otherwise I don't have to come to LSE to study, just stay in Germany for distance learning"

> "Can not believe that the School would let them do this. We paid such a high fee to come here for lectures and education, not to use the system. I think that this idea of online education here is just a cheap way for lecturers not spending so much with students. Let some kind of computer system deal with us, instead of them."

These three statements also reflected their understanding of online education as a system that automates instruction like lectures and paper reading materials. There was a little belief that the system was able to replace, at least mimic, classroom discussion. They feared that they would be completely left alone if classroom discussion took place online instead of in face-to-face situations. In their view, they perceived that there was nothing as good as a real time interaction. One student expressed that,

> "first impression [of online system], I was a bit worried. No I was actually a bit angry why we have to go through this system for our course work, instead of normal face-to-face contact."

In the work of Webster and Hackley (1997), survey outcomes showed that reliability and quality of perceived information technology adopted was positively related to the student perception of learning outcomes. Our early findings were consistent with what found in their study. Since it was the first time such a system was to be used and since they had not heard of the software before, some students were concerned about system reliability and quality. There were worries about the system not being fully tested before its launch. They expected a high rate of system failures, and thus, lots of troubles ahead in their learning during the term.

Expectations of Online Discussion

On the one hand, positive students saw that online learning as a form of e-commerce of education, bringing convenience and flexibility. On the other hand, there were others having doubts about its ability to promote interpersonal interaction or class discussion as takes place in face-to-face teaching environments. When asked in greater detail about their expectations of online discussion, it seems that regardless of their feelings about online education on campus, most were confused about how the online group discussion would work. Because of the nature of communication, online group discussion becomes more transparent and permanent. They felt that they needed to be more cautious about what they say since the message would be seen by others and could not be deleted. They also sensed that there was a need to take discussion seriously since it was part of their assessment. Besides, they were told that the lecturer had access to the system. For face-to-face classes at the LSE, classes are normally taught by senior Ph.D. students instead of lecturers themselves. In their eyes, having lecturers overlook their discussion added another layer of pressure when discussing class questions online. They did not want to create the image of 'being stupid' in front of lecturer if they didn't get the answer right.

> "the thing is that the change of group communication from [one where] not everything is remembered, which is like normal class system. I think that people feel scared, you know, as one posts the wrong answer or did

> something very wrong. Once it is posted, it is open for everyone to see, whereas no one really remembers what you said in the classroom."

At the introductory session, students were given a short explanation regarding the structure and timeline of class discussion. However, there were no explicit guidelines given with respect to discussion style or norms of participation. During the first few weeks, many students still had no idea how to participate in the group online discussion. Our field notes indicated that students were trying to find out from each other "how much are you going to write?" or " do you know what are you going to post?" in their conversations after the lecture. Students expressed that the only information they knew is that the teacher would give them feedback at the end of discussion. Relying on this piece of information, they assumed that the purpose of online discussion was for teachers to be able to respond to their answers and mark their grades. This was also reflected in the first interview, two students commented that,

> "It is a group thing, you want to have a good standard of discussion. However, I think at the beginning, you need to educate us how to use and behave in this kind of learning environment. If we have proper education and training, I guess that we will be more interactive than we have been.
>
> "I think that more training at the beginning will be very helpful to get us into situation more quickly than it was."

Understanding of Technology

The second theme in our findings on technological frames is that of students' understanding of technology. Here we showed how students make sense of the WebCT at the early stage of the use.

Our findings indicated that at time of this study, students appeared not to be aware of the existence of commercial online learning software product. Some thought that the technical team created the system from scratch while some thought that the system was some kind of interactive website using HTML or Flash design tools. One explanation was that although students might have knowledge about online education from newspapers, there was limited coverage about online education software.

Identified in Chapter One, the development of such software mostly started in 1997 and gradually expanded during the following years. In our first interview, only 3 students said that they had heard of 'WebCT'. The second reason was that most students had not used products other than Microsoft software for their main learning activities. At the introductory session, the technical team emphasized that the system would be web-based and provided a few screens of its interfaces. They demonstrated to students the capability of downloading reading materials, listening to lectures, sending mails and participating in discussions by using the system. Additionally, a simple manual on system functionality was handed out during the session. However, details on how the system would actually be used to support teaching and learning were not clearly specified either by the technical staff or the lecturer. Consequently, the lack of knowledge and experiences with WebCT led students to extrapolate from similar technology of this kind, such as Microsoft Outlook.

Why Outlook? For students and staff at the LSE, Microsoft Outlook is the chosen means of electronic communication. As well as mostly using the system for e-mail purposes, students and staff rely on the facility 'Public Folder' for an information retrieval function. The IT Services at the LSE create a public folder for each department. After that, each department has its own choice of how it wants to make use of the departmental public folder. The IS department decided to create individual sub-folders for each course taught in the department. However, there was no restriction on the access to individual folders provided they are faculty and students in the department. Within each course folder, the responsible lecturer would normally post the lecture PowerPoint slides, handouts and reading materials. Figure 7 demonstrates the example of the typical use of Outlook for one ADMIS course. The access to the Outlook was through computer facilities located in the department and other computer labs on campus. Besides, the school makes the Outlook available through the school website. Therefore students can still retrieve their e-mails or relevant course documents in the Public Folder through Internet connection outside campus.

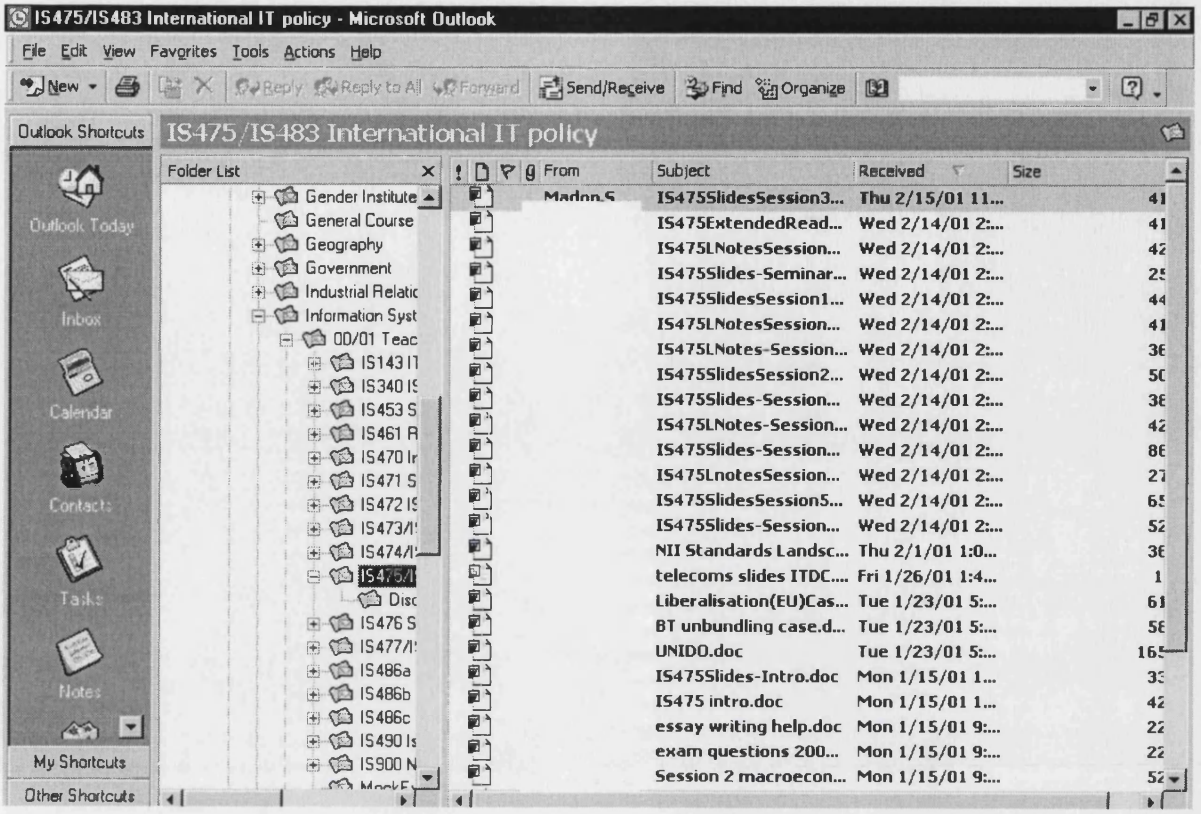

Figure 7: Example of Public Folder within the Outlook

Students had been using the Outlook for the first term of their study and the majority did not see how the online education system was any different from the Public Folder built into the Microsoft Outlook. After being demonstrated a few screens at the introductory sessions, those who were positive about online education saw online technology offering a more centralised and structured website which was exclusive for their use only. They felt that the online system could provide an extra benefit of multi media, something lacking in Outlook. They appeared to be more willing to explore a technology developed especially for learning, despite little knowledge of it. On the contrary, the sceptics thought the online learning environment was the mirror site for the 'Public Folder". Instead of using the Public Folder, they considered that the lecturers had merely made a decision to disseminate materials through another system. In their view, the difference of functionality between the Public Folder and the online learning system was very small. They felt

that the only distinction was that 'online learning technology sounds more modern and fashionable than just the Outlook', as one student put it.

Expectations of Technology

Finally, when asked about their expectations of technology, which refers to the expectations on system usage to facilitate their learning, we also obtained contrasting responses from students. The group of students with a positive attitude suggested that it would be easier and more convenient for them to re-visit lectures and print out reading materials. They anticipated that the recorded lectures and talks at colloquium would be used frequently since it would certainly help them revise lectures if they had a problem of understanding the lectures or were unable to attend the lectures.

> "The most I would like to use is that you have different choices of understanding the lectures. You can listen to real media or PowerPoint slides media, and you get to control it within your time."

However some considered that the system could create more difficulties for them. First of all, because the system is not fully hosted by the IT Services, the technical team had a problem of integrating the LSE log on username and password into the online learning system. Therefore, students had to remember another set of username and password for this course, which might be different from their LSE one. Consequently, they resented the fact that username and password was not made the same as their LSE computer access username and password.

> "..not only I feel that I have to use two systems that I think are not too much different, I have to remember another username and password, log on to a different site. How come I cannot access it through the central LSE site.. kind of trouble for going through it.."

> "why [do] we have to use different username? They should be the same.."

Second, it also meant that in order to collect materials for all courses that they were taking, they had to log on to two different systems instead of Outlook only. Furthermore, as mentioned earlier, it appears that some students were not very confident about the reliability of the system. Considering the fact that it was not

maintained by the IT Services at the LSE They expected that it would take a long time to retrieve materials or there would be frequent downtimes. In the first week of the course, the lack of confidence in the system was also reflected by constant suggestions made by students on system back up. They suggested that the materials of the course should also be available in the Outlook, so that they could download information from the public folder if the online learning system became inaccessible.

Despite the above differences, it appears that students understand the technology as a means of downloading information and of having opportunities for listening to lectures at their own choice of time and location. Their expectation of the technology seemed to centre on its ability for making individual study easier or more efficient. Those 3 students who were neither optimistic nor pessimistic talked about the opportunity of using system to facilitate their group discussion, help them organise team work and exchange extra reading materials. As one student expressed in the interview,

> "I don't think much of it, I know that I want to do security anyway. I was no that scared of doing it [online learning], because I don't think that it will affect my work. Well, probably will help me be more efficient."

This is consistent with the above findings on their expectation of online discussion, which they saw as a means of submitting weekly assessment between individual and teacher, rather than as the mechanism for enhancing group communication or promoting class discussion.

Technology Use and Online Learning Activities

Technology Use

Stemming from our theoretical assumptions, we made a point that students would appropriate the online education system based on their perceptions and interpretations of online education and technology. We have presented above their early attitudes towards online education and other technological frames. Here we look at the consequent impact on their use of the online system.

First, studying the computer-generated statistics of student log on at Phase One showed that the numbers of student access had been increasing at a stable rate, from the daily average of 6-10 students accessing to the system in the first week to on average of 15-20 in Week Three. However, because students did not see the online learning system as serving the purpose of group learning, the way they used the system was very similar to how they had used Outlook for their other courses in the first term. The page tracking facility built within the WebCT indicated that students used the system mostly for listening to the lectures and printing out reading materials. During Phase One, the system records showed that Lecture One had 35 hours and Lecture Two had 28 hours of listening. Other facilities such as e-mail, student homepages or course tools were hardly visited or used by students. Students reported that they still used Outlook for their personal e-mail communication even when they needed to communicate with the ISS course teacher or coursemates individually. The explanation given was that the online learning system was not a 'global' system. By using the online learning system, they found that they could only send internal e-mail to students who were in the same course, whereas through the Outlook they could e-mail anyone as long as they had an e-mail address. Furthermore, they had been using the e-mail account for the first term and considering the fact that the learning system would only be available for 20 weeks, they felt that it was more feasible to continue using e-mail through Outlook. As one student explained in the first interview,

> "I find the private mail a bit of a nuisance (just one more place to look for mail). Why not have messages go directly to our LSE inboxes? Perhaps

messages from classmates could have some kind of identifier so we know where they came from."

Collaborative and Situated Learning Activities

The aim of collaborative learning is to help students' knowledge construction by engaging them in a series of discussion, negotiation and debate. According to our theoretical argument in Chapter Three, online education provides a great opportunity of fostering such a learning environment without time and space constraints. Nevertheless, looking at our case study, online discussion was not used actively, at least not for the first three weeks. Table 7 sums up the numbers and distributions of messages posted for the first three weeks.

Week	Total Messages	Students Messages	Tutors Messages	Student%	Tutor %
1	13	3	10	23.08%	76.92%
2	48	26	22	54.17%	45.83%
3	74	41	33	55.41%	44.59%

Table 7: Numbers and Contribution of Message at Phase One

Teachers mainly dominated the first week postings with one message to 7 groups about discussion questions and three messages regarding administrative matters. Only two students responded to the question, one of whom had an online discussion experience before. The message from the third student was on an administrative issue. In the second week, although there was an increase in the numbers of postings from students, there were still only 22 students out of 36 who had made an attempt to post a response. By Week Three, 26 students had posted at least one message and a few more active students started to dominate the messages in the class discussion forum and other open forums.

According our interviews with students and observation on the timeline and numbers of student online posting, we see four explanations are possible for such outcomes at this phase. First, the negative attitude towards online education prevented students from exploring the value of the system. Second, the fear of being seen as the stupid one suppressed their willingness for putting their comments online.

They waited for other coursemates to take the plunge and to see what kind of feedback the teacher would give. Put differently, they wanted to see from the teacher what was the expected standard. The problem of waiting caused many to respond to the class question only immediately prior to the deadline, and hence this did not allow sufficient time for debate and discussion among group members. Third, from our information on the institutional background and observations, students at the LSE tend to study individually, and normally do not value strongly the importance of group discussion or could not get used to the idea of constant intellectual exchange with other fellow students. As one student commented:

> " I would say that I am still pretty much on my own. I don't have much contact with other group members in terms of thinking and discussing. I was just doing it on my own."
>
> "I find my last term classroom rather disappointing.. it's better to study by myself.. I am not expecting there will be any huge difference in the online education."

Finally, although in the introductory session the lecturer made an attempt to explain the idea of online education, the issue of the norms of the online discussion was undecided. Students were confused about what form of language, style of discussion and the length of discussion were acceptable in online discussion sessions. Consequently, as shown in our findings on their expectations of online discussion and technology, they interpreted it as writing a formal short essay aimed at the teacher rather than for the purpose of group discussion. The results of analysis of their communication flow on the second online class confirmed this. Of seven private discussion groups, Group 2 was the only group in which all members responded to the discussion question. We found out that Group 2 members were those who at the start of the course had more positive feelings towards online learning and technology. In addition, one Group 2 member had used the same system for his undergraduate study and started the discussion in a more informal way.

Compared with Group 2, the other groups were less active and discussion was more formal. Group 3, 4 and 6 all only had two students responding to that class question. In the middle of the discussion the lecturer commented on students'

answers in Group 5 and 6. This further created a little discussion in Group 5, but the same situation did not occur in Group 6. The following is an example of lecturer's comment message in Group 5, and followed by another student's response,

> **Message No. 89:** posted by **Lecturer XXX** on Mon, Jan. 24, 2000, 21:20
> **Subject: Re: Online tutorial number one. Class questions**
> I think that [Student XXX] is right to say that control is preferable to unfettered access. But noone would disagree. The real problem is how to deliver that control at a fine level of detail. Few information security chiefs will say that they don't have the technology to deliver the control, what they all say is they are worried about the unpredictabilities of the human and social agents. Constant shifting in business priorities, activities, job descriptions and so forth, coupled with the rise of sophisticated hacking communities... these are the issues.
> [Name of Lecturer]
>
> **Message No. 104:** posted by **Student XXX** Wed, Jan. 26, 2000, 00:19
> **Subject: Reply to question**
>
> I believe it is important for organisations to control their information and allow access to specific people within the organisation. Having said that, we should keep in mind that in order for the organisation to achieve its goals, it is important for people within the organization to collaborate. Therefore, I think control should definitely be given priority, but it should not alter collaboration.
>
> How is this put into practice? Do most organizations actually give priority to control or collaboration?

As for form and content of message, students responded to the question without starting with any kind of greeting, such as 'dear all' or 'hi, everyone'. The majority wrote in the format of answering an essay question in an exam, with formal English and a good structure. On average, most students wrote approximately 500-word long message. One student even created a lengthy Word document and posted the message as an attachment.

> **Message No. 87:** posted by **Student XXX** on Mon, Jan. 24, 2000, 19:32
> **Subject: Re: Online tutorial number one. Class questions**
> [Word Document Attachment]
>
> THIS IS MY ANSWER. IT IS IN A WORD DOCUMENT. THANKS

Furthermore, in the process of their discussion, students gave many empirical examples to support their theoretical argument, which demonstrated their ability of

linking knowing and doing. Apart from the one member in Group 2 who wrote as his message title "stirring up the discussion", there was no sign of obvious attempts by students to invite group members to comment on their answer. Besides, as mentioned earlier, students tended to post messages only one or two days before the deadline. This gave very little time available for reflection on what had been posted.

In addition to private class discussion forums, there were three different open forums for students: IS Debate, Reading Suggestion and Summer Project. There was not a single message from students in Summer Project Forum at this phase of the study. Students reported that they did not feel comfortable with online socialisation considering that they could still see their coursemates in the lectures. However, the most important reason was that they did not want the social messages being seen by the lecturer or teacher. We analysed the interaction that took place in the Reading Suggestion and IS Security Debate forums. These two forums were highly relevant to the concept of situated learning. As indicated in our early discussion in Chapter Three, one aim of situated learning is to achieve knowledge construction through the reference to real life events in the classroom. At the face-to-face lecture, the lecturer encouraged students to post other relevant or current readings related to course and to use the open forum to discuss current affairs in IS security. At this stage, there were only seven students who started to use such forums and the content of discussion was centred on current issues regarding 'outsourcing security'. There was no sign of post-colloquium discussion to continue debate raised by the guest speakers from industry.

Looking at the format of message and characteristics of students participating, the length of messages were much shorter than those in class discussion forum, it appeared that students were really discussing instead of writing an essay. As for their characteristics, unsurprisingly, all seven students participating in the IS Security Debate Forum had been among those who had displayed positive opinion about online learning at the outset of the course. In the Reading Suggestion Forum, teacher and lecturer posted a few messages to make further suggestions for references. Three students followed in and shared the information they read in news or in journals. These three were among the seven students who took part in the IS Debate Forum.

In short, at this stage of the study the argument for online education supporting collaborative and situated learning seems to be rather weak. There were few group discussion activities despite students being put into a group and being supposed to discuss the question set by the teacher. The online learning activities reflected a more individualistic learning behaviour coming from the influence of LSE learning culture and some classroom experiences from the first term.

5.2.2 Phase One Summary

Figure 8 demonstrates our findings about the relationship among the context, attitude towards online education, technological frames and online learning activities at Phase One.

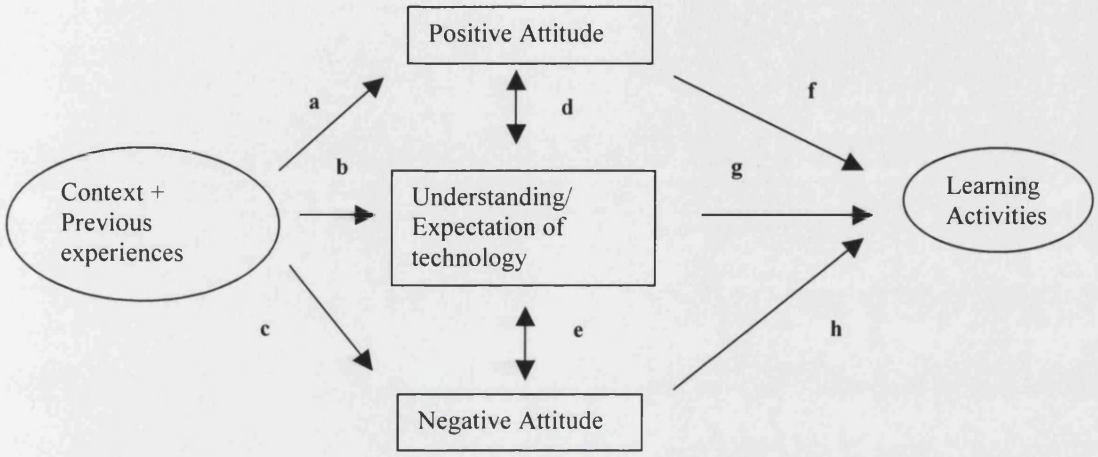

Figure 8: Online learning at Phase One

The arrows a, b and c show that the learning environment, online education commitment of the LSE and individuals' previous experiences have certainly influenced students' understanding and attitude towards the concept of online education. Because of the limited information and knowledge available, all students held two opposing attitudes based on their own interpretations of what was given. With regards to their perception and expectation of technology, the majority of students had never used any online learning software before taking part in this course and they were not explicitly told how to use the system for the purpose of collaborative and situated learning. As a result, they tried to make sense of the technology by comparing it with Outlook, the current system in use, and at the outset of the course many could not point to any significant differences between the two. Some students even considered the WebCT was system to be irrelevant.

The arrows d and e illustrate that the relationship between students' attitudes towards online education and their expectations of technology is closely related. On

one hand, their understanding and expectation of technology were partly influenced by their view about online education as whole. On the other hand, their insufficient knowledge about WebCT also played a part in their view of online education. For instance, the characteristics of convenience and flexibility enabled by the technology and previous positive experiences with the use of similar system helped some students to generate positive feeling about online education.

Consequently students acted in accordance with their perceptions and interpretations of online education and technology, as shown by arrow f, g and h. The most obvious observation was that students seemed to follow the user behaviour inherited from the use of Outlook such as, downloading lecture slides and reading materials. Most continued to use Outlook for their e-mail communication instead of using the one provided by the online learning system. They explained that WebCT was too localised, while the Outlook was more global. Besides they did not see any reasons for using WebCT for e-mail contact, since it offered less functionality than the Outlook and only lasted for one term use while they could use Outlook as long as they were registered students.

As far as online activities were concerned, it was evident that students did not fully appropriate the system for group interaction. Because of the undefined group discussion norms and their reduced understanding of the technology at this stage of their study, the majority treated the discussion as a formal individual assessment rather than as opportunity to discuss with classmates informally on IS security issues. One student remarked that,

> " I have to check my grammar and make sure that, I answer questions to the point. I would never use colloquial words like how are you doing? I treat this seriously."

This seriousness about online discussion further led to no social postings in the public forum, which initially was set up partly to serve the purpose for informal socialisation online. However, there were some indications that students who were more positive about the implementation of online system started to try out the IS Security Debate and Reading Suggestion Forums, as described in the section above.

Overall, up to this point of the study, there was no clear evidence that online education at the LSE provided additional support for social constructivism approach to learning.

5.2.3 Phase Two: Exploitation Time (Week Four – Week Ten)

We move on to look at the second phase of students' online education system use from Week Four to Week Ten. We refer this period as Exploitation Time. The reason for grouping week four to ten as the second phase is that there seems to be a significant change in students' learning activities online, which we will touch on shortly. On closer scrutiny, the change is related to actions undertaken by both the lecturer and some students. Before starting the description of the consequent impact on students' technological frames and online learning activities during Phase Two of the case study, the following section will first give an account of the involvement of the lecture and classmates that appeared to change the prevailing attitude towards the use of the system.

Lecturer's involvement

In Phase One, the online teacher took a more passive facilitating role rather than being actively involved with students. As pointed out earlier, each class discussion lasted for two weeks. The online teacher set each question to start the discussion after the face-to-face lecture on Wednesdays. During these two weeks, apart from occasional interventions, he mostly left the discussion in the hands of students. At the end of discussion period, he would provide a model answer and comment on each student's response. He also approached the discussion forum in a formal manner. At his first posting of discussion question, he wrote:

"**Message No. 2:** posted by **XXXX(Name of the Teacher)** on Wed, Jan. 12, 2000, 14:10
Subject: Online tutorial number one. Class questions.
Welcome to the first online tutorial. Here are the first class questions. What I'd like to see from you when answering them, is evidence that you have comprehended the themes and concepts discussed in the lecture, and use this knowledge to answer the following:

What changes within and between organisations have created new risks for them?

What are the risks?

Which of the following do you think should be given priority over the other?
- Widespread access to organisational information to allow collaboration and co-ordination. or - Control of an organisation's information

Regards, XXXX"

His style had a consequent effect on students as we discovered in their phase one learning activities. The discussion norm was not clearly stated in the message and there was no signal of promoting group discussion. As a result, with no experience of online education before, students did not know how to react and behave at the start of the online discussion class and hence continued their normal learning style for the LSE. They treated their online discussion as if they had to give teacher their answer on pre-set question and in return for his feedback, as reflected on Figure 8.

In Phase One, the course lecturer closely monitored the use of the system and followed the development in online discussion forum. Being part of 'Teaching and Learning Technology Group' initiative, he had a great confidence and belief in the value of online learning technology to enhance learning quality at the LSE. Despite not actively participating in online discussion, he always asked students how they were getting on with the use of the system before the start of the face-to-face lectures. He kept in close touch with the technical support team and teacher in order to receive early feedback on student use and system performance. After realising student concerns over online education and observing the low rate of participation in online classes, the course lecturer decided to take action in order to show students his belief and commitment in online education. First of all, in order to make students become more involved in online discussion, at the end of Week Three he used his authority

and sent out a formal message to all students through both the mail embedded in the online learning system and the Outlook:

> "Dear Students:
> I am writing to remind you that your participation and contribution to the online classes will be assessed and count towards your grade for the course, so I am expecting to see your postings very soon.
>
> If you still need some help or have any questions regarding our online learning environment, please contact us as soon as possible.
>
> XXXXX
> Course Tutor, IS484 and IS476"

Second, to promote further interactions within the group, he participated in discussion and gave students positive feedback in some groups. For example, he wrote in his message to Group 2,

> "Dear Group 2 I just wanted to post my commendation to you all for this excellent group interaction. It has demonstrated how it is possible to draw everyone in to a quality discussion on quite rarefied subjects. Keep up the good work."

In the IS Security Debate Forum he congratulated students on their ability to use the medium to the full and encourage further discussion. He used those messages as a token to show students how he had paid attention to their participation. As described earlier, students at the LSE take seriously their image in front of the lecturer. They did not want to have a black mark against them in the eyes of the lecturer. Discovering that the lecturer actually followed their use of the system had changed some students' previous perception about online education, in particular, regarding the loss of lecturer contact time. This issue will be examined later.

Influences of Classmates

Apart from actions undertaken by the course lecturer, we noticed that classmates also played a role in influencing each other's online learning activities. Our first set of questionnaires saw 20 of 26 students responding that using the online

education system forced them to do more work than they might otherwise. During the first interviews, they were asked where such pressure came from. Most students pointed out that peer pressure was becoming more influential than pressure from the lecturer or tutor. At the beginning, the authoritative e-mail that was sent by the course lecturer put them under pressure to participate in online class discussion. Once they started interacting with others, they came to realise that if they saw someone posting a very good answer, they themselves would want to reach that level or even better it. Furthermore because they still had a chance to see each other in other face-to-face courses, it would be embarrassing for them to be a person who did not participate in the discussion or post a reasonably good answer. Consequently, they would work harder and do more readings with the aim of preparing better responses. Students further explained that they regarded this kind of pressure as healthy competition in the process of their learning. One student explained,

> "It became more and more important for me to check my progress against the others. I don't want to be left behind, I will feel uneasy.. They have a lot of new ideas, so I do enjoy reading their comments and see what they have to say for one typical question."

Furthermore, in the online discussion forum, those students who had a good discussion going on in the open forum decided to bring the same spirit of debating into their private class discussion forum. Accordingly, in some online class forums, we saw students posting messages such as ' hello, group, are you out there? Let's get some good discussion going!', to stimulate discussion among group members. As a result the promotion from other students and seeing the discussion pattern in the open forum, most students gradually learnt to respond each other's answers in a short and informal manner.

Technological Frames

We turn to the question of whether and how actions undertaken by the lecturer and classmates change everyone's understanding of online education and the system in use? Again, we can explore this issue through the lens of technological frames. Here we divide technological frames into two sections: understanding of online education; and understanding of technology in use.

Understanding of Online Education

At the beginning of the course, we noticed that students held two different types of attitudes towards the concept of online education at the LSE: excitement and resentment. As the results from the first phase showed, positively oriented students were more willing to participate actively in the group discussion and hence achieved some goals of collaborative and situated learning, particularly in the open forum at Phase One.

Nevertheless, our case study findings showed that the involvement of the lecturer and active behaviours from the fellow students seem to have some impact on how student viewed online education. At the start of the course, some students said that they were worried about the loss of contact and personal interaction with the lecturer. Therefore they had a fairly negative attitude towards online education. In our first set of questionnaires, we asked students whether they had had doubts about the concept of online education on campus at the beginning of the course, and if so, whether they had changed their mind after using it for more than half the term. Out of 26 questionnaires collected, 10 were positive at the beginning, 16 said that they had doubts. Of these 16, 13 reported that they had changed their mind while three remained negative. The survey results clearly illustrated the change of students' attitude towards online education.

As recalled earlier, the cause of students' resentment came from fear of losing interaction with the faculty, seeing the online approach as an automation system, and with little trust in system reliability and quality. Stepping into the second phase of the study, we identified the following reasons contributing the transformation of students' negative viewpoint about online education at the LSE. First, the messages sent by the lecturer and his regular queries about students' system usage during the face-to-face lectures had demonstrated to students his commitment and belief in online learning on campus. To understand further the source of impact of the course lecturer's action on them, in our second questionnaire we divided the impacts into two kinds: encouragement and force. Questionnaire was adopted from the work of

Webster and Hackley (1997) and constructed using a five-point Likert-type scale measurement with 1=strongly agree to 5= strongly disagree. The questions include such as "I think that the lecturer forced students to communicate using the online learning technology" and "I think that the lecturer encouraged students to communication using online learning technology". The intention of these questions were intended to triangulate our qualitative findings on lecturer' influence. On the basis of the mean, we find that students agreed lecturer influencing and encouraging them using online learning technology. Students also expressed the role of the lecturer during the first interview:

> " Lecturer's comment to the group has actually made students think. You know they are interested in what you are saying. The ability to be able to interact with Jim or our class tutor is great."

Another student added,

> "If I can see Teacher or Lecturer making some comments about what I put on, I feel very encouraged to do more."

Another student explained the lecturer's encouragement on technology use,

> "Instructors always make some encouraging remarks. I think that we don't get a lot of encouragement at the school, but I think that it is important to encourage us. The initial encouragement push from the lecturer has made me tried hard to see what the system can do."

Survey Items	Mean	S.D
Supervisor's belief on online learning	2.75	0.45
Supervisor's impact on use	2.25	0.5
Force students to use	2.50	0.75
Encouragement students to use	1.50	0.58

Table 8: Supervisor's influence

Second, the contributions made by active students and comments from the course lecturer and teacher also changed students' opinion about online learning as an automated process of instruction. The early signs of situated learning activities emerged from the discussion in IS Debate Forum, which was initiated by positively oriented students and further encouraged by lecturers. The process of knowledge

exchange among students themselves made them realise the capability of the online education system in stimulating group discussion, which was seriously questioned at the outset of the course. Finally, with respect to worry over system reliability and quality, the system was down just once for the first half of the term and twice for the second of the term. One downtime was due to a problem with the server and the other times were because of the failure of the School network. On the issue of system quality, 19 out of 26 responses (73%) in our first set of questionnaire considered the system quality was good. All these gave students more confidence in the system. Students also described the system quality in the interview,

> "It does not crash as much as I thought I would be. Now it is like checking e-mail or surfing the Internet!"

According to the above findings, it seems that the causes of negative attitude were dealt with as the course progressed. To triangulate our interviews and observations, in the second set of the questionnaire, we raised questions with regards to their attitude towards online education. The same as that in Table 9, questionnaire was adopted from the work of Webster and Hackley (1997) and constructed using a five-point Likert-type scale measurement with 1=strongly agree to 5= strongly disagree. There were four questions: whether they would recommend this type of education to other students; whether they would take up another online course in the future; whether they were positive at the beginning of the course; and whether they were positive at the end of the course. At the descriptive level, the mean indicates that there are relatively more people feel positive about online education after finishing this course (mean= 2.25) than that before starting this course (mean=2.75). The questionnaire outcome of less positive attitude towards the concept of online education was also consistent with our findings indicated at Phase One. In the interview, one student described how he changed his mind about online education:

> "I was not too sure about this online learning at the beginning, not having class interaction is not what I am coming to LSE for. But when I go out and talk to people now, and I told them that I did online learning course at the LSE. They were very surprised and impressed. They think that I have experienced in some cutting edge technology, which makes me feel very good about it."

Survey Items	Mean	S.D
Recommend to others	1.75	0.45
Take another online course	2.00	0.5
Early positive attitude	2.75	0.75
End positive attitude	2.25	0.58

Table 9: Attitude towards online learning

Our results of the mean, shown in Table 9, indicated that students would recommend online education on campus to other students or take another course through the online system. Two students mentioned in the interviews that they have already enrolled in another online learning course in the Internet, one of them told that he had registered the free online short course offered by the Harvard Law School.

Furthermore, we noticed that there was a change in the students' view about the value of collaborative learning. Earlier, we mentioned that LSE had an individual learning culture because of its geographical character and the traditional learning culture. The ten-week interaction with others had made them think about the value of group learning and information sharing. As two students elaborates this views in the interviews,

> " You know, the thing is that in my study in ADMIS, the classes have been the most disappointing part, usually the classes are some presentation which may or may not be good. There is no real discussion going on. But in this case, for me, it is a real discussion. Everybody commented something about it, so I got to hear everybody's opinion about the topic or their perspectives."

> "Discussion with others is very helpful. You could start with idea A, then it is interesting to see idea B,C..at the end, idea A has been modified to the way I didn't think of. I am surprised at the willingness of everyone helping everyone out!"

In short, many students had new-found attitudes towards online education, they now interpret and assign meaning to online education as the way to:

- Provide better access to lecture and peers;
- Engage in interactive group discussion;
- Change their learning style.

Understanding of Technology in use

During Phase One, owing to the limited information and time available to understand WebCT and the concept of group-oriented learning, they mostly interpreted the system on the basis of their past experiences with the Public Folder located in Outlook. As a result, we found that students used the system by following their pattern of use in Outlook.

For the negatively oriented students, the emergent change in their understanding of technology first started with the increasing awareness of convenience and availability. In comparison with the Public Folder in Outlook, the ISS education system offered other facilities such as lecture media, digital materials and all course information. One student who was not too sure about the capability of the system changed his view and remarked,

> "it's amazing, all the things you need for the course were all there. You do not need to get out of home or wait until the next morning if you want to study at night in order to find materials or discuss with others"

According to our literature review, one problem related to the asynchronous mode of communication was the problem of delayed feedback. During Phase One, we did not hear students mention this concern since they saw the system as an individual learning tool rather than a groupware-like product. Thus, delayed feedback was never an issue or concern. With the gradual engagement of the online discussion forum, the discussion about the issue of delayed feedback started to come up in conversations between the researcher and students. Four students started to report their awareness of the time lag in responding. In order to explore the issue of delayed feedback further, in our second set of questionnaire, we put this issue as part of the questions. At the interviews, students suggested that although sometimes they did feel anxiety when waiting for teacher's or other students' reply, the relatively fast speed of reply had helped minimise feelings of frustration during the communication process. On further exploration, they pointed out that the chance of receiving a reply from teacher in the online class discussion was much greater than using the school e-mail system or office hours. They felt that, in relative terms, the teacher gave more regular and detailed

attention on each student's work, sometimes lacking in classroom teaching, when the focus tends to locate on those who had courage to speak out within a limited time. Hence this helped to reduce the problem of delayed response inherent in this communication medium. In addition, they mentioned that in normal situations, the teacher would be the only solution point when they encounter a problem. The system gave them an opportunity of getting help or suggestions from other coursemates. As one student described,

> "In the face-to-face classes, teacher does not have time to tell you. He only can say few things about those who have spoken up. In online discussion, you can have his opinion about what you post and also from other classmates as well."

Based on the above finding, there is an indication in the change of their perception of the system. In Phase One, students interpreted the system as the same as Outlook, i.e. as a tool that facilitated individualistic learning. With the response from the lecturer and active students to start with, most students began to see the system as a communication medium that catered for group collaboration. Consequently, apart from being able to perform the usual downloading of lectures, the ability to communicate with others and good learning feedback changed their view about the function and purpose of the WebCT.

In order to obtain more on student views of the system in use, at the end of term, we asked students in the second questionnaire whether the technology had been useful during their learning process. The survey items were adopted from the work of Davis (1989) on technology acceptance model. Questions asked include "whether the online learning system has made it easier to reach people", "whether the online learning system increased the efficiency of their studying", and "whether the online learning system gave them greater control over their study". Again we constructed using a five-point Likert-type scale measurement with 1=strongly agree to 5= strongly disagree. According to the descriptive statistic results illustrated in Table 10, students felt that the system made it easier to study, enabled them to have greater control over their study, and to reach people with whom they needed to communicate. Students reasoned that the implementation of the system and the design of the discussion forum

enabled them to check their learning progress against their own performance and that of fellow students in the same course. On the improvement in quality and efficiency of their study, they suggested that sometimes when they came across with some questions during their study, they either had to wait till the next class or teacher's office hour. Under normal circumstances, they might easily forget about the question when they went to the next class or could not bother to make a long journey into school in order to see the teacher in his office hour just for one or two questions. However, the existence of the system allowed them to post their questions immediately and within days they could have one or more responses from other people. As a result of such efficiency in problem solving, they felt that they had control over their study and compared with other courses the overall quality was better. Furthermore, they regarded the most useful feature of the online system to be that it provided leads, references, and useful information related to the course. This feeling was also reflected in the interviews,

> "I think that the overall online learning is richer and very useful. Through this system, sometimes I feel my class members are my secretaries, reminding me that I have to read and do some work. It is very good, this helps you to keep up to date with readings and the course."

> "It helps me not to do things in the last minutes! You do work earlier, not wait until just before the exam."

Survey Items	Mean	S.D
Easier to Reach People	1.80	0.45
Useful Information	1.25	0.5
Efficiency of study	2.43	0.75
Quality of study	2.50	0.58
Control over study	1.79	0.49
Easier to study	1.55	0.6
Overall usefulness	2.00	0.82

Table 10: Usefulness of technology

Therefore, in Phase Two, as a result of influences from lecturers and active classmates as well as the increasing familiarity with the system in use, students seemed to reach a new level of understanding of the WebCT:

- Offering convenience and flexibility;
- Medium for group communication and learning;
- Medium for efficient problem solving
- Useful to help individuals manage learning process.

Learning Activities and Outcomes

We have described the findings on how students' technological frames changed over the course of ten-week at both phases as well as gave an account of online learning activities at Phase One. In this part of the chapter, we summarise their overall learning activities and present the results mostly from the second questionnaire and interview covering issues of technology use, situated and learning outcomes. We decided to include some results at Phase One. There are two reasons for doing so. The first explanation is that some statistics were not fully presented in Section 5.2.1. The opportunity to offer a richer picture as well as presenting some contrasting learning activities between phases is the second reason.

Overall Learning Activities

Message distribution and content

Using the message itself as a unit of analysis, we first focus on the number and trend of discussion postings during the term time. Within that period of time, the systems received 574 messages in total. Furthermore, there were still 13 messages posted in the open forum in Week 11 (a week after the term officially ended), hence, totalling 587 messages. Among these 587 messages, 417 were from students while the online teacher and the lecturer were responsible for the remaining 170. In other words, the percentages of postings from students and the tutor team were 71% and 29% respectively, as the pie chart indicates in the next page.

Breaking down the distribution to a weekly basis, we discovered some interesting findings. First, Week One started with a relatively low number of 13 messages, but then there was a big increase of around 30 messages per week between the first and the fourth week. In particular, after the formal e-mail from the lecturer at

the end of Week Three, there was a significant increase in numbers of postings from students, resulting form the messages sent by the course lecturer (See Section 5.2.3).

In Week Five, which was half way through the course, the number of postings reached its peak of 119 comprising 92 student and 27 tutor messages. One reason for this high volume of messages was the discussion on summer project opportunities and group essay organisation during that period. At the end of Week Four, the tutor posted a message to ask the willingness of students to participate in various summer projects. Students replied to express their interest. After that, there was a very obvious drop in Week Six postings, in comparison with that at Week Five. To be more precise, the former was about only half of the latter. The number of messages posted by the teacher fell because of the interaction among students themselves and the merger of some small groups. Taking this cue, the quantity of weekly messages seemed to decline steadily until the end of the course. Coincidentally, the total numbers of messages posted at the first week was exactly the same as the last week.

The next step was to consider by each week the weight of distribution between students and the tutors. Apart from the first week, students appeared to dominate the posting activities. In terms of percentages, student postings in Week Two were more than twice as much as the first week. There was another large percentage rise from Week Three to Week Four. From Week Four onwards the percentage of student posting remained high and the difference between students and teachers stayed mostly above 55%. It was very interesting to note the reversed weight distribution between students and teachers in the first and last weeks, although both had the same number of messages input.

Week	Total Messages	Students Messages	Tutors Messages	Student%	Tutor %
1	13	3	10	23.08%	76.92%
2	48	26	22	54.17%	45.83%
3	74	41	33	55.41%	44.59%
4	103	76	27	73.79%	26.21%
5	119	92	27	77.31%	22.69%
6	59	44	15	74.58%	25.42%
7	66	55	11	83.33%	16.67%
8	45	29	16	64.44%	35.56%
9	25	21	4	84.00%	16.00%
10	22	19	3	86.36%	13.64%
11	13	11	2	84.62%	15.38%
	587	***417***	***170***	***71.04%***	***28.96%***

Table 11: Online discussion messages distribution

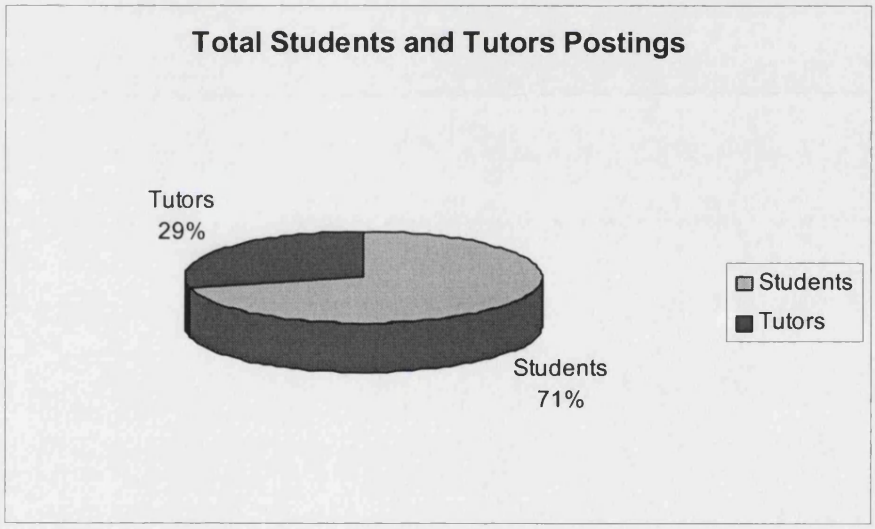

Figure 9: Total Students and Tutors Postings

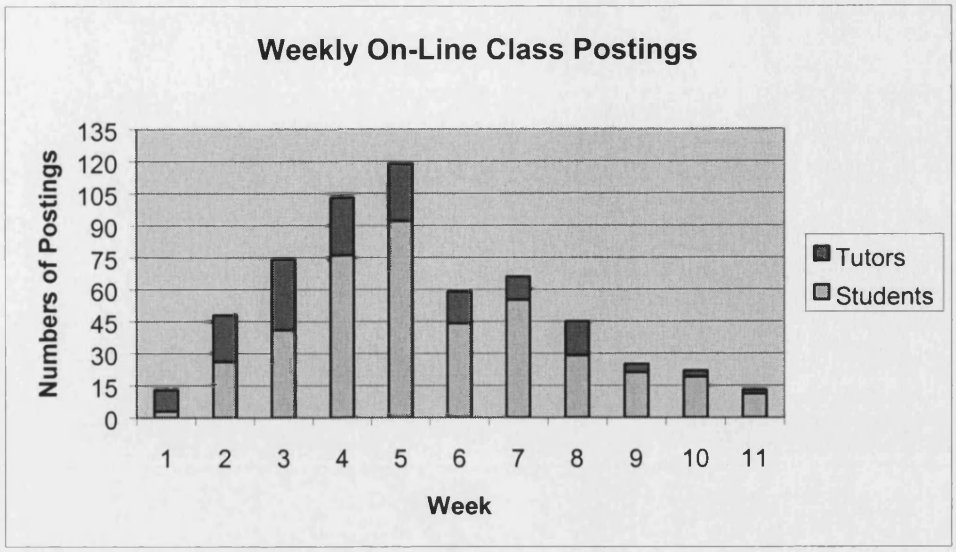

Figure 10: Total Students and Tutors Postings

In addition to summary of the structural analysis, we were also interested in the content of messages. As stated earlier, we see online education as an information system. Therefore, we endeavour to find something that allows us to analyse the content of messages through the lens of an information systems perspective. As a result, we find that the concept of rule-based systems seems to serve the purpose of guiding our content analysis on online messages. According to Liebenau and Backhouse (1990), when using rule-based system to model an information system, three sets of rules apply: substantive, message and control. In this context, substantive rules refer to the message focusing on the discussion of the subject itself. Messages rules represent the message providing information to advance discussion of the subject. Control rules identify the message centring on norm or organisation of discussion. Table 12 lays out our understanding of each rule in this particular context and gives the example from one online class discussion forum on the benefit of BS7799 (information system security standard).

	Description of the Message	**Example**
Substantive Rule	Focusing on the discussion of the subject itself	"the benefit of BS7799 ensures organisation meet the requirements of client and to measure against best practice....."
Message Rule	Focusing on provision of information to advance discussion of the subject	"the following information comes from the BSI-DISC website..."
Control Rule	Focussing on norm or structure of discussion	"I hope that some more people in class will join in with my discussion...."

Table 12: Rule-based system analysis

Based on the above description and again using message itself as a unit of analysis, we looked at 587 messages posted over the period of eleven weeks and assigned them to the appropriate category. Some messages might contain more than one type of rules. We found that the majority of messages were substantive, i.e. discussion on the prime tasks initiated by the teacher or other students. This meant that students really used the online discussion forum to enhance their understanding of the lectures and to facilitate their learning. There were a constant number of message rule based online messages through out the term apart from the first two weeks. We speculate that considering the majority of students were novice to the subject area, it seemed normal that they were not able to provide further information to support or advance the discussion at the beginning of the course. As the term progressed, they became more capable of locating and identifying relevant information, thus message rule based postings started to build up.

There were few control rule based messages in the early stage of the course. This is consistent with the issue of ill-defined group norms during Phase One. Between Week Four and Week Six, we noticed a significant number of control rule based messages, in particular followed by the message posted by the course lecturer. Students were under the pressure to post messages on online discussion, however, there was confusion in respect of discussion format and norms. Therefore, the focus

of messages during that period mainly lies on the invitation for comments or enquiry about discussion style.

Collaborative and Situated Learning Outcomes

In Chapter Two, we identified the main benefit of online education as its ability to foster a social constructivist learning environment extended from the traditional campus education. The notion of collaborative learning is to enhance knowledge construction through the process of group interaction. However the results at Phase One were not able to give a positive response to such assertion.

At the end of term, we sent out the second questionnaire to students regarding their learning outcomes with the use of the online system, in particular, online class discussions. As mentioned in Chapter 4 (see Section 4.3.2), drawing existing survey variables from the current literature helps increase the validity of a study. Here our measures for learning outcomes came from the study of Hiltz (2000) and Alavi (1994) on collaborative learning through Asynchronous Learning Network (ALN) and Lotus Note Groupware, and we constructed items using a five-point Likert-type scale measurement with 1=strongly agree to 5= strongly disagree. Examples of questions asked include 'the online system has increased my ability to integrate facts', 'the online system has helped me to identify central issues better' and 'the online system has helped me to understand security concept better." Of the questions asked and 30 questionnaires collected, the descriptive results show that there were three particular benefits of the system as compared with other face-to-face courses being taken at the same time, namely

1. The online system helped them increase their critical thinking skills;
2. The online system helped them to learn factual material;
3. The online system helped them to think for themselves.

Survey Items	Mean	S.D
Ability to think critical thinking	1.97	0.89
Integrate facts	2.47	0.97
Analytical skill	2.20	1.06
Confidence	2.27	0.94
Value other viewpoint	2.43	0.86
Interrelate ideas	2.67	1.06
Understanding concepts	2.30	0.99
Factual materials	2.13	0.73
Identify central issues	2.27	0.87
Interest of discussion	2.53	1.2
Additional reading	2.37	1.13
Do some thinking	2.03	0.81

Table 13: Critical thinking skill development

Our results on learning outcomes are also reflected in the findings on content analysis described earlier: that most messages were substantive rule based. That means that students had gained knowledge through the process of exchanging substantive rule based messages. In addition, teacher and the lecturers indicated that judging from their teaching experiences, online students appeared better than face-to-face students at incorporating the old and new knowledge together in a discussion. The course lecturer found that messages posted by students in online discussion forums were very thorough and analytical. A number of students described how the system helped their process of knowledge development during the second round of the interviews.

> " The greatest benefit I got from the online learning environment was the wide variety of schools of thoughts that I can read and discuss. The online form allows me to have sufficient time to think, to reflect, and to put my well-organised arguments."
>
> "The online learning system has been very helpful in increasing my understanding of basic principles, as well as widening the breadth of my reading."
>
> "The level of knowledge accumulation over time is higher than in other courses. In this course, you are forced to accumulate knowledge little by little at different stages. Yes, I think that I learnt more. I wish that I could have this for all my courses."
>
> "I used to think learning most of time is very individual, but this (online learning) changes it. It is more like group learning. I mean not just from reading, but from other people as well."

Previously we also mentioned online education as an ideal environment for the design of situated learning. One key theme of situated learning is that meaningful learning can only be achieved if learning and doing are not separated. Based on our theoretical framework, we argue that because of the technology used in conjunction with the World Wide Web, students are not learning in a 'contextless' environment. Looking at messages exchanged by students and teachers, there were so many occasions that students or teachers made a reference connecting what had been taught in the lecture to current events, either in form of web link of related organisations or newspaper reports. Student further commented that the design of security colloquium and recorded media gave them an opportunity to review and to learn to apply what they have learnt in the lectures. Furthermore, in the IS Security Debate Forum, there had been a constant discussion activity, mostly initiated by students themselves, regarding contemporary security issues. Two examples are,

> **Message No. 352:** posted by **Student XXX** on Fri, Feb. 11, 2000, 10:01
> **Subject: Re: Reading materials suggestion**
> This is some of the better coverage of the recent Denial of Service attacks...
>
> A string of "denial of service" attacks temporarily paralyzed more popular Web sites, including ZDNet and E*Trade. Among Net experts, the attacks were seen as a wake-up call -- both to technologists, demonstrating the need for more reliable systems, and to consumers, as a warning that risks remain in this still developing medium.
> http://www.mercurycenter.com/svtech/news/indepth/docs/hack021000.htm
> http://www.washingtonpost.com/wp-dyn/articles/A36093-2000Feb10.html
> http://www.nypost.com/news/1034.htm
> http://news.bbc.co.uk/hi/english/business/newsid_637000/637781.stm
> http://www.wired.com/news/technology/0,1282,34249,00.html
> http://www.msnbc.com/news/368183.asp

> **Message No. 468:** posted by **Student XXX** on Sun, Feb. 27, 2000, 21:49
> **Subject: Re: Security risks increase with speed**
> I think that is interesting but easy to present just comments of the rising security issues from the daily flow of articles that appear in news papers we read (I think the FT would be the best to be kept you inform about everything in a filtered way) but many solutions and options also rise from that treats because there is a market out there that will generate a supply that security necessities demand. And not to just do the interesting comments about it but to give the academic level that this forums deserve (and that from my point of view, level that most of the posting have very

> well achieve) I will paste the abstract of a paper that underlies some concepts that underlie as important topics for security matters. One of the rising problems that systems create when increase in complexity is entropy, well now the security needs can be also solve with entropy, give it a look: ----------
> http://www.counterpane.com/personal-entropy.html full text available in .pdf Protecting Secret Keys with Personal Entropy C. Ellison, C. Hall, R. Milbert, and B. Schneier Future Generation Computer Systems, to appear.

On the subject of online technology to facilitate situated learning, students expressed in the interviews that

> " for this course, I am a bit worried that there were too many theories, no technical knowledge. But all these references from other people and teachers really help me to understand some issues."

> "oh, with this open discussion, I have learnt so much from XXX (a student who has a strong industrial experiences), who is not in my private class discussion group, about what security management is all about. You know, I have to say, the references he put up and discussion with him was one of highlights of my experiences of using the system."

The above results from the questionnaire and the interviews, demonstrate the capability of online learning system to support an educational environment intended for the purpose of collaborative and situated learning.

5.2.3 Phase Two Summary

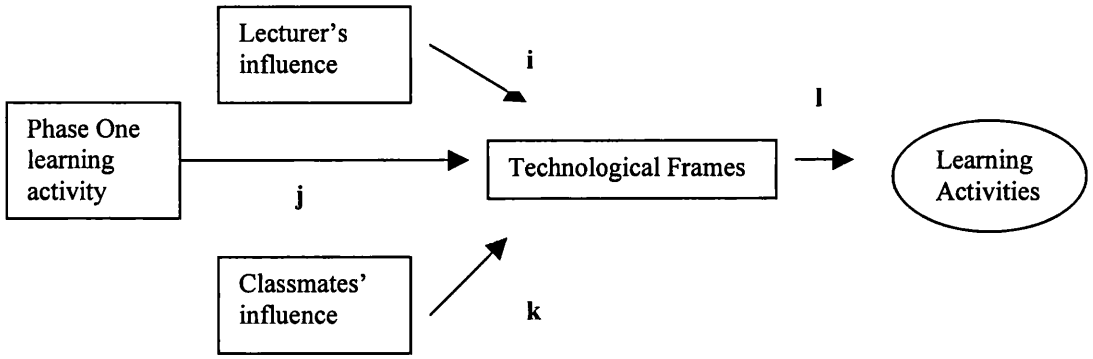

Figure 11: Online learning at Phase Two

In this section, before entering the descriptions of students' final learning outcomes, we offer through Figure 11 a short summary with respect to the use of the online learning system. In this phase, we saw the impact of lecturers and classmates on students' technological frames, as demonstrated by arrows i and k. Some students' early perceptions of online education as a means of reducing contact with the lecturer were changed by the commitment of the lecturer, who demonstrated through the constant query in the face-to-face lectures and online messages to students. The messages aiming to promote interaction from active students also stimulated the discussion process and invited other passive students to join in, consequently altering their understanding concerning the concept of online learning on campus. Besides, the actions undertaken by the lecturer and some of the students made a certain impact on how the system was understood. The effort of making the system a group system had paid off. More students started to realise that the value of the system was more than just that of an individual learning tool, like the Public Folder in Outlook.

Arrow j illustrated that some learning activities taking place in Phase One also played a role in transforming some technological frames. As indicated earlier, students expected the online class discussion to work like an individual assessment. However, the informal and interactive style of the open discussion forum was seen by everyone and encouraged by the lecturer. In this way the students gradually grasped

the emerging discussion norms and put them into practice. More details about the discussion style during this phase will be given in the coming section and the next chapter.

According to our conceptual framework, people behave according to how they make sense of technology and the environment. Arrow 1 represents such a relationship, that is to say, students' technology frames affected how they behaved and used the online learning system. The next section is summary of online learning activities, with a stronger focus on the second phase since we have already provided findings in Phase One in Section 5.2.2.

5.3 Other Findings

In addition to the findings concerning the students' technological frames and their online learning activities during the course of the case study, we also present other interesting findings related to online education in general. The following outlines other results drawn from our empirical study.

First, on the development of social interaction online, it appeared that at the end of the course students had a positive attitude towards others with whom they had communicated through the online system. For instance, they said that they would stand up for their online discussion group members and felt that they could depend on other members of the group.

> "I also found that the fellow students are acting very actively, they will answer my comment. I thought that it was quite interactive, I feel encouraged and started feeling enthusiastic about it. I did enjoy communicating with them at the end."

> "we also create a network that we may not create without having this online, because you could answer people."

The form of messages exchanged among students also illustrated the development of friendship online. We noticed that the style of writing was formal and rigid at the beginning, but gradually, the writing grew to be more informal and

messages became more frequent and shorter. There were increasing numbers of jokes or humours embedded in messages and more use of symbols which represented missing physical cues such as ☺ or ☹. For instance, students wrote in their messages:

> "I don't want to repeat any of the things they've said, so I'm going to go off and research a bit, to find some weird information or use my skills of talking about something totally unrelated and relate it somehow to make some interesting chat :-)"

> ">> [Student X] now look what you've done. You threw down the gauntlet and created a monster. If he couldn't be first then he had to be most comprehensive!
> I think a security measure has definitely been breached somewhere! :-)
> [Student Y]"

The second interesting finding has to do with students' nationalities and their mother tongues. We find that the online learning environment was highly valued by Asian students in particular. Our interviews offered two explanations: the value of the Real Media software and the asynchronous communication mode. For the majority of Asian students in the course this was the first time they had experienced education delivered in English. Owing to their weak grasp of English, some found great difficulty in understanding fully a two-hour long lecture. Consequently, this reduced the quality of learning and the amount of knowledge learnt. In contrast, the online learning environment provided the recorded lectures, and one Asian student stated 'the ability of going back to listen to lectures repeatedly has make my learning much better'.

As for the benefit of the asynchronous mode of communication, participants commented that it not only helped them to remove fears about class discussion but it also enhanced learning quality. In a normal face-to-face classroom, they were slightly intimidated by the Western style of class. Most Asian students tended to 'hide', fearing their language ability might prevent them expressing themselves properly. Also, they considered themselves culturally less outspoken and argumentative than their Western counterparts, and hence had a tendency to remain

silent in class. However, the asynchronous nature of the online environment allowed them to cross over the language barrier since they were able to take their time to form and correct their English before posting in the group discussion forum. Besides, the feeling of 'talking to a computer' gave them a sense of being protected behind the screen. Gradually, instead of just being at the receiving side of knowledge, they learnt to voice their opinions and to debate with other students. The system helped them to change the way they learned. As result of constant interaction over the period of ten weeks, they felt that their English had improved and they had gained more knowledge than they might otherwise have done in traditional classroom teaching.

Through our observations, the use of online education system also helped community building among different nationalities. Revisiting the early description of the distribution of nationalities showed that LSE has a greater proportion of international students than other U.K universities. There is a tendency for people coming from the same or similar background to socialise together. In addition, the graduate degree was only one year in length and the campus was not centralised. All this resulted in limited opportunity for students with different cultural backgrounds to get to know each other. However, given an opportunity through the discussion forum to interact with other students from various backgrounds, gradually they started to make friends with their online classmates, and then meet up off-line. Since they usually attended the lecture once a week and left immediately afterward, some students commented that they would probably not have got to know each other had the class been held in a traditional mode. The nature of asynchronous communication extended the concept of class, initially bounded by time and space, and hence increased the chance of helping students' friendship bonding process. One student commented that,

> "It is funny to feel that I had more interaction and was more comfortable with my classmates in the online discussion than my other face-to-face classmates. In a way, I felt that I talked to them more. Also, it helps to develop off-line friendship."

Another interesting finding is related to the acquisition of new skills. Students stated that because of this online learning experience they not only acquired more knowledge, but also additional skills of online group communication. With the growing phenomenon of virtual teams and organisations, online communication skills have increasingly become more and more important in all kinds of organisations. Online discussions gave them an opportunity to learn how to interact with others through computer conferencing systems. One student explained in the interview,

> "I am grateful that I have a chance to take a part in this because what I have learnt, not only security, but also how to interact with people online. I think that it is very important, especially for my generation or beyond."

Another surprising point raised by some students was that of career opportunity. Some students thought that since online education and training is a globally expanding phenomenon this experience would also make them more attractive to potential employers. Their experiences might be appealing to organisations embarking on online training programmes. "When I told my potential employer that I had been participating in online learning, they were very enthusiastic to hear about my experience," as one student told us.

There were also two exploratory findings related to the faculty. First, we found that online education is not only a new concept to students, but also to faculty members. Despite the ease of use of the system, teachers still need to learn basic web skills and most importantly, online facilitation skills. In Chapter Two, we mentioned that online discussion changes the role of teacher from being an instructor to a facilitator. Consequently, it requires a different set of skills from traditional classroom teaching. The teacher explained,

> "I wasn't quite sure how to deal with online discussion, how much intervention I should put in and when. But I think that it actually takes more time and effort than classroom teaching. You have to monitor them more frequently and give them responses."

More time and effort required is another finding in relation to the use of online learning system from the viewpoint of teachers. Unlike traditional classroom

teaching, apart from the schedule of two-week per online discussion session teachers do not have a clear timeframe of interaction in online discussion. The teacher reported that he spent twice as much time in preparation for classroom teaching. However, from some suggestions in the literature (Salmon 2000), we speculated that with proper training in facilitation skill, teachers should be able to control time and manage discussion more efficiently. We consider that this is also potential area for further research.

5.5 Summary

Following the thread of discussion on our theoretical framework and research methodology, this chapter concentrated on the conduct of the fieldwork. We started with a sketch of the institution in which the empirical study took place. The purpose of describing this context was to reveal the unique learning environment and culture that played a significant role in the formation of students' technological frames at the outset of the online learning course. The second section of this chapter focused on the description of our findings on students' technological frames and their online learning activities in two different phases, which was divided by an apparent change in intensity of online learning activities. Our findings suggested that the relationship between technological frames and learning activities was closely intertwined. Moreover, we discovered that apart from the context itself, the results highlighted the importance of the role of lecturer in the implementation of online learning on campus, at least in this particular case. In the section of final perceived learning outcomes, the results showed that most students considered this experience successful.

In addition to the findings relating to our theoretical underpinnings, the time spent with students and semi-structured interviews gave us other information concerning both student use of the online learning system in general and other consequences. This included knowledge about the formation of online community, acquisition of online communication skill, the additional benefits for Asian students and faculty workload.

The next chapter concentrates on further discussion of our findings in relation to other relevant work in this field and on the re-interpretation of the theoretical framework set out in Chapter Three.

Chapter Six
Discussion

The preceding chapter has presented the research results in accordance with the theoretical framework, which serves to explore the student learning experience and the process of technology appropriation in a particular online education context. The organisation of this chapter is twofold: 1) providing an in-depth analysis of findings in the light of research questions and of the previous research studies discussed in Chapter Two and theories stated in Chapter Three; and 2) re-visiting our synthesised theoretical framework and discussing whether there are any modifications required as a result of the empirical work.

Section 6.1 will concentrate on the student appropriation process of WebCT throughout the duration of the ISS course. The analysis carried in this section serves the purpose of answering our first research question: how do students perceive and interpret online technology in the context of online education on campus? Our findings in Chapter Five have shown some superficial influences of context in online education. In order to provide a more detailed analysis, we apply Avgerou's three principles to study the significance of context in IS innovation (Avgerou 2001). Through the lens of these principles, we re-examine the intertwined relationship

between technology adaptation and the socio-cultural dimension of the institution as well as how the world outside the institution might have an effect on the development and understanding of online education locally.

Section 6.2 will focus on answering our second and third research questions in Chapter Two, questions of whether there is a case for implementing online education in the traditional education environment, and if so, what are its potential educational benefits? We do not intend to generalise or make any final assertion in respect of the value of online education on campus. As discussed in Chapter Four, case study results are more suitable for analytical generation than statistical generation. This section here seeks to reflect the findings with other research results described in Chapter Two as well as explore other additional issues observed in our case study. As a result, this will make a contribution to enhance further our understanding in respect of online education on campus.

Section 6.3 will re-examine our original synthesised framework on the basis of the empirical findings and the detailed analysis undertaken in this chapter. We will discuss whether we need to modify the framework resulting from the fieldwork, and if so, what are the modifications required?

The final section of this chapter will summarise the overall analysis and highlight the key research discoveries as a consequence of this case study.

6.1 The Significance of Context

In this part of the chapter, we scrutinise the findings described in the preceding chapter, of particular, concentrating on the WebCT appropriation process during students' 11-week use in the second term. The following is an examination from this focus.

At the outset of this thesis, we position ourselves with the argument that the majority of the current studies on online education overlook the importance of

context. The context refers to the general environmental conditions and settings in which the technology has been implemented and used. In the field of information systems, many research studies have shown that different social and organisational climate offers explanations various outcomes of IT projects in organisations. (Ciborra 1996; Madon 1993; Orlikowski 1996; Walsham and Waema 1994).

Applying our theoretical framework to our empirical findings, we have revealed at the surface level some links among context, perception of online education and technology, and the consequent learning activities. In order to conduct a deeper investigation about the role of context played in any IT implementation project, we chose to follow the principles suggested by Avgerou (2001). In one paper, she proposes that researchers should pay attention to three principles to study the significance of context: 1) the inseparable process between IS innovation and social-organisational changes; 2) the inclusion of different layers of context; and 3) the combination of technical/rational and social/institutional forces. The rest of Section 6.1 is the re-examination of our findings through the lens of these principles.

6.1.1 IS Innovation in Relation to Socio-Organisational Change

The principle of 'IS innovation in relation to socio-organisational change' reinforces the underlying philosophy of the socio-technical approach to IS, that information systems are social systems (Backhouse and Liebenau 1990). This principle states that information systems consist of technical, formal and informal systems. Technical system refers to the artifact and physical infrastructure. Formal system refers to policy setting out the rules on the use of the system while informal system refers to social, culture and organisational norms influencing the use of the system. Thus the ignorance of any one of these three systems in research process can limit our understanding on how technology is really used in organisations.

Our empirical findings showed that the intention of using the WebCT to support teaching and learning was not fully achieved as had been expected at the beginning of this case study. At the Phase One, students did not actively participate

in the online discussion forum. They used WebCT mainly for the purpose of downloading information and listening to lecture presentation. Therefore the benefits of IT-enabled collaborative learning were not observed i.e. online discussion and interaction. The analysis illustrated that reasons behind this came from the insufficient information given to students, ill-defined group interaction norm, understanding WebCT as Outlook and the LSE learning culture, as indicated in the Phase One findings. These findings of insufficient information and influence from the organisational culture appear to be similar to Orlikowski's observations on the use of groupware at Alpha (Orlikowski 1993).

In the article, Orlikowski (1993) made a point that people make sense of new technology first through their existing technological frames. Such mental models can be modified through the amount of information about technology presented to them or through different types of training programmes. Otherwise, users only depend on their existing technological frames as a device to understand the purpose of new technology. Our findings confirm these arguments. In this case study, students were informed about the new education system in a short one-hour presentation approaching the end of the first term. Besides that, there were no advance indications about the arrival of the new system in the first term or even before starting their MSc. degree. There were no detailed documents given out on the educational value of online learning system to students and there were no active communication exercises, e.g. further presentations or consultant exercise, taking place before the actual use of the system. Many students felt confused and uneasy with WebCT. Consequently, not being able to realise the potential value of the system to facilitate group collaboration at the outset, students transferred their use pattern from Microsoft Outlook, as described in Chapter Five.

The LSE learning culture also offers further explanation for the under-usage of the discussion forum in Phase One. Orlikowski (1993 and 2000) suggests that implementation of technology is less likely to succeed when there is a structural conflict between the nature of technology and institutional work practice. Despite being a student at the LSE for only ten weeks before embarking the online education

experience, the majority felt the individualist and competitive learning culture. The individualist learning culture was fundamentally in contrast with the concept of online education. The individualist learning attitude made students value interaction with teacher in a class more than with other students in an online discussion forum. This evidently was reflected in some students' resentment at the early stage and led to others deciding not to take the course after being told about online delivery because of the fear of losing contact with the lecturer and teacher. At this stage of case study, students' enactment on technology fits with what Orlikowski refers to as "limited-use technology-in-practice" because there is little interest in using the technology, institutional conditions are individualistic and competitive and there are no processual consequences (Orlikowski 2000).

Nevertheless, it was also very interesting to observe how the competitive culture contributes to the change of online discussion both in terms of quantity and quality as the term progressed. We mentioned that because of its reputation, LSE students all have good academic track records, and consequently, to do well academically is very important to them. Therefore, when the lecturer sent out an e-mail to signal that he values participations from students, some jumped in and started posting messages because they were afraid of being seen as "lazy and bad" by the course lecturer. The number of messages posted shot up immediately after the lecturer's message. Interestingly, once students all started to participate online, we further discovered that this competitive atmosphere among students started to play a different role in transforming the online discussion during Phase Two. In this phase, the driving force was to produce better answers than any given previous posting in their online group. Put differently, the source of pressure in this stage no longer came solely from the lecturer out instead mostly from other fellow students. In the words of students, they explained that

> "Yap.. I love challenge. If there is the best answer, I will try to reach it. I don't like to do the same kind of answer, this is the way of pushing people to work. If you are the second person to give [an] answer, you have to create. If you are the third, you still have to create value. It does create pressure on people, also on time scale. I think it is great."

> "peer pressure? Definitely, we have this little something going on. We talked about who is being the first."

Thus, in a slightly interesting and unexpected way, the competitive culture somehow enrolled students into forming a knowledge sharing and stimulating discussion network, which was against the individualist learning style. They gradually learnt the benefits of intellectual exchange and information sharing among themselves. As a result, they were able to access to different school of thoughts and generate knowledge about information systems security as a community. As one student further explained:

> "It is like healthy competition. Because you know everyone on the course, then someone puts a very good answer, you know that, you have to try to do something to reach that level. And you have to make sure that your answer is not just coming out on the top your head. You have to put some effort into your answer...otherwise, you would not learn.

Going back to Orlikowski's work on technology-in-practice (Orlikowski 2000), we see that there is a transformation from "limited-use technology-in-practice", i.e. the use of technology is minimal, to "individual-productivity technology-in-practice", i.e. use technology to increase individual effectiveness of productivity. The reason is that while institutional culture remains competitive and individualist, interest in using technology has increased and there is a consequence of an increase in efficiency in leaning activities towards the end of Phase One such as retrieving lecture notes, listening to lecture recording and posting individual class answers. During Phase Two, we the emergence of "improvisation technology-in-practice". Taking our empirical findings as example, the conditions were changed because of increasing sense of community as well as the increasing knowledge about WebCT itself. Thus we argue that the move away from initial technology-in-practice is possible if there are changes in conditions shaping the use of technology. In other words, these conditions have "translated" the technology towards its intended design for use, as found in the study of Lin and Cornford (2000).

So far, we have offered some insights of the social and organisational dimension of context in affecting the perception and interpretation of online education and technology-in-use. Nevertheless, from our empirical data we discovered that the geographical context in which the online education was implemented also made a contribution to the formation and change of student technological frames. We articulate that the individualist learning style not only came from the embedded institutional learning approach but also from the unique geographical location of the institution. As described in Section 5.1.3, the high cost of living in combination with the limited space of school accommodations in the central London had driven students away from the school to live further out. By choosing to live distant from the school, on the one hand, students can reduce the cost of accommodation, on the other hand, they would incur a greater travelling expense. As a result, students reduce their frequency of coming into the school in order to reduce travelling expenses as well. Instead, they built a hobby of studying at home, not on campus.

The introduction of online education system made some students view this as the solution to access teaching materials as well as to reduce the commuting costs at the same time. This was apparent from our Phase One findings, where some students ascribed meanings to the system such as allowing convenience and flexibility to learn. After students started to participate in online group discussion during Phase Two, students began to use the system to assist their social interaction and organise group assignment in order to overcome the limitation of living far apart from each other. Building on the increasing familiarity with the WebCT, they learnt that the system had a capability of helping them establish and maintain friendship with other course mates. On a number of occasions, we observed that students made use of the public forum to organise trips to IS security conferences together. For the group essay assignment, instead of using the Microsoft Outlook, some groups decided to use the group forum to keep their meeting minutes and facilitate the coordination of meeting schedules, while other groups used the system as the central place for information sharing and document editing.

> "we are trying to make sure everybody know what exactly we are doing at any simple point of time. Also, we put everything in the same place in that way I know

> where I am and also trace back. If we use the mail, we tend to block our mailbox. So, we thought since we have it (the online learning system), why not use it. Also, we don't need to use two places to find the information. We have anything in one place."

However, the same observation of the system use was not made in the other case where students were located in a large campus and the majority were accommodated in the school residences close to each other (Hsu and Lin 2002). Therefore, we propose that geographical proximity has a role to play in determining how students would form their technological frames of online education and technology in use. Another interesting discovery was to see how each group adopts the system differently to coordinate their group activities. During the course of the study, there were no explicit guidelines or requirements given on how students should use the group forum apart from the intended purpose of intellectual discussion or reading materials sharing. Our case study results showed that both "anticipated change" as well as a "emergent change" (Orlikowski and Hofman 1997) (Orlikowski 1996) or "community of practice" (Robey, Huoy et al. 2000) process of IT appropriation in different online groups. The intention of the public forum was to offer a place for public debate about the current IS security issues, which was achieved as "anticipate change" at the second phase of the study. Moreover, we also found an example of an emergent change using the forum to organise trips to IS security conferences and share job hunting information. These were not expected and planned action, but arose from the process of students' increasing interaction with the technology over time. These findings again reinforce our argument that technology is part of a social system, each system tends to have different informal norms, subsequently leading to different outcomes of technology appropriation.

In short, following the first contextual principle, the re-examinination of our case study findings in this section has shown the process of technology appropriation is embedded in social actions taking place within the environment in which the technology is implemented. Furthermore, we demonstrate that technology-in-practice is only stabilised temporarily and translation of technology can take place once there are changes in the environment in which the technology is used. The next section will turn its attention on the second and third principles stated in Avgerou's paper (2001).

6.1.2 Pettigrew's Contextual Approach

Here we will combine the description of two principles together since both are grounded in or extended from Pettigrew's conceptual research approach. We will begin with the discussion of each principle, followed by the analysis of our empirical findings on the basis of these principles.

In the second principle, Avgerou (2001) proposes that when studying IS innovation, researcher should go beyond the boundary of organisational context. This argument is rooted in the work of contextual approach suggested by Pettigrew (1985 and 1987). Having accumulated a great amount of knowledge gaining from the research of strategic decision making and leadership in organisations, Pettigrew (1987) put forward the contextual approach as an alternative to study decision making process. This approach is made up of studying three basic elements and their relationship: content, context and process. In his own words, he explained that

> "the development of strategic change in the firm takes on the character of a political learning process, a long-term conditioning and influence process designed to establish the dominating legitimacy of a different pattern of relation between strategic content, context, and process." (Pettigrew 1987: 666)

He further defines that there are generally two layers of context: inner and outer. Inner context refers to the work practice and norm within the organisation, while outer context means the political, social, economic and culture climate in which the organisation functions. With the purpose of revealing a fuller picture of how organisational change takes place, a contextualist enquiry requires the researcher managing two interconnected steps of analysis: 1) to uncover how the content changes at each level in time of past, present and future, i.e. a horizontal analysis and 2) to understand the manner in which each level of context interacts, i.e. a vertical analysis. In the field of IS research, there are a number of IS studies applying a contextual approach, such as Lin (2000) on groupware project initiatives in organisations, Walsham and Waema (1994) on IS strategy of a building society and Madon (1993) on IS development in developing countries.

Extending Pettigrew's contextual approach to IS innovation in organisations, Avgerou (2001) suggests the third principle - " rationally planned intervention" vs. "subjectively situated action" approaches- as the way to conceptualise the process of change. These two approaches have different and contrasting epistemological and ontological belief. This is best explained by the work of Burrell and Morgan (1994). In the book *"sociological paradigms and organisational analysis"*, Burrell and Morgan classify organisational theories into four different paradigms on the basis of two criteria: the nature of science and the nature of society. The nature of science concerns the dimension of objective - subjective approach to social science, while the nature of society refers to the regulation – radical change perspective to society. Applying these two dimensions, four individual paradigms are created: functionalist; interpretive; radical humanist; radical structuralist.

According to the philosophical underpinnings of each paradigm, we see the notion of "rationally planned intervention" fits well into the functionalist paradigm- which is "firmly rooted in the sociology of regulation and approaches its subject matter from an objectivist point of view" (Burell and Morgan 1994:25). Within the IS literature, the rational/functionalist worldview encompasses such theories as contingency theory, resource dependency theory, the competitive strategy model and business process re-engineering (BPR) (Avgerou 2001; Dhillon and Backhouse 2001). The concerns from this stream of thought is concentrated on how to enhance overall business performance with a successful implementation of information systems. Subsequently, most theorists coming from this paradigm subscribe to the concept of technology-determinism.

By contrast, the concept of "subjectively situated action" dovetails with the interpretive paradigm, which asserts that one should work through a subjectivist approach to study sociology of regulation. Within the IS community, theorists stemming from this school of thought challenge the concept of technology-determinism. They advocate the need to " appreciate the social implications of computer based information systems" (Dhillon and Backhouse 2001:138). The underlying argument states that the IS use within an organisation is an emergent

process evolving from the complex interactions among elements of cultures, powers, politics and economic development. Examples of IS theories or framework under this paradigm include the use of structuration theory, the institutionalist theory, the web models, semantics and contextualist approach (Avgerou 2001; Dhillon and Backhouse 2001). Of course, not forgetting to mention that the underlying theoretical framework of this thesis, technological frames analysis, also sits within the confines of this particular paradigm.

Having discussed and examined the nature of two different approaches in the third principle, Avgerou (2001) makes a suggestion that in order to fully capture the process of IS innovation change, one should apply both concepts across layers of context spanning international, national, regional and organisational.

Re-visiting our case study findings through the lens of these two principles, first we identify that there are two levels of context: inner and outer. Inner context refers to the environment within the LSE itself while outer context means the physical and social boundaries beyond the LSE. The discussion of inner context was mostly covered in the previous section when we discussed the institutional culture and geographical factor on online education. Thus, here we concentrate on the influence of outer context, which covers both national and international level. To understand the change of online education adaptation process, we use technology-driven factors and technological frames analysis, as "rationally planned intervention" and "subjectively situated action" respectively suggested by the third principle. The following discussions are the re-interpretation of our empirical findings.

Outer Context

First, we explore the technical/rational ideas to the implementation of online education at the LSE from the level of the outer context. The analysis of our findings shows that there were two external forces prompting the LSE to jump into the boat of online education. One was the increasing amount of international and national reports or media coverage about the commercial and academic opportunities and the other was the growing number of prestigious universities, both within the U.K. and in America,

undertaking online education strategy. As a result, within a very short period of time, the School, through its commercial entity, formed two strategic alliances externally to exploit the idea of the Web-based education: Fathom and the Unext.com, and internally set up LTTG and was in preparation for one online MSc. degree. Both initiatives were fairly technology-driven with the intention to transfer teaching materials into the virtual environment since the main objective was to generate university incomes as well as being as competitive as other top universities in respect of embracing new technology and attracting good students. At the planning stage, the involvement of faculties as the content provider as well as students as the end-user were fairly minimum. Owing to the limited information available and publicity, the majority of lecturers and students carried out their teaching and learning activities as usual. Consequently, Fathom and the Unext.com have not generated a critical mass of participation from academics, and online MSc. programme did not materialise since there were no clear management change introduced within the School, that might be necessary to accompany the implementation of such strategy.

From "subjectively situated action" perspective, we examine how the outer context contributed to students' sense-making process of online education i.e. their technological frames. As revealed in Chapter Five, there were two different views towards the implementation of online education at the LSE. We found one factor contributing to students positive attitude towards online education was because of their relatively high awareness of online education trend at the international and national scale. In contrast, students who were less informed about the global inclination towards online education tend to be those who were not so keen on the idea of online education on campus at the beginning of the course. Besides, in the section of Other Findings in Chapter Five, the research findings supplementary illustrated that the globally expanding trend of online training had an impact on how students interpret their online education experience, in particular towards the end of the course. In the second round of the interviews, some expressed that their online education experiences were also very appealing to their potential employer in their job interview session. Consequently, they came to the conclusion that online education was a valuable experience.

To sum up, although the focus of this thesis lies within the confines of the inner context, the process of re-visiting our empirical findings based on Pettigrew's contextual approach indicated some influences coming from the outer context of online education operation. First, the concept of 'rationally planned intervention' showed that the outer context acted as a trigger for a series of online education projects taking place at the LSE. Second, from the 'subjectively situated action' perspective, it was also evident that some students sought to made sense of online education on the basis of its global popularity and continuous development. Nevertheless, more work is required in order to provide a deeper understanding regarding the impact of the outer context in this area of research.

6.2 Online learning outcomes

In the previous section, we examine the significance of the inner and outer context on the IS appropriation in our empirical research. The resulting analysis has offered an insight to the first and part of the second research questions stated at the end of Chapter Two. The purpose of this section is to answer the rest of the research questions of this thesis in the light of our findings in Chapter Five. To do so, we reflect on what we have found in student learning outcomes with the existing literature discussed in Chapter Two as well as identifying other discoveries from our empirical setting. The organisation is divided into two parts: effectiveness of online; and interaction analysis and acceptance of technology. Both categories were the same as that being organised in Chapter Two.

6.2.1 Effectiveness of Online Education

In Chapter Two, we stated that the current research on online education is populated with studies on its effectiveness. We further classified two kinds of effective studies: micro and macro level. The micro level analysis concerns with educational values of online education, mostly by comparing with the traditional mode of education which the macro level focuses on the broad effect on institution or

society at large. The focus of this thesis is located at a micro level analysis. Thus we will not have discussions at a macro level.

Overall, our survey results on perceived learning outcomes are quite consistent with other studies on this subject (Alavi 1994; Benbunan-Fich and Hiltz 1999; Dejnaronk 2000). According to the students' own reflections on their development of critical thinking skills in comparison with other face-to-face courses, they were very positive about knowledge acquired through the online medium. Based on our case study, we argue that the educational values enabled by the online learning system were threefold.

First, as described in Chapter Five, most students were novice in the field of IS security, hence, the main purpose of the lectures was trying to cover the fundamental materials with empirical examples in this subject area. Because of very limited amount of pre-knowledge about IS security, students still found it difficult to grasp every concept taught in a two-hour long session. The recorded media files allowed them to access the lecturer's talk time after time. In our conceptual framework, we suggest that the system has a capability of enhancing situated learning because at the early stage of their learning, through media files students had an opportunity to repeatedly listen to the lecturer. This was the first step of helping students to link the factual materials to industry practices. Without achieving the fundamental understanding first, it might be difficult to implement the educational strategy of linking knowing and doing.

Second, the nature of the ISS course, which is social-science oriented, depends much on debate and discussion with others to stimulate knowledge development process. In our case study, the majority of students suggested that the online learning environment provided them with an opportunity to share updated information and have a debate with their peers on a particular topic for a longer time period than with the conventional classroom discussion. As described in Section 5.2.3, students revealed in the interviews that the online learning system allowed them to share new reports and updated news items about IS security. The use of the online learning

system helped them to establish a learning community in which constant support and interaction were available. Besides, they perceived that by engaging in the process of reading and responding to other people's online postings, they were able to advance their thinking and increase their understanding of issues covered in the lectures.

Third, many existing studies point out that the asynchronous mode of the medium provides the room for reflection and thought processing. In our informal conversations, the teacher and the lecturer commented that online students seemed to be able to formulate their argument better than those in classrooms. We reason that, as well as being stimulated by other students' answers, online students were given more time to gather information and process arguments presented by the peers, which was not possible in face-to-face interaction. In our empirical setting, we also discovered that the online learning system was considered by many oriental students as a "fear remover". As indicated in Other Findings section in the previous chapter, suggestions had been made that when there were mixed of nationalities in one group, the Asian students appeared to gain more confidence in a collaborative learning setting mediated through the use of an online system over time.

Focusing on perceived learning outcomes within our theoretical framework, we suggest that online education has a capability of hosting a situated learning environment. The objective of situated learning is to create an environment where knowing and doing are indivisible, i.e. the inclusion of authentic tasks into the learning process. In the light of this approach, we locate some situated learning strategies within the ISS course design, such as the arrangement of security colloquium, in which industry practitioners gave students a flavour of IS security in the real world. It appeared that the recorded media files further strengthened such an initiative. The computer-generated statistics offered some supporting evidence. The statistical results indicated a frequent rate of visit by students accessing the colloquium media files. In interviews, students commented that through the exercise of listening to face-to-face guest talks and the recorded version afterwards, lots of teaching materials started "making more sense". In addition to situated learning strategies implemented by the lecturer, we also observed other situated learning

activities originated by students themselves. For example, in some answers for online discussion questions, students would make reference to relevant real world events or current affairs. Some would even post the web address (URL) of the news or organisations that might be related to the taught subject area. Some students who had experiences of working in the security industry also shared their knowledge with other students who were new to the IS security field. All these activities have strengthened the benefit of linking learning and doing together, as proposed by situated learning educationalists.

In Chapter Two, we also discussed technological influences on teaching effectiveness. Both of our survey results and interviews findings seem to agree with Webster and Hackley's (1997) argument regarding the relationship between reliability and quality of technology and the perceived learning outcomes. They suggested that students were more likely to experience positive learning outcomes when they were confident about the performance of the technology. In our study, the first interview results indicated that the worries over the online system reliability played a part in the early negative thoughts towards online education. When the system was proved to be dependable, students showed a more positive attitude towards online education.

In respect of instruction style on teaching effectiveness, most studies indicate that the role of the teacher is transformed from instructor to facilitator. To help students become familiar with the system and promote discussion, Salmon (2000) proposes that facilitator should constantly be supportive, active and friendly at the beginning of the course. Salmon's comments might offer one explanation for the low participation in Phase One. A more passive approach by the teacher did not help to engage students with an individualist learning style in a collaborative learning environment Moreover, our findings showed that involvement of the course lecturer can make a difference in student participation level. As well as playing the role of encouraging supporter, a firm line also increases student commitment of participating in online discussion. The impact was quite clearly reflected in the sharp increase in the number of messages after actions undertaken by the course lecturer. Nevertheless,

the teacher reflected that the amount of time and effort required to facilitate online discussion was much more than that in face-to-face classroom teaching.

In Chapter Three, we mentioned that some researchers considered that text-based communication could add to the development of higher order and critical thinking (Garrison 1997, McCabe 1998). From our empirical findings, the support for this argument can be found in students' comment.

> " Well, when you are having a discussion in the class, you could say something, it does not have to be the best thing in the world and then it disappeared. But when you put it in writing and everyone reads, it is more permanent. You cannot even bluff. You have to think through a little harder about what your whole argument is."

> " By putting my thinking into words, I find that I spent more time on it...I need to make sure that I answer questions to the point."

Besides, students whose first language is not English made remarks that the online communication not only helped the process of knowledge development, but also provided an opportunity for them to practice and improve their written English, which was lacking in face-to-face environment. Thus, they consider online discussions contributed their language skill development.

The final reflection in relation to perceived effective studies is the establishment of sense of community. In the work of Hiltz and Wellman (1997), they point out that students considered the difficulties of developing new friendship and the more likelihood of skipping classes in the online environment in comparison with the traditional classroom. By great contrast, our interviews and survey results told a different story. Students in our empirical setting reported that because of the online learning system, they were able to establish a closer friendship with their classmates and even form a community cross the ethnic or nationality barriers. On the issue of classes, students felt that even though there were not fixed time of attending, they found themselves working on each class discussion for a much greater amount of time than they would normally do in the traditional classroom. We argue that these contrasting research outcomes can be explained through the lens of the contextual

approach. As we explained earlier, the environmental characteristic and institutional learning culture played a part in students' adaptation process of the learning system. We reason that the LSE and the institution where Hiltz and Wellman (1997) carried out their study might have quite a different learning culture, management and approach. In our case study, the contextual factors have created the opportunity for students to use the system as a medium of getting to know each other better. Nevertheless this might be not so in other studies due to the different context.

6.2.2 Interaction Analysis and Acceptance of Technology

The previous section dealt with the effectiveness of online education. Here we combine the analysis of interaction together with acceptance of technology in one section. Owing to the research scope, research focus and the chosen methodological approach, this research was not able to offer a full account of both areas. However, we do have some findings which allow us to reflect on some studies discussed in Chapter Two.

In the area of interaction analysis, we identified earlier that there were two types of analysis: structural and content analysis. As described before, the definition for structural analysis is studies using statistical method to trace and present online communication activities. Using the message itself as the unit of analysis, one can map out the message flow and level of participation taking place in a virtual environment. Applying the same technique, our findings showed that students were the main contributors of messages and the number of messages fell towards the end of the term, which was consistent with what was found in Riedl's study (1989).

Nevertheless, as we argued in Section 4.2.4 that starting with the pre-set up categories of measurement, this type of analysis subscribes to ontologically objective and epistemologically positivist assumptions. Thus it might fail to consider the emergent properties arising from the interaction with the technology and be unable to offer explanations on why statistical results vary from one setting to another. Through an interpretive case study strategy, the story of our case study offers numbers of

examples of how contextual elements accounted for the fluctuation of message flow and participation pattern. For instance, our observations showed that at the outset, the overarching learning culture at the institution led students not to participate in a collaborative learning style and take the discussion as seriously as the written essay assignment. Through the analysis of technological frames, we showed that the increase in the number of messages in Phase Two was firstly coming from the pressure of the course lecturer, and after that the origin of pressure shifted from the lecturer to fellow students in the course. The emergent adaptation of the system for organising social events and sharing job information also added to the intensity of messages. All the information would not have been discovered if we only had opted for the statistical method. Put differently, our approach showed how a qualitative approach can complement a quantitative approach in terms of telling the 'story' behind the 'numbers'.

The other form of interaction analysis is content analysis, aiming to examine the written content in each message. Despite its potential for enhancing our understanding of group dynamics and cognitive development in the world of online education, our literature review illustrated that there are yet limited studies using this research method. In Section 5.2.3, borrowing from the work of Liebenau and Backhouse (1990), we used the rule-based system analysis to explore the context messages exchanged over time from an IS perspective. Using the message as the unit of analysis, we showed that most messages were substantive in nature, implying that the content of discussion centred on the examination issues in relation to lecture and reading materials. Our analysis further showed that the ill-formed nature of group norms was apparent from the significant number of control rule messages at the initial stage when the discussion was taking off. At this point, students wanted to make sure of the rules of conduct before commencing their participation. Salmon (2000) suggests that it is very important to have a clear online participation norms in terms of style, length and frequency. This will help students to quickly get familiar with the system and to reduce problems of group communication that might occur as the online discussion progresses. Consequently, we speculate that this will lead to a reduction in control rule messages at the early stage of online discussion.

On the subject of technology acceptance, in Chapter Two we held that majority of existing research gave a rather thin analysis of technology satisfaction. As part of our final questionnaire, we also adopted items used for TAM to test usefulness of technology at the surface level. The result showed that students considered online system as a useful medium to reach people, control their study and increase the quality of study. Although TAM has its values in understanding technology usefulness, ease of use and acceptance, we argue that TAM neglected the context analysis on the process of technology appropriation. The work done in this research offers an insight of how technology acceptance and student satisfaction took place through a conceptual framework grounded in a social constructivist approach. We see the work here as a contribution to knowledge on this topic in the area of online education.

6.3 Re-examination of the Synthesised Conceptual Framework

The preceding section endeavours to re-examine and re-interpret our case study findings within the scope of our three research questions set in Chapter Two. As a result of such reflection process, here we re-visit our initial synthesised conceptual framework formulated in Chapter Three and consider whether any changes are required, and if so, what changes.

The early conceptual framework started with the argument on the significance of context in studying online education on campus. Our findings in Chapter Five evidently showed what and how contextual factors, both physical and social, contribute to students' sense-making process of IT appropriation and online education. We further revealed the emergent usage pattern as students gain more experience with technology over time. Applying three principles proposed by Avgerou (2001), we were able to offer an in-depth analysis on the influence of context in online education. The outcomes of our re-examination on empirical findings also taught us that the outer context also made a contribution to the development and implementation of online education at this particular university. Thus, for further research, we consider the need to add the outer context, i.e. at the inter-organisational, national and international level, to our conceptual framework.

In addition to showing the intertwined relationship among context, IS use and learning activities, our empirical results lead us to explore the role of teacher and instructor, which was not explicitly addressed in our original conceptual framework. There are several discoveries on this topic. First, the most apparent finding is the effect of the lecturer's commitment on student use of the system for learning purpose. We speculate that if the lecturer had not taken any action at the end of Week Three, the whole learning experience might not have been as successful as students reported at the end of their study. We see the lecturer's action as the trigger to the start of many discussions, i.e. an influence factor for technology translation. Therefore, we recommend that in the situation of online education on campus, although the lecturer might not be the online class facilitator, his commitment is positively related to student attitudes towards online education. Instructional strategies are the other exploratory finding. The design of the security colloquium and the use of media files have a role to play in enhancing student learning outcomes. It appears that the online media can help the instructors to implement a situated learning environment and reinforce the concept of not separating knowing and doing. Thus, in the future, we stress the need to make instructional design a more transparent and explicit factor in our conceptual framework.

6.4 Summary

To sum up, this chapter provides an in-depth discussion on empirical results presented in Chapter Five, in particular through three research questions raised in Chapter Two. We re-interpreted the empirical findings to highlight the significance of context in this study. The exercise of comparing learning outcomes with the literature analysed in Chapter Three revealed that the implementation of online education has potential to enhance student learning outcomes as indicated by many other studies in the field.

In Section 6.3, we re-examine the synthesised conceptual framework of this thesis. We found that the initial theoretical framework was able to provide help in our journey to understand student assumption, interpretation and the consequent use of the

WebCT, as well as the overall learning outcomes at the end. Nevertheless, as a result of reflection, we discover that some modifications are required to improve our original conceptual framework for further research: the outer context level and the role of lecturer.

The next chapter (Chapter Seven) is the final chapter of this dissertation. It will provide an overview of the thesis, discuss its theoretical, methodological and practical contributions; address the limitation of the research; and comment on areas for further research.

Chapter Seven
Conclusion

The core of this research is to understand how the context impacts on student interpretation of online education and technology, and the relationship between such interpretation and the online learning as an on-going process. This research was motivated, in particular, to examining the adoption of online education technology in order to facilitate campus education. Building upon the information systems perspective, we argue that the environment in which the technology is implemented and used, can have a strong influence on students' understanding of the system and on its subsequent use. Furthermore, we argue that perceptions and interpretations are not static, but *in situ.* In our work, we demonstrate this line of argument by using technological frames analysis coupled with a collaborative and situated learning model. This framework is then used as the basis for data collection and descriptions of fieldwork findings throughout the period of our empirical research.

We now reach the closing remarks of this research. Section 7.1 provides a recapitulation of each chapter and the highlights of the main findings. In the second section we discuss how our work can contribute to the development of theory,

methods and practice in this field. Section 7.3 offers a discussion of the limitations both of the theoretical framework and research design. We close this research with suggestions on the direction for future research.

7.1 Overview of the thesis

The first chapter sets the motivation and scope of this research. The researcher explained that this journey started with a general interest in the use of modern technological innovation to support teaching and learning. In particular, the development and growth of CMC-enabled educational delivery became the focus of this research. Section 1.3 defines what we meant by online education and portrays its growth in recent years, we argue that online education is a hybrid of both distance education and traditional face-to-face education (See Figure 1). In order to narrow the scope of the research this thesis concentrates on online education on campus.

The second half of Chapter One centers on the discussion as to whether our work constitutes research within the IS tradition. As well as providing supporting arguments within the IS community, the researcher argues that online education is IS research because it consists of such elements as technology, people and the surrounding context. The current direction of research in this field centers mainly on the educational effectiveness of online education by means of a positivist approach. We argue that by looking at online education through the eyes of the IS and interpretive approach, we can offer some insights and hence enhance our understanding of this new area of research.

Chapter Two concentrates on a literature review within the boundary of online education. The chapter is divided into two sections: a general review of technological applications in online education; and a review of the current literature on online education. The first section reviews the relevance of three technologies (ARPANET, CSCW and the WWW) that have made online education possible today. The theme of this section is to show that although the term 'online education' is relatively new, the concept of collaboration beyond time and space is not. In discussion, the

researcher pointed out the value of each technology in contributing to the development and research of online education.

By critically examining the current state of the online literature in Section 2.2, we identified the area of least research in online education. We present this argument by way of discussing three categories of literature: effectiveness studies; interaction analysis; and student satisfaction and acceptance of technology. The resulting conclusion is that despite enhancing our understanding of the educational value of and the social-psychological aspects of online education, most existing studies fail to take into account the increasing weight of technology and the role of context. Moreover, we maintain that the inconsistency in various learning outcomes has largely to do with ignorance of contextual issues and their consequent implications in technology use. In the field of IS, we have learnt how the same technology might result in different social and organizational consequences. Drawing on this perspective, this research considers that in order to further understand how online learning technology is used, there is a need to study students' sense-making process associated with technology. Having examined the literature and presented our underlying argument, we finish Chapter Two with three research questions that this research sets out to address.

Theoretical framework is the heart of Chapter Three. Continuing the thread of the argument for the need to bring context and technology into play, the theoretical framework of this research is made up of two main elements: educational and IS-based. We adopt collaborative and situated learning as our theoretical parts from the educational perspective. Both learning strategies emphasise the benefit of group collaboration and discussion, which online education has great potential to facilitate. We take on technological frames analysis, developed by Orlikowski and Gash, as the input from the IS stream. This approach has shed light on the study of the meanings that individuals ascribe to technology on the basis of their work in groupware technology. They set out the argument that frames are context-dependent and flexible. Given a particular context this approach allows the researcher from our perspective, to elicit students' assumptions and interpretations of online education and of the technological system used. This theory further states that one's frame does not

remain fixed and that change can be expected as a result of interacting with technology or as a result of changes in the environment. We are interested in how students' technological frames are reshaped as a consequence of engaging in collaborative learning with other students.

Having stated our theoretical framework, we devoted Chapter Four to discussing and describing the research strategy in this thesis. The first section of the chapter examined epistemological and ontological assumptions of both positivist and interpretive approaches in the IS field. We further looked at various research strategies to study online education in the existing literature: survey; laboratory and field experiment; case studies; and content analysis. Our analysis show that they mainly come from the school of positivism. Taking into account the nature of the research questions and the researcher's own philosophical beliefs, an interpretive research approach was selected as the most appropriate for this thesis because it acknowledges the existence of multiple realities and enables us to grasp emerging themes arising in the process of empirical work.

After defending our choice of research paradigm, the second section of Chapter Four provides an argument for the choice of case study as our research strategy as well as setting out the details of research design. We explain the choice of the site as a pragmatic one on the grounds of access and availability of rich information. The case study took place at a traditional university in the U.K, where the researcher did her academic study and worked as technical support to the project. Over the course of the empirical research, there were multiple sources of data collected through the survey, both formal and informal interviews, and computer-generated messages. Constant reflection is made on different information sources in order to ensure the validity and credibility of the research findings. As well as guiding the data collection process, the theoretical framework presented in Chapter Three is used to organize the case study findings.

Chapter Five and Six centre on the case study. Chapter Five describes the organisational background and the development of online education at the institution

where this study took place. The background information serves the purpose of setting the scene for the study and portrays the context which is particularly crucial to this research. In the first part of Chapter Five, we give details of the online education system used in this case study. The descriptions of the actors involved (i.e. teachers, students and the researcher) as well as course design are given in full. The second half of Chapter Five concerns the presentation of the research findings. Similar to the data collection process, we map our findings on to the theoretical framework developed in Chapter Three. Furthermore, in order to show how students' technological frames changed over time, empirical findings were demonstrated in two phases.

Having studied the evidence collected, we divide technological frames analysis into three sections: understanding of online education; perceptions of technology; and expectations of technology. Surveys, interviews and computer-generated messages provided findings in relation to collaborative and situated learning processes. The descriptive relationship among context, technological frames and learning was demonstrated in Figure 8 and 11. The final section of the chapter demonstrated research findings in respect of overall learning activities and outcomes. The questionnaire showed student reflection on their online learning outcomes and some results of message interaction and content were also presented in a statistical format. All the research findings described here provided the basis for further scrutiny in Chapter Six.

Chapter Six offers further discussion of the empirical findings in relation to three research questions stated in Chapter Two. Section 6.1 deals with the first and part of the second research questions. Applying Avgerou's three principles to studying the significance of context, we revealed how the institutional learning culture and its unique geographical location played a part in student's technological frames and the consequent use of the learning system. Besides analysis within the inner context, our re-interpretation of the empirical findings further showed that the outer context had an effect on the development of online education at LSE as well as on students' assumptions and understanding of online education.

The second part of Chapter Six addresses both the second and the third research questions of this thesis i.e. whether online education offers any value to education on campus; and if so, what the nature of this value is. This discussion was organized in accordance with the structure of the literature review in Chapter Two. Section 6.2 re-examines the empirical findings with those discussed in Section 2.2.1 and our educational theoretical framework. Our analysis ostensibly demonstrates support for the implementation of online education on campus. Taking into account the contextual background and elements, the case study results further disclosed that students learnt how to appropriate the online system for the purpose of group-oriented learning and social interaction over time.

As a result of the re-interpretation and re-examination of the findings collected in the empirical setting, the last section of Chapter Six reviews the synthesised conceptual framework established in Chapter Three. On defining the context boundaries, we have learnt to incorporate different layers of context, in particular, the concept of the outer context which was not initially defined in this thesis. Of the elements contributing to the student IT appropriation process, we recognise in particular the importance of instructional design, the facilitating style and commitment of the teacher. Our findings clearly demonstrate that the commitment of the lecturer plays a significant part in changing how students assume, interpret and understand the existence of the online education system.

7.2 Contributions

This section concentrates on the contributions and implications of this research. We separate the discussion into three areas: theory, research methodology and practice.

7.3.1 Theoretical contributions

We see the theoretical contributions of this dissertation as dividing into two aspects. One is in extending the framework developed by Orlikowski and Gash to the field of online education. The other is to contribute to the development of knowledge in the field of online education itself. The concept of technological frames analysis has been applied in the study of the implementation of groupware in organizations, but our work here demonstrates the value of this framework in understanding students' perceptions and behaviours in the context where the technology is used for an educational purpose. Both theory and findings make a contribution to our understanding of how the perception and interpretation of online education and technology influences the process of learning and vice versa.

In Chapter Two, we maintained that in the area of online education research there is a lack of studies that consider context and technology as an actor. The majority of studies have concentrated their focus on the effectiveness of this new form of education, mostly in comparison with the traditional one. We argued that the role of context might offer some explanations and insights in respect to the technology appropriation process over the period of online learning. Despite our empirical results at the end illustrating learning outcomes in favour of online education, by applying the technological frames framework, we show that the feelings were not all favourable right from start to finish. At the outset of the case study, the nature of the institution and the amount of information on online education available to students created mixed feelings of support, confusion and doubt among students in respect of the purpose of technology and its educational value in the campus environment. For example, the findings showed that those who were more positive at the start had similar experiences before or were more aware of developments in online education, while others demonstrated resentment owing to their limited understanding of online education. The analysis of technological frames allowed us to demonstrate how a student's sense-making process is context-bound and influenced by his or her past experiences and knowledge about the particular technology.

Furthermore, technological frames analysis suggests that people might adjust their frames as a result of use or influence from other actors involved. In other words, frames are flexible. In our study, the analysis demonstrated how students, in particular those who were not convinced at the beginning, changed their views and behaviours towards WebCT as time went by. One turning point arose from the realization of its educational value. We learnt that the LSE learning culture was more individualist and owing to cost of living in and travel to central London students did not spend much time on campus. The implementation of WebCT provided opportunities for students to realise the benefits of collaborative learning, and supported a community for knowledge generation in IS security, which would not otherwise have been possible. In addition, the course lecturer and active students were heavily promoting the potential to other members during the first few weeks of the course. This gradually led to the enrollment of less positive students into the network and the establishment of a learning community. Thus our work here makes a contribution to demonstrate the relationship, in this particular context of online education, between collaborative learning and an individual's technological frames.

Advancing knowledge development in the area of online education is the other contribution. Chapter Two offered a summary of the existing research in this new area. As well as providing a systematic analysis of the current literature, we argue that the contextual issues surrounding technology use have not been greatly studied in most research. Our underlying assumption states that online education is not only about the cognitive process of knowledge development, but also the cognitive process of making sense of technology in use. We suggest the latter requires more attention by researchers. Coming from an information systems background, this dissertation makes a contribution by bringing a fresh perspective on online education. Through the lens of technological frames analysis, our findings revealed a fuller description and analysis of this dimension.

In Chapter One we justified the reasons of categorising this research as part of the IS tradition. We see that the application of our theoretical framework not only enhanced our understanding of the impact of information technology on the cognitive

process but also offered some insights on the implementation of technology mediated learning at the institutional level. This may supply additional support for IS researchers who are interested in online education.

7.3.2 Methodological contribution

The contribution of this thesis to research methodology comes from the value of the interpretive approach in enhancing our understanding of online education. Chapter Three showed that most studies in this area were rooted in positivism, relying on survey and experiment as the main research strategy. As an interpretivist, the researcher recognised the importance of the meanings that individuals ascribe to technology, as well as acknowledging meanings as a social product. From this perspective, the researcher sees perceptions and interpretations as the driving factor that influences people's behaviour towards information technology. The interpretive approach provided the means with which to understand the meanings of a complex world in which technology and people interact. Applying this approach to research, the researcher is able to grasp and interpret an approach to the role of institutional culture and the online education system through the eyes of students and teachers, which might otherwise not be possible.

The choice of an interpretive case study is to give an opportunity for the researcher to concentrate on a particular phenomenon in depth within the time available. Benbasat et al. (1987) credit the value of the case study to research as an area which is relatively new and at the stage of development. This was fully recognised in this thesis since we introduced two active actors, i.e. technology and environment, into the research on online education. Starting from this angle, we further show how to apply the theory and framework developed as well as the data required to study implementation of online education on campus. The underlying belief is that other researchers who are interested in carrying out interpretive research in online education may find our experiences with this research approach and the methods we used to exercise data collection helpful. In the rest of this section, we

discuss the detailed methodological lessons we have learnt over the duration of the empirical work.

Having taken into account the nature of the research questions, we came to a decision that an interpretive case study, which allows the researcher to play " insider-researcher", was crucial in obtaining in-depth information regarding technology appropriation in the online education process. Our case study also brought out the importance of building up a rapport with the students in this kind of research in order to gain their trust and hence reveal what students really think of various institutional and learning issues.

The case study allows the use of multiple data collection techniques (Yin, 1994). The LSE brochure and newsletters helped create the environment and background information of the online education project. This is particularly important since without a proper understanding of the LSE learning culture, we might not be able to make sense of why students interpret technology and online education in a particular fashion. Apart from these documents, being a student at the same institution as the research site further granted the researcher opportunities to apply a great amount of knowledge about the LSE. This certainly speeded up the establishment of the relationship between students and the researcher. Another discovery was that the researcher's attendance at every lecture and colloquium session appeared to play a role in gaining trust from students. Sitting together with them in the lecture room made students feel that the researcher was part of them instead of someone belonging to the other side. Consequently, students were more willing to express their real feelings and tell what they thought of online education and technology in use. In addition, we discovered that the researcher's knowledge of the course content, i.e. IS security, also contributed to the bonding process. For example, a typical discussion with a student(s) tended to start with something about security and finish up with something about the technology or the concept of online education at the LSE.

We spent the entire duration of the study at the site, this provided us the opportunity of having numerous unstructured interviews and informal conversations with the students. This gave the researcher the means with which to capture the complex relationship between context, technology use and learning process at different stages of the empirical work. The use of survey helped the researcher to triangulate interviews and content analysis, in particular for overall learning outcomes. E-mail communication after the study was very helpful to clarify some issues and to acquire additional data required after the completion of the 11-week long empirical study. As a result of this research process, the findings from the case study at the LSE revealed a rich and detailed picture of the interaction between the technology and different actors involved.

7.3.3 Practical contributions

The practical contributions of this thesis are derived from both the theory and our research findings.

First, in deciding what strategy is required to ensure a successful implementation of online education on campus, we suggest that practitioners and academics can apply technological frames analysis to examine how students interpret and understand the purpose of technology and of online education. Learning from many IS studies, we realised that the implementation of technology in organisations can lead to different unexpected changes or outcomes due to differences in both internal and external contextual variables. In the early chapters, we explained that online education could be understood as an information system because it encompasses technical, formal and informal systems (Backhouse and Liebenau, 2000). Through the work of this study, we have demonstrated how an IS perspective can contribute to our understanding of online education. Therefore, this research offers alternative thinking in the implementation of online education to academics or IT staff in the traditional educational environment.

We recognize that good instructional design certainly increases the success of system use. However, without student acceptance of technology in the first instance, the educational benefits enabled by the system will probably never be utilized. Taking our work here an example, the findings demonstrate that sometimes the under-use of the learning system came from resentment towards online education in general (e.g. fear of being used to replace the lecturer) or from the unclear role of this new system with the existing technology (e.g. WebCT vs. Microsoft Outlook). All these illustrate that there is more concerns than good instructional design in the world of online education.

Moreover, in Chapter One, we define online education as encompassing both distance and face-to-face education. Our research conclusion further draws the attention of academics working in traditional educational environments. The research outcomes show that online education has great potential for fostering the establishment of a learning community, especially in the situation where the campus is located in an urban area and the cost of living and traveling are high. Students in our research suggested that through the use of the online education system, they became socially closer to their classmates. WebCT allowed them to have a sense of being on campus at all time. Therefore, one way to bring students together could be the implementation of a system similar to that described in this thesis.

Another practical contribution is more particularly linked to the content of teaching materials, i.e. IS security. Due to the rapid speed of technological innovation and the mass use of technologies, the number of security concerns or related issues are constantly published and reported. Sometimes it is very difficult for the lecturer to keep up with the constant changes, needless to say being able to provide students with every piece of updated information. The case study findings here indicate that students themselves appropriate the online education system as the means with which to share news and conference information in the field of IS security. Their actions utilise the benefits of situated and collaborative learning. Consequently, students learn to teach security among themselves by using and sharing materials gathered from their own sources such as journals, news items and new books. As well as

enhancing student knowledge in security, the teacher can also benefit from a great amount of information provided by the students. Thus overall teaching and learning quality in IS security is able to improve.

7.4 Limitation of the research

7.4.1 Research design limitations

The main contribution of this research is to inject an IS perspective into the research on online education. The researcher demonstrated how student interpretations of technology have an impact on the learning activities as well as on how learning activities changed their initial perception of online education and technology. Nevertheless, as discussed in Chapter Four, this dissertation suffers from the problem of generalisation to other traditional institutions or to the distance education context. As a result of this work, what we have achieved is to increase attention about the need and value of an interpretive approach to the study of online education. The researcher cannot claim however that the findings are universal or that the findings constitute the development of a new theory.

Choosing to adopt the "involved researcher" strategy in a case study, we were able to gain in-depth and valuable information from students. Yet the problem of researcher bias became unavoidable and required delicate management. As explained in the chapter on research methodology, the researcher had studied at the LSE during the five years previous to the research. Thus the researcher has her own views and perceptions of the learning culture at the LSE. Furthermore, having decided to be a technical support person for the learning system, although it gave her the means to establish a close relationship with students, at the same time the researcher also formed her own understanding in regard to both online education and technology. It might endanger the value of the research outcomes. Nevertheless, as discussed in Chapter Three, we concluded that good access to students and a first hand understanding of the institutional culture outweighed the issue of the researcher's bias.

In addition, the use of multiple data sources and the process of triangulation have helped to minimise the problem of subjectivity and bias.

Another limitation concerns the starting point and the length of the case study. Because of the programme design, the security course was only available in the second term. The researcher had no connection with students before the start of the ISS course. Therefore, some information on their initial perceptions of the LSE and their learning experience might have been lost. Despite the researcher's attempt to overcome this problem by asking students in the interviews or informal conversations, about their first term experience she might benefit more if she had been with students from the very beginning, i.e. the first term. Besides, being constrained by the departmental syllabus and the school term schedule, the duration of system use was only limited to 11-weeks. This might have some implications for exploring the pattern or relationship between learning and technology perception. We suggest that a longitudinal study might offer more insights into this particular aspect.

7.4.2 Criticism of the theoretical framework

Within the use of technological frames analysis, the concept of incongruence of frames was not greatly addressed. Incongruence of frames is mainly the technique used to identify different frames existing among various stakeholders in organisations. In this case study, we only focused on one group of stakeholder, i.e. students. However, our findings also showed that it is possible to have frame incongruence even within one group of stakeholders. For instance, at the beginning of course, there were two distinct frames in the understanding of online education. This incongruence of the frames between two groups of students led to somewhat different behaviour in the online learning environment. Nevertheless, as shown in Chapter Five and Six, some of the students who held negative attitudes towards online education were won over by those who were active and positive. It can be argued that this ultimately leads to the congruence of frames, and the subsequent success of technology use in this research.

Another limitation comes from the instructional design of collaborative and situated learning. This research did not carry out a comparative study i.e. online vs. face-to-face environment. Although the survey findings showed reports of positive learning outcomes resulting from online education, a definite comparison with face-to-face setting was not undertaken. Thus we cannot make an absolute claim that online students attained a higher academic achievement than those in a classroom setting. Perhaps a comparative study should have taken place to test this. On the other hand, we decided not to do so since the centre of this research was to analyse whether and how contextual elements affect the student view of online technology and learning activities. To include a comparative study as a second agenda might engender ambiguity of the research purpose and make the research scope too broad to allow in-depth analysis of one particular phenomenon.

7.5 Suggestions for further research

At the outset of this thesis, the researcher commented that further research is still required on the educational, social-psychological, economic and institutional effects of online education. The findings resulting from this thesis made some contributions to educational and institutional aspects of online education. We confirmed the ability of an online learning system to facilitate collaborative learning in a face-to-face educational environment. At a micro level, through the lens of technological frames analysis, we demonstrated how institutional culture could influence student use of the online learning system.

Our first recommendation for further research is to address other areas of online education that the researcher was not able to cover, owing to the scope and scale of the dissertation. In particular, as indicated in Chapter Two, much work is still needed to study how online education can engender a better quality of life or can revolutionise the existing educational system (e.g. Section 2.2.1). The knowledge generated through this type of research will help online education projects in undeveloped or some developing countries where educational resources at the national level can be scarce.

The second suggestion for further research is to apply technological frames analysis to the study of the different stakeholders involved in the delivery of online education within an institution. Although our work here concentrated on the sense-making process from the students' perspective, we recognise that there are other actors involved in the implementation of such a project, for example, IT services staff and decision-makers at the management level. The concepts of congruence and incongruence of frames can then be applied fully, thus enabling us to gain a fuller picture of the process of online education adoption in the context of a traditional education environment.

The third suggestion for further research is to develop the rule-based category system. Owing to the scope of the research, we only demonstrate the potential of the rule-based category system to analyse online activities. By applying this tool for content analysis, we could research the dynamics of group interaction and discussion taking place in the context of online education.

Despite offering supportive arguments for a social constructivist approach to learning, the researcher believes that this theoretical framework requires further development if it is to be used as a technique with which to understand the relationship between collaborative and situated learning, and the educational technology sense-making process. We hope that we have responded adequately to the call for research in online education within the IS field (Alavi and Leidner, 2001), as well as bringing the two communities of education and IS a step closer together.

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Appendix One: Publications related to this thesis

Hsu, C. and Backhouse, J (2001). The Implementation of Online Education On Campus *AMCIS*, Boston: United States.

Abstract
This paper explores three aspects of online education on campus: technology usefulness, social interaction and learning outcomes. The empirical findings of this study suggest that online technology offers educators promising opportunities for fostering an effective collaborative learning environment in traditional universities. Students reported that the online system was useful for studying, helped them form friendships with others, and enhanced their overall quality of learning. We recommend more studies to examine the potential and the implications of implementing online learning technology on campus in the future.

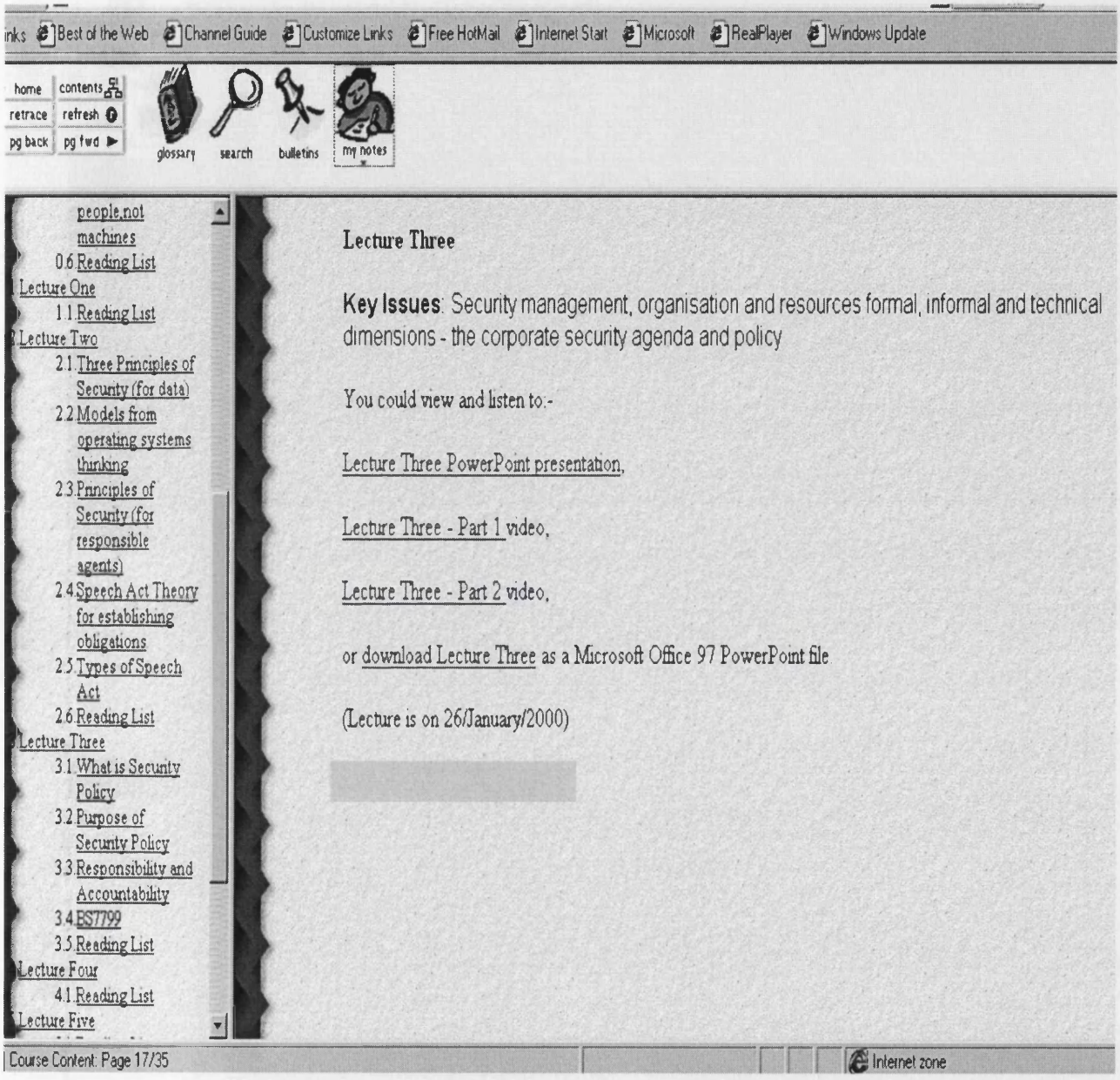
Hsu, C. and A. Lin (2002). The Implementation of Online Education On Campus: A Comparative Study, *UKAIS*, Leeds: UK

Abstract
This paper reflects on the results of two exploratory case studies of online education carried out in two UK higher education institutions during the period of 2000-2001. The research presented here is focused on two aspects of on campus online learning environment: perception of technology and social interaction. We argue that these two issues often determine the effectiveness of online learning and interaction. The data collected is analysed from the perspectives of social cognition and social interactionism. The findings confirm that the effectiveness online learning environment is by and large affected by students' perception of online technology in their learning outcomes and by social interaction among students. We suggest that in order to create an effective online learning a number of issues need to be taken on board such as course design, institutional factors, formal training sessions for tutors and students, online and offline social interaction, and the integrity of information presented online.

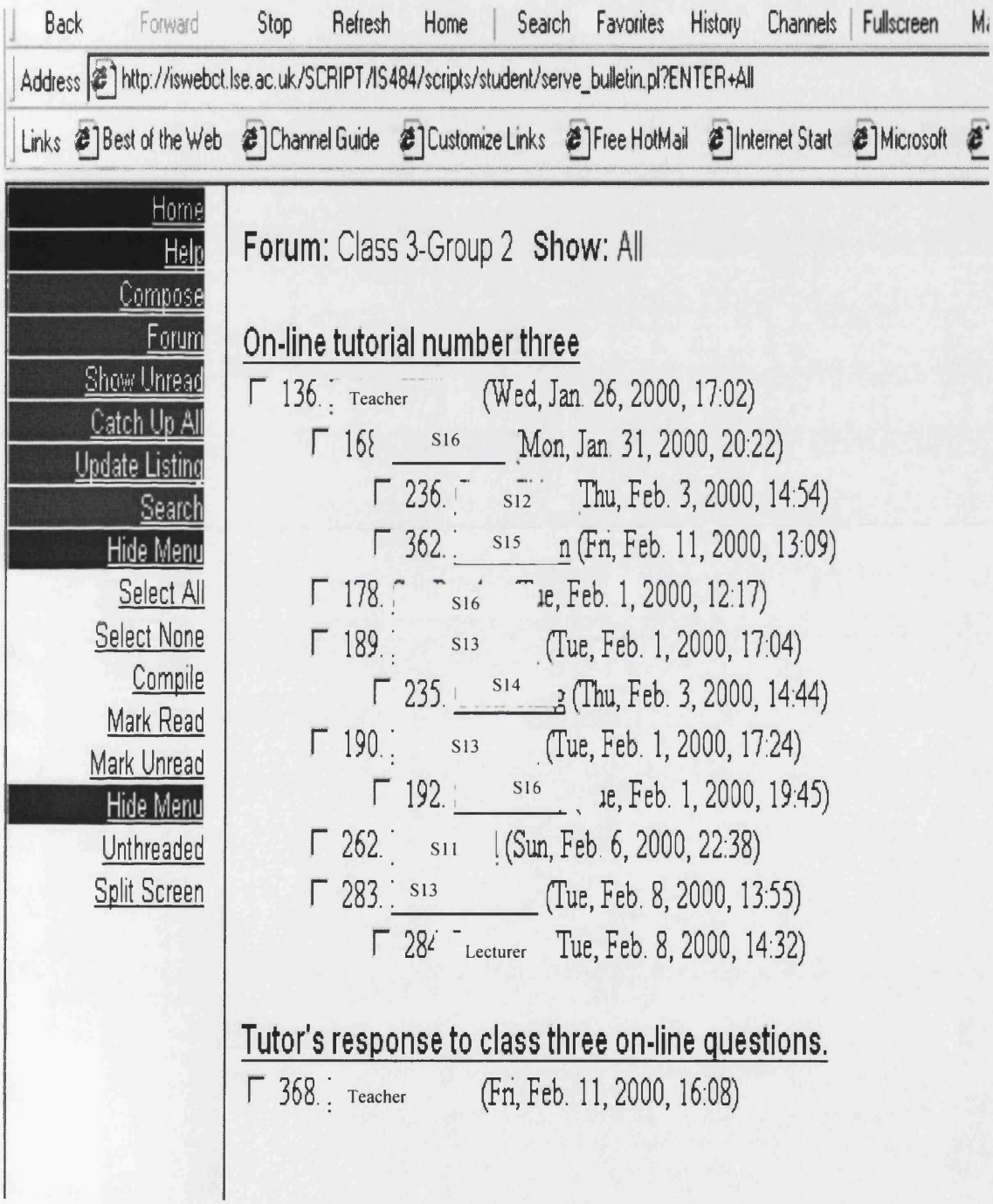
Hsu, C. and Backhouse, J (2002). Information Systems Security Education: Redressing the Balance of Theory and Practice *Journal of Information Systems Education,* 13(4)

Abstract
One of the perennial concerns in education is students' inability to apply what they have learnt at school in the real world context. To tackle this issue, this paper proposes the adoption of a situated learning strategy as a mechanism for linking theory and practice for delivering information systems security education. There are two areas of focus in the research presented. First, we offer an example of an information systems security course applying situated learning strategy. Secondly, we examine student feedback on this particular teaching design. The exploratory findings suggest that situated learning strategy has potential for knowledge development as well as for balancing theory and practice. Thus we recommend our example of an information systems security course for use as model of practice for other educators in this field.

Appendix Two: An Example of Access Lectures in WebCT



Appendix Three: An Example of Discussion Forum in WebCT



Appendix Four: Questionnaire

First Questionnaire:

A. General Background

1. Option IS484 IS476

2. Sex Male Female

B. On-line Learning System

1. From where do you access the on-line learning system most?

   School School Accommodation Home

2. When do you log on to the system most?

   Weekdays Weekend No fixed time

3. How easy do you find the ease of the system to use in general? If bad or poor, why?

4. How do you find the quality of the system?

5. Do you think that training on the use of the system are well-provided? Reason?

C. Learning Experience

1. Did you have doubts about the approach of using such a system to help you learn more and better?

   If yes, have you changed your mind about this after using it for three weeks?

   Yes, I had doubts at the beginning No, I was positive about this
   Yes, I have changed my mind No, I didn't change my mind

2. Do you find the on-line learning system in general helpful in your learning on this course compared with face-to-face learning?

3. Do you think that on-line group discussion (tutorial) helps you have a better understanding of the course?

4. Do you think that discussion on-line forces you to do some work which otherwise you might not?

5. What do you like or hate about on-line group tutorials in comparison with face-to-face classes?

6. What are you general comments about this on-line system in terms of enhancing your learning?

Second Questionnaire

A. On-Line Learning Outcomes

A.1 Grades
1. Please select your final grade for the course you took
over 70 60-69 50-59 40-49 below 39

Please compare your online classes to your previous or current experience with face-to-face courses taken in ADMIS.

To what extent do you agree with the following statements about the comparative process and value of the IS484 and IS476 on-line learning environment?

SA=Strongly Agree A=Agree N=Neutral D=Disagree SD=Strongly Disagree

A.2 Perceived Learning Outcomes
1. The online learning system has increased my ability to think critically
SA A N D SD
2. The online learning system has increased my ability to integrate facts
SA A N D SD
3. The online learning system has increased my ability to analyse materials
SA A N D SD
4. The online learning system has increased my confidence in learning
SA A N D SD
5. The online learning system has helped me to value other viewpoint more
SA A N D SD
6. The online learning system has increased my ability to interrelate ideas together
SA A N D SD
7. The online learning system has helped me to understand security concepts better
SA A N D SD
8. The online learning system has helped me to understand factual materials better
SA A N D SD
9. The online learning system has helped me to identify central issues better
SA A N D SD
10. The online learning system has helped me to understand security concepts better
SA A N D SD
11. The online learning system has helped me to interest my interest in discussion
SA A N D SD
12. The online learning system has helped me to do additional reading
SA A N D SD
13. The online learning system has helped me to do some thinking

SA A N D SD

B. Technology Characteristics
B.1 Perceived usefulness of the online system

1. The online learning system has made it easier for me to reach people with whom I need to communicate
SA A N D SD
2. The online learning system provided leads, references and useful information related to the course
SA A N D SD
3. The online learning system increased the efficiency of my studying
SA A N D SD
4. The online learning system increased the quality of my study
SA A N D SD
5. Using the online learning system gave me greater control over my study
SA A N D SD
6. Using the online learning system makes it easier to study
SA A N D SD
7.Overall, I find the online learning system useful for me when studying
SA A N D SD

C. Organisation
C.1 Supervisor's influence
1. I think that my lecturer considers the online learning system is useful instruction technology compared with face-to-face education
SA A N D SD
2. The lecturer encouraged students to communicate using the online learning technology
SA A N D SD
3. The lecturer forced students to communicate using the online learning technology
SA A N D SD
4. The amount of use of the online learning technology by lecturers and tutors has influenced my use of this technology
SA A N D SD

D Attitude towards online learning
1.I was positive about participating online learning course at the beginning
SA A N D SD
2. I was positive about participation online learning course at the end
SA A N D SD
3. I will take another online course in the future
SA A N D SD
4. I will recommend this type of online learning course to someone else
SA A N D SD